Contents

EXERCISE 1A

1. (a) $13+(-6)=13-6=7$ (b) $(-15)+8=-15+8=-7$

(c) $(-9)+(-21)=-9-21=-30$ (d) $(-22)+37=-22+37=15$

(e) $43+(-16)=43-16=27$ (f) $(-38)+(-26)=-38-26=-64$

2. (a) $163+(-312)=163-312=-149$

(b) $1015+(-387)=1015-387=628$

(c) $-1025+357=-668$

(d) $-379+(-214)=-379-214=-593$

(e) $-2000+1248=-752$

(f) $-138+400=262$

3. (a) Additive inverse of $(-38)=38$

(b) Additive inverse of $465=-465$

(c) Additive inverse of $0=0$

(d) Additive inverse of $-1002=1002$

4. (a) $-52-38=-90$

(b) $32-(-26)=32+26=58$

(c) $-43-(-27)=-43+27=-16$

(d) $-24-(-56)=-24+56=32$

(e) $0-138=-138$

(f) $-230-(-143)=-230+143=-87$

(g) $0-(-46)=46$

(h) $123-(-65)=123+65=188$

5. $[38+(-87)]-(-134)=(38-87)+134$

$=-49+134$

$=85$

6. $(-34)-(-1032+878)=-34-(-154)$

$=-34+154$

$=120$

7. (a) $(-31)+(\mathbf{-9})=-40$ (b) $(-60)-(\mathbf{-1})=-59$

(c) $-(-83)=\mathbf{83}$ (d) $(-72)+\mathbf{0}=-72$

(e) $(-68)+(-76)=(\mathbf{-76})+(-68)$

(f) $53+(-37)=(-37)+(\mathbf{53})$

(g) $(-26)+\{(-49)+(-83)\}=\{(-26)+(-49)\}+(\mathbf{-83})$

(h) $\{(-13)+27\}+(-41)=(-13)+\{27+(\mathbf{-41})\}$

8. $36-(-64)=36+64=100$

$(-64)-36=-64-36=-100$

But $100>-100$

Hence, these are not equal.

9. $\{-13-(-27)\}+\{-25-(-40)\}=(-13+27)+(-25+40)$

$=14+15=29$

10. Given $a=-9,\ b=-6$

$a-b=-9-(-6)=-9+6=-3$

$b-a=-6-(-9)=-6+9=3$

But $-3\neq 3$

Hence, $(a-b)\neq(b-a)$

11. Given $a=-8,\ b=-7, c=6$

$(a+b)+c=\{(-8)+(-7)\}+6$

$=(-8-7)+6$

$=-15+6$

$=-9$

$a+(b+c)=(-8)+\{(-7)+6\}$

$=-8+(-7+6)$

$=-8+(-1)$

$=-8-1$

$=-9$

Hence, $(a+b)+c=a+(b+c)$.

12. $a-(-6)=4$

$a+6=4$

$a=4-6$

$a=-2$

13. Sum of two integers $=-16$

$53+$ other integer $=-16$

other integer $=-16-53=-69$

Hence, other integer is (-69).

14. Sum of two integers $=65$

$-31+$ other integer $=65$

other integer $=65+31=96$

15. (a) F (b) T (c) T (d) F (e) F

EXERCISE 1B

1. (a) $14 \times 9 = 126$

(b) $17 \times (-6) = -(17 \times 6) - 102$

(c) $34 \times (-11) = -(34 \times 11) = -374$

(d) $(-22) \times 14 = -(22 \times 14) = -308$

(e) $(-43) \times 18 = -(43 \times 18) = -774$

(f) $(-75) \times 0 = 0$

(g) $0 \times (-38) = 0$

(h) $(-15) \times (-11) = 15 \times 11 = 165$

(i) $(-102) \times (-8) = 102 \times 8 = 816$

(j) $(-45) \times (-50) = 45 \times 50 = 2250$

(k) $(-87) \times (-1) = 87 \times 1 = 87$

(l) $35 \times (-15) = -(35 \times 15) = -525$

2. (a) $2 \times 3 \times (-4) = 6 \times (-4)$
$= -(6 \times 4)$
$= -24$

(b) $3 \times (-4) \times (-7) = -(3 \times 4) \times (-7)$
$= (-12) \times (-7)$
$= 12 \times 7 = 84$

(c) $(-4) \times (-5) \times (-6)$
$= (4 \times 5) \times (-6)$
$= 20 \times (-6)$
$= -(20 \times 6) = -120$

(d) $(-5) \times 5 \times (-5) = -(5 \times 5) \times (-5)$
$= (-25) \times (-5)$
$= 25 \times 5$
$= 125$

(e) $6 \times (-7) \times 4 = -(6 \times 7) \times 4$
$= -(42) \times 4$
$= -(42 \times 4)$
$= -168$

(f) $(-6) \times (-5) \times 2 = (6 \times 5) \times 2$
$= 30 \times 2$
$= 60$

3. (a) $(-30) \times (-20) \times (-5) = -(30 \times 20 \times 5)$
$= -3000$

(b) $(-60) \times (-10) \times (-5) \times (-1) = 60 \times 10 \times 5 \times 1$
$= 3000$

(c) $(-6) \times (-5) \times (-7) \times (-2) \times (-3) = -(6 \times 5 \times 7 \times 2 \times 3)$
$= -1260$

(d) $(-4) \times (-5) \times (-8) \times (-10) = 4 \times 5 \times 8 \times 10$
$= 1600$

(e) $(-5) \times (-5) \times (-5) \times \ldots 5 \text{ times} = (-5)^5 = -3125$

(f) $(-3) \times (-3) \times (-3) \times \ldots . 6 \text{ times} = (-3)^6 = 729$

(g) $(-1) \times (-1) \times (-1) \times \ldots . 171 \text{ times} = (-1)^{171} = -1$

(h) $(-1) \times (-1) \times (-1) \times \ldots . 200 \text{ times} = (-1)^{200} = 1$

4. (Product of 103 negative integers) × (Product of 65 positive integers)
= A negative integer × A positive integer
= A negative integer
Hence, the sign of the product will be negative.

5. (Product of 90 negative integers) × (Product of 9 positive integers)
= A negative integer × A positive integer
= A positive integer
Hence, the sign of the product will be positive.

6. (a) $9\times(-13)+9\times(-7)$
$=9\{(-13)+(-7)\}$
$=9(-13-7)$
$=9\times(-20)$
$=-(9\times 20)$
$=-180$

(b) $(-8)\times 9+(-8)\times 7$
$=(-8)(9+7)$
$=(-8)\times 16$
$=-(8\times 16)$
$=-128$

(c) $10\times(-12)+5\times(-12)$
$=(-12)(10+5)$
$=(-12)\times 15$
$=-(12\times 15)$
$=-180$

(d) $(-11)\times(-15)+(-11)\times(-25)$
$=(-11)\{(-15)+(-25)\}$
$=(-11)(-15-25)$
$=(-11)\times(-40)$
$=11\times 40$
$=440$

(e) $(-16)\times(-15)+(-16)\times(-5)$
$=(-16)\{(-15)+(-5)\}$
$=(-16)(-15-5)$
$=(-16)\times(-20)$
$=16\times 20$
$=320$

(f) $20\times(-16)+20\times 14$
$=20\{(-16)+14\}$
$=20(-16+14)$
$=20\times(-2)$
$=-(20\times 2)$
$=-40$

(g) $(-26)\times 72+(-26)\times 28$
$=(-26)(72+28)$
$=(-26)\times 100$
$=-(26\times 100)$
$=-2600$

(h) $(-16)\times(-8)+(-4)\times(-8)$
$=(-8)\{(-16)+(-4)\}$
$=(-8)(-16-4)$
$=(-8)\times(-20)$
$=8\times 20=160$

7. (a) $(-5)\times \mathbf{0}=0$

(b) $7\times(-3)=(-3)\times \mathbf{7}$

(c) $(-18)\times \mathbf{1}=(-18)$

(d) $(-6)\times(\mathbf{-1})=6$

(e) $(-8)\times(-9)=(-9)\times(\mathbf{-8})$

(f) $\{(-5)\times 3\}\times(-6)=(\mathbf{-5})\times\{3\times(-6)\}$

8. (a) T (b) T (c) T (d) F (e) T (f) F (g) T

EXERCISE 1C

1. (a) $70 \div (-14) = \frac{70}{-14} = -5$ (b) $(-91) \div 13 = \frac{-91}{13} = -7$

(c) $(-72) \div 18 = \frac{-72}{18} = -4$ (d) $(-143) \div 13 = \frac{-143}{13} = -11$

(e) $(-125) \div 25 = \frac{-125}{25} = -5$ (f) $(-108) \div (-18) = \frac{-108}{-18} = 6$

(g) $(-105) \div (-15) = \frac{-105}{-15} = 7$ (h) $(-63) \div (-1) = \frac{-63}{-1} = 63$

(i) $0 \div (-21) = \frac{0}{-21} = 0$ (j) $(-36) \div 36 = \frac{-36}{36} = -1$

(k) $(-32) \div (-32) = \frac{-32}{-32} = 1$ (l) $(-6) \div 1 = \frac{-6}{1} = -6$

2. (a) $(76) \div (\mathbf{-19}) = -4$ (b) $-28 \div (\mathbf{7}) = -4$

(c) $(\mathbf{84}) \div (-4) = 21$ (d) $(\mathbf{0}) \div 35 = 0$

(e) $(\mathbf{-53}) \div (-1) = 53$ (f) $(\mathbf{-73}) \div 1 = -73$

(g) $39 \div (\mathbf{-39}) = -1$ (h) $(1) \div (\mathbf{-1}) = -1$

(i) $(-1) \div (\mathbf{1}) = -1$

3. (a) T (b) F (c) T (d) F (e) F (f) T

EXERCISE 1D

1. $-9 - (-6) = -9 + 6 = -3$
(b) is correct.

2. $6 - (-8) = 6 + 8 = 14$
(c) is correct.

3. $(-4) - 4 = -4 - 4 = -8$
(b) is correct.

4. $(-5) - 6 = -5 - 6 = -11$
(c) is correct.

5. $-8 - (-13) = -8 + 13 = 5$
(c) is correct.

6. $-3 - (-9) = -3 + 9 = 6$
(c) is correct.

7. (d)

8. (b)

9. $(-36) \div (-9) = \frac{-36}{-9} = 4$
(a) is correct.

10. Other integer $= 6 - (-3) = 6 + 3 = 9$
(b) is correct.

HOTS

- Whatever may be the number of positive integers, it will not affect the sign of the product.
  Since 5 is odd and product of odd number of negative integers is negative, so the given product is negative.

VALUE BASED

- Students in the class = 43
  Each student contributed = ` 50
  Total money collected = ` 50 × 43
  = ` 2150
  Hence, ` 2150 was collected.

Chapter 2 Fractions

EXERCISE 2A

1. (a) $\frac{5}{14}, \frac{9}{28}, \frac{3}{7}, \frac{8}{21}$

2	14, 28, 7, 21
2	7, 14, 7, 21
3	7, 7, 7, 21
7	7, 7, 7, 7
	1, 1, 1, 1

LCM of 14, 28, 7, 21 = $2 \times 2 \times 3 \times 7 = 84$

Now, $\frac{5}{14} = \frac{5 \times 6}{14 \times 6} = \frac{30}{84}$

$\frac{9}{28} = \frac{9 \times 3}{28 \times 3} = \frac{27}{84}$

$\frac{3}{7} = \frac{3 \times 12}{7 \times 12} = \frac{36}{84}$

$\frac{8}{21} = \frac{8 \times 4}{21 \times 4} = \frac{32}{84}$

Hence, $\frac{30}{84}, \frac{27}{84}, \frac{36}{84}$ and $\frac{32}{84}$ are like fractions.

(b) $\frac{5}{22}, \frac{6}{11}, \frac{8}{33}, \frac{9}{44}$

2	22, 11, 33, 44
	11, 11, 33, 22
	11, 11, 33, 11
	11, 11, 11, 11
	1, 1, 1, 1

LCM of 22, 11, 33 and 44 = $2 \times 2 \times 3 \times 11 = 132$

Now, $\frac{5}{22} = \frac{5 \times 6}{22 \times 6} = \frac{30}{132}$

$\frac{6}{11} = \frac{6 \times 12}{11 \times 12} = \frac{72}{132}$

$\frac{8}{33} = \frac{8 \times 4}{33 \times 4} = \frac{32}{132}$

$\frac{9}{44} = \frac{9 \times 3}{44 \times 3} = \frac{27}{132}$

Hence, $\frac{30}{132}, \frac{72}{132}, \frac{32}{132}$ and $\frac{27}{132}$ are like fractions.

(c) $\frac{13}{25}, \frac{9}{10}, \frac{3}{5}, \frac{17}{20}$

LCM of 25, 10, 5, 20 = $2 \times 2 \times 5 \times 5 = 100$

Now, $\frac{13}{25} = \frac{13\times 4}{25\times 4} = \frac{52}{100}$

$\frac{9}{10} = \frac{9\times 10}{10\times 10} = \frac{90}{100}$

$\frac{3}{5} = \frac{3\times 20}{5\times 20} = \frac{60}{100}$

$\frac{17}{20} = \frac{17\times 5}{20\times 5} = \frac{85}{100}$

2	25, 10, 5, 20
	25, 5, 5, 10
	25, 5, 5, 5
	5, 1, 1, 1
	1, 1, 1, 1

Hence, $\frac{52}{100}, \frac{90}{100}, \frac{160}{100}$ and $\frac{85}{100}$ are like fractions.

2. (a) $\frac{7}{18} \times \frac{3}{7}$

$7\times 7 = 49$ and $18\times 3 = 54$

$\because \quad 49 < 54$

$\frac{7}{18} < \frac{3}{7}$

(b) $\frac{15}{16} \times \frac{13}{14}$

$15\times 14 = 210$ and $16\times 13 = 208$

$\because \quad 210 > 208$

$\frac{15}{16} > \frac{13}{14}$

(c) $\frac{5}{13} \times \frac{16}{23}$

$5\times 23 = 115$ and $13\times 16 = 208$

$\because \quad 115 < 208$

$\frac{5}{13} < \frac{16}{23}$

3. (a) $\frac{3}{5}$ and $\frac{5}{8}$

LCM of 5 and $8 = 5\times 8 = 40$ (Since, 5 and 8 are co-prime numbers)

Now, $\frac{3}{5} = \frac{3\times 8}{5\times 8} = \frac{24}{40}$ and $\frac{5}{8} = \frac{5\times 5}{8\times 5} = \frac{25}{40}$

$\because \quad \frac{24}{40} < \frac{25}{40}$

$\frac{3}{5} < \frac{5}{8}$

(b) $\frac{7}{15}$ and $\frac{8}{25}$

LCM of 15 and $25 = 3\times 5\times 5 = 75$

Now, $\frac{7}{15} = \frac{7\times 5}{15\times 5} = \frac{35}{75}$ and $\frac{8}{25} = \frac{8\times 3}{25\times 3} = \frac{24}{75}$

$\because \quad \frac{35}{75} < \frac{24}{75}$

3	15, 25
5	5, 25
5	1, 5
	1, 1

$$\frac{7}{15} < \frac{8}{25}$$

(c) $\frac{11}{12}$ and $\frac{15}{16}$

2	12, 16
2	6, 8
2	3, 4
2	3, 2
3	3, 1
	1, 1

LCM of 12 and 16 $= 2 \times 2 \times 2 \times 2 \times 3 = 48$

Now, $\frac{11}{12} = \frac{11 \times 4}{12 \times 4} = \frac{44}{48}$ and $\frac{15}{16} = \frac{15 \times 3}{16 \times 3} = \frac{45}{48}$

$\because$ $\frac{44}{48} < \frac{45}{48}$

$\frac{11}{12} < \frac{15}{16}$

4. (a) $\frac{3}{4}, \frac{5}{6}, \frac{7}{9}, \frac{11}{12}$

2	4, 6, 9, 12
	2, 3, 9, 6
	1, 3, 9, 3
	1, 1, 3, 1
	1, 1, 1, 1

LCM of 4, 6, 9 and 12 $= 2 \times 2 \times 3 \times 3 = 36$

Now, $\frac{3}{4} = \frac{3 \times 9}{4 \times 9} = \frac{27}{36}$; $\frac{5}{6} = \frac{5 \times 6}{6 \times 6} = \frac{30}{36}$

$\frac{7}{9} = \frac{7 \times 4}{9 \times 4} = \frac{28}{36}$; $\frac{11}{12} = \frac{11 \times 3}{12 \times 3} = \frac{33}{36}$

$\because$ $\frac{27}{36} < \frac{28}{36} < \frac{30}{36} < \frac{33}{36}$

$\frac{3}{4} < \frac{7}{9} < \frac{5}{6} < \frac{11}{12}$

(b) $\frac{4}{5}, \frac{7}{10}, \frac{11}{15}, \frac{17}{20}$

2	5, 10, 15, 20
	5, 5, 15, 10
	5, 5, 15, 5
	5, 5, 5, 5
	1, 1, 1, 1

LCM of 5, 10, 15 and 20 $= 2 \times 2 \times 3 \times 5 = 60$

Now, $\frac{4}{5} = \frac{4 \times 12}{5 \times 12} = \frac{48}{60}$; $\frac{7}{10} = \frac{7 \times 6}{10 \times 6} = \frac{42}{60}$

$\frac{11}{15} = \frac{11 \times 4}{15 \times 4} = \frac{44}{60}$; $\frac{17}{20} = \frac{17 \times 3}{20 \times 3} = \frac{51}{60}$

$\because$ $\frac{42}{60} < \frac{44}{60} < \frac{48}{60} < \frac{51}{60}$

$\frac{7}{10} < \frac{11}{15} < \frac{4}{5} < \frac{17}{20}$

(c) $\frac{5}{12}, \frac{7}{18}$ and $\frac{19}{36}$

2	12, 18, 36
	6, 9, 18
	3, 9, 9
	1, 3, 3
	1, 1, 1

LCM of 12, 18 and 36 $= 2 \times 2 \times 3 \times 3 = 36$

Now, $\frac{5}{12} = \frac{5 \times 3}{12 \times 3} = \frac{15}{36}$; $\frac{7}{18} = \frac{7 \times 2}{18 \times 2} = \frac{14}{36}$

$\because \quad \frac{14}{36} < \frac{15}{36} < \frac{19}{36}$

$\frac{7}{18} < \frac{5}{12} < \frac{19}{36}$

5. (a) $\frac{3}{4}, \frac{7}{12}, \frac{7}{8}, \frac{17}{24}$

LCM of 4, 12, 8 and $24 = 2 \times 2 \times 2 \times 3 = 24$

2	4, 12, 8, 24
	2, 6, 4, 12
	1, 3, 2, 6
	1, 3, 1, 3
	1, 1, 1, 1

Now, $\frac{3}{4} = \frac{3 \times 6}{4 \times 6} = \frac{18}{24}; \frac{7}{12} = \frac{7 \times 2}{12 \times 2} = \frac{14}{24}$

$\frac{7}{8} = \frac{7 \times 3}{8 \times 3} = \frac{21}{24}; \frac{17}{24} = \frac{17 \times 1}{24 \times 1} = \frac{17}{24}$

$\because \quad \frac{21}{24} > \frac{18}{24} > \frac{17}{24} > \frac{14}{24}$

$\frac{7}{8} > \frac{3}{4} > \frac{17}{24} > \frac{7}{12}$

(b) $\frac{8}{15}, \frac{3}{5}, \frac{2}{3}, \frac{7}{10}$

LCM of 15, 5, 3 and $10 = 2 \times 3 \times 5 = 30$

2	15, 5, 3, 10
3	15, 5, 3, 5
5	5, 5, 1, 5
	1, 1, 1, 1

Now, $\frac{8}{15} = \frac{8 \times 2}{15 \times 2} = \frac{16}{30}; \frac{3}{5} = \frac{3 \times 6}{5 \times 6} = \frac{18}{30}$

$\frac{2}{3} = \frac{2 \times 10}{3 \times 10} = \frac{20}{30}; \frac{7}{10} = \frac{7 \times 3}{10 \times 3} = \frac{21}{30}$

$\because \quad \frac{21}{30} > \frac{20}{30} > \frac{18}{30} > \frac{16}{30}$

$\frac{7}{10} > \frac{2}{3} > \frac{3}{5} > \frac{8}{15}$

(c) $\frac{1}{5}, \frac{4}{15}, \frac{8}{25}, \frac{9}{20}$

LCM of 5, 15, 25 and $20 = 2 \times 2 \times 3 \times 5 \times 5 = 300$

2	5, 15, 25, 20
	5, 15, 25, 10
	5, 15, 25, 5
	5, 5, 25, 5
	1, 1, 5, 1
	1, 1, 1, 1

Now, $\frac{1}{5} = \frac{1 \times 60}{5 \times 60} = \frac{60}{300}; \frac{4}{15} = \frac{4 \times 20}{15 \times 20} = \frac{80}{300}$

$\frac{8}{25} = \frac{8 \times 20}{25 \times 20} = \frac{96}{300}; \frac{9}{20} = \frac{9 \times 15}{20 \times 15} = \frac{135}{300}$

$\because \quad \frac{135}{300} > \frac{96}{300} > \frac{80}{300} > \frac{60}{300}$

$\frac{9}{20} > \frac{8}{25} > \frac{4}{15} > \frac{1}{5}$

6. Meera got the part of apple $= \frac{2}{7}$

Nisha got the part of apple $= \frac{4}{5}$

LCM of 7 and 5 = 35 (Since, 7 and 5 are co-primes)

$$\frac{2}{7} = \frac{2\times 5}{7\times 5} = \frac{10}{35} \text{ and } \frac{4}{5} = \frac{4\times 7}{5\times 7} = \frac{28}{35}$$

$\because$ $\frac{10}{35} < \frac{28}{35}$

$\frac{2}{7} < \frac{4}{5}$

Difference between both parts $= \frac{4}{5} - \frac{2}{7} = \frac{28}{35} - \frac{10}{35}$

$$= \frac{28-10}{35} = \frac{18}{35}$$

Hence, Nisha got more part by $\frac{18}{35}$.

7. (a) $\frac{2}{11} + \frac{5}{11} = \frac{2+5}{11} = \frac{7}{11}$ (c) $\frac{3}{25} + \frac{9}{25} + \frac{4}{25} = \frac{3+9+4}{25} = \frac{16}{25}$

(b) $\frac{8}{9} + \frac{7}{12}$

LCM of 9 and 12 = $2\times 2\times 3\times 3 = 36$

$$\frac{8}{9} = \frac{8\times 4}{9\times 4} = \frac{32}{36}; \frac{7}{12} = \frac{7\times 3}{12\times 3} = \frac{21}{36}$$

$$\frac{8}{9} + \frac{7}{12} = \frac{32}{36} + \frac{21}{36} = \frac{32+21}{36} = \frac{53}{36}$$

2	9, 12
2	9, 6
3	9, 3
3	3, 1
	1, 1

(d) $\frac{7}{12} + \frac{11}{16} + \frac{9}{24}$

LCM of 12, 16 and 24 = $2\times 2\times 2\times 2\times 3 = 48$

$$\frac{7}{12} = \frac{7\times 4}{12\times 4} = \frac{28}{48}; \frac{11}{16} = \frac{11\times 3}{16\times 3} = \frac{33}{48}$$

and $\frac{9}{24} = \frac{9\times 2}{24\times 2} = \frac{18}{48}$

$$\frac{7}{12} + \frac{11}{16} + \frac{9}{24} = \frac{28}{48} + \frac{33}{48} + \frac{18}{48}$$

$$= \frac{28+33+18}{48} = \frac{79}{48}$$

2	12, 16, 24
	6, 8, 12
	3, 4, 6
	3, 2, 3
	3, 1, 3
	1, 1, 1

(e) $8\frac{3}{4} + 10\frac{2}{5} = \frac{35}{4} + \frac{52}{5}$

LCM of 4 and 5 = 20 (Since, 4 and 5 are co-primes)

$$\frac{35}{4}=\frac{35\times5}{4\times5}=\frac{175}{20};\ \frac{52}{5}=\frac{52\times4}{5\times4}=\frac{208}{20}$$

$$8\frac{3}{4}+10\frac{2}{5}=\frac{175}{20}+\frac{208}{20}=\frac{175+208}{20}=\frac{283}{20}=19\frac{3}{20}$$

(f) $3\frac{4}{5}+2\frac{3}{10}+1\frac{1}{15}=\frac{19}{5}+\frac{23}{10}+\frac{16}{15}$

LCM of 5, 10 and 15 $=2\times3\times5=30$

2	5, 10, 15
	5, 5, 15
	5, 5, 5
	1, 1, 1

$$\frac{19}{5}=\frac{19\times6}{5\times6}=\frac{114}{30};\ \frac{23}{10}=\frac{23\times3}{10\times3}=\frac{69}{30}$$

and $\frac{16}{15}=\frac{16\times2}{15\times2}=\frac{32}{30}$

$$3\frac{4}{5}+2\frac{3}{10}+1\frac{1}{15}=\frac{114}{30}+\frac{69}{30}+\frac{32}{30}$$

$$=\frac{114+69+32}{30}=\frac{215}{30}=\frac{43}{6}=7\frac{1}{6}$$

8. (a) $\frac{7}{18}-\frac{5}{18}=\frac{7-5}{18}=\frac{2}{18}=\frac{1}{9}$

(b) $\frac{5}{6}-\frac{3}{4}$

LCM of 6 and $4=2\times2\times3=12$

2	6, 4
2	3, 2
3	3, 1
	1, 1

$$\frac{5}{6}=\frac{5\times2}{6\times2}=\frac{10}{12}\ \text{and}\ \frac{3}{4}=\frac{3\times3}{4\times3}=\frac{9}{12}$$

$$\frac{5}{6}-\frac{3}{4}=\frac{10}{12}-\frac{9}{12}=\frac{10-9}{12}=\frac{1}{12}$$

(c) $3\frac{1}{5}-\frac{9}{10}=\frac{16}{5}-\frac{9}{10}$

LCM of 5 and $10=2\times5=10$

2	5, 10
	5, 5
	1, 1

$$\frac{16}{5}=\frac{16\times2}{5\times2}=\frac{32}{10}\ \text{and}\ \frac{9}{10}=\frac{9\times1}{10\times1}=\frac{9}{10}$$

$$3\frac{1}{5}-\frac{9}{10}=\frac{32}{10}-\frac{9}{10}=\frac{32-9}{10}=\frac{23}{10}=2\frac{3}{10}$$

(d) $8-4\frac{2}{3}=\frac{8}{1}-\frac{14}{3}$

LCM of 1 and $3=1\times3=3$ (Since, 1 and 3 are co-primes)

$$\frac{8}{1}=\frac{8\times3}{1\times3}=\frac{24}{3}\ \text{and}\ \frac{14}{3}=\frac{14\times1}{3\times1}=\frac{14}{3}$$

$$8-4\frac{2}{3}=\frac{24}{3}-\frac{14}{3}=\frac{24-14}{3}=\frac{10}{3}=3\frac{1}{3}$$

(e) $5\frac{3}{10}-2\frac{2}{15}=\frac{53}{10}-\frac{32}{15}$

LCM of 10 and 15 $=2\times3\times5=30$

$$\frac{53}{10}=\frac{53\times3}{10\times3}=\frac{159}{30} \text{ and } \frac{32}{15}=\frac{32\times2}{15\times2}=\frac{64}{30}$$

$$5\frac{3}{10}-2\frac{2}{15}=\frac{159}{30}-\frac{64}{30}=\frac{159-64}{30}$$

$$=\frac{95}{30}=\frac{19}{6}=3\frac{1}{6}$$

2	10, 15
	5, 15
	5, 5
	1, 1

(f) $6\frac{2}{5}-2\frac{4}{10}=\frac{32}{5}-\frac{24}{10}$

LCM of 5 and 10 $=2\times5=10$

$$\frac{32}{5}=\frac{32\times2}{5\times2}=\frac{64}{10} \text{ and } \frac{24}{10}=\frac{24\times1}{10\times1}=\frac{24}{10}$$

$$6\frac{2}{5}-2\frac{4}{10}=\frac{64}{10}-\frac{24}{10}=\frac{64-24}{10}=\frac{40}{10}=4$$

2	5, 10
5	5, 5
	1, 1

9. (a) $\frac{3}{10}+\frac{4}{15}-\frac{9}{20}$

LCM of 10, 15 and 20 $=2\times2\times3\times5=60$

Now, $\frac{3}{10}+\frac{4}{15}-\frac{9}{20}=\frac{18+16-27}{60}=\frac{7}{60}$

2	10, 15, 20
	5, 15, 10
	5, 15, 5
	5, 5, 5
	1, 1, 1

$60\div10=6$ and $6\times3=18$

$60\div15=4$ and $4\times4=16$

$60\div20=3$ and $3\times9=27$

(b) $9-4\frac{1}{2}-2\frac{1}{4}=\frac{9}{1}-\frac{9}{2}-\frac{9}{4}$

LCM of 2 and 4 $=2\times2=4$

2	2, 4
	1, 2
	1, 1

Now, $9-4\frac{1}{2}-2\frac{1}{4}=\frac{36-18-9}{4}$

$4\div1=4$ and $4\times9=36$

$4\div2=2$ and $2\times9=18$

$4\div4=1$ and $1\times9=9$

$$=\frac{9}{4}=2\frac{1}{4}$$

(c) $18\frac{2}{3}-15\frac{5}{6}+4\frac{1}{8}=\frac{56}{3}-\frac{95}{6}+\frac{33}{8}$

LCM of 3, 6 and $8=2\times2\times2\times3=24$

Now, $18\frac{2}{3}-15\frac{5}{6}+4\frac{1}{8}=\frac{448-380+99}{24}$

$24\div 3=8$ and $8\times 56=448$

$24\div 6=4$ and $4\times 95=380$

$24\div 8=3$ and $3\times 33=99$

2	3, 6, 8
2	3, 3, 4
2	3, 3, 2
3	3, 3, 1
	1, 1, 1

$=\frac{167}{24}=6\frac{23}{24}$

10. Required number $=18-7\frac{3}{5}=\frac{18}{1}-\frac{38}{5}=\frac{90-38}{5}$ (LCM of 1 and 5 = 5)

$=\frac{52}{5}=10\frac{2}{5}$

11. Required number $=10-3\frac{3}{4}$

$=\frac{10}{1}-\frac{15}{4}=\frac{40-15}{4}$ (LCM of 1 and 4 = 4)

$=\frac{25}{4}=6\frac{1}{4}$

12. Cost of pen = ` $16\frac{3}{5}$ = ` $\frac{83}{5}$

Cost of pencil = ` $4\frac{3}{4}$ = ` $\frac{19}{4}$

LCM of 5 and $4=5\times 4=20$ (Since, 5 and 4 are co-primes)

$\frac{83}{5}=\frac{83\times 4}{5\times 4}=\frac{332}{20}$ and $\frac{19}{4}=\frac{19\times 5}{4\times 5}=\frac{95}{20}$

$\because \quad \frac{332}{20}>\frac{95}{20}$

` $\frac{83}{5}$ > ` $\frac{19}{4}$

Difference between both costs = ` $\left(\frac{83}{5}-\frac{19}{4}\right)$

= ` $\left(\frac{332}{20}-\frac{95}{20}\right)$ = ` $\frac{332-95}{20}$

= ` $\frac{237}{20}$ = ` $11\frac{17}{20}$

Hence, pen costs more by ` $11\frac{17}{20}$.

13. Weight of apples $= 3\frac{3}{4}$ kg

Weight of guava $= 4\frac{1}{2}$ kg

Total weight of fruits $= \left(3\frac{3}{4} + 4\frac{1}{2}\right)$ kg

$= \left(\frac{15}{4} + \frac{9}{2}\right)$ kg $= \frac{15+18}{4}$ kg (LCM of 4 and 2 = 4)

$= \frac{33}{4}$ kg $= 8\frac{1}{4}$ kg

Hence, total weight of fruits purchased by Savita is $8\frac{1}{4}$ kg.

14. Width of picture $= 7\frac{3}{5}$ cm

Width of frame $= 7\frac{3}{10}$ cm

Width of be trimmed $= \left(7\frac{3}{5} - 7\frac{3}{10}\right)$ cm $= \left(\frac{38}{5} - \frac{73}{10}\right)$ cm

$= \frac{76-73}{10}$ cm (LCM of 5 and 10 = 10)

$= \frac{3}{10}$ cm

15. Total length of wire $= 3\frac{3}{4}$ m

Length of one piece $= 1\frac{1}{2}$ m

Length of other piece $= \left(3\frac{3}{4} - 1\frac{1}{2}\right)$ m $= \left(\frac{15}{4} - \frac{3}{2}\right)$ m

$= \frac{15-6}{4}$ m (LCM of 4 and 2 = 4)

$= \frac{9}{4}$ m $= 2\frac{1}{4}$ m

EXERCISE 2B

1. (a) $\frac{5}{8} \times \frac{4}{7} = \frac{5\times 4}{8\times 7} = \frac{5}{14}$ (b) $\frac{3}{5} \times \frac{7}{11} = \frac{3\times 7}{5\times 11} = \frac{21}{55}$

(c) $\frac{4}{9}\times\frac{15}{16}=\frac{4\times15}{9\times16}=\frac{5}{12}$ (d) $\frac{9}{5}\times45=\frac{9}{5}\times\frac{45}{1}=\frac{9\times45}{5\times1}=81$

(e) $\frac{6}{7}\times42=\frac{6}{7}\times\frac{42}{1}$ (f) $\frac{5}{8}\times1000=\frac{5}{8}\times\frac{1000}{1}$

$=\frac{6\times42}{7\times1}=36$ $=\frac{5\times1000}{8\times1}=625$

(g) $2\frac{4}{15}\times12=\frac{34}{15}\times\frac{12}{1}$ (h) $3\frac{1}{8}\times16=\frac{25}{8}\times\frac{16}{1}$

$=\frac{34\times12}{15\times1}=\frac{136}{5}$ $=\frac{25\times16}{8\times1}=50$

(i) $9\frac{1}{2}\times1\frac{9}{19}=\frac{19}{2}\times\frac{28}{19}=\frac{19\times28}{2\times19}=14$

2. (a) $\frac{2}{5}\times\frac{6}{11}\times\frac{15}{18}=\frac{2\times6\times15}{5\times11\times18}=\frac{2}{11}$

(b) $\frac{10}{27}\times\frac{28}{65}\times\frac{39}{56}=\frac{10\times28\times39}{27\times65\times56}=\frac{1}{9}$

(c) $\frac{12}{25}\times\frac{15}{28}\times\frac{35}{36}=\frac{12\times15\times15}{25\times28\times36}=\frac{1}{4}$

(d) $2\frac{2}{17}\times7\frac{2}{9}\times1\frac{33}{52}=\frac{36}{17}\times\frac{65}{9}\times\frac{85}{52}=\frac{36\times65\times85}{17\times9\times52}=25$

(e) $3\frac{1}{16}\times7\frac{3}{7}\times1\frac{25}{39}=\frac{49}{16}\times\frac{52}{7}\times\frac{64}{39}=\frac{49\times52\times64}{16\times7\times39}=\frac{112}{3}=37\frac{1}{3}$

(f) $1\frac{4}{7}\times1\frac{13}{22}\times1\frac{1}{15}=\frac{11}{7}\times\frac{35}{22}\times\frac{16}{15}=\frac{11\times35\times16}{7\times22\times15}=\frac{8}{3}$

3. (a) $\frac{1}{4}\times24=\frac{1\times24}{4}=6$ (b) $\frac{3}{8}\times32=\frac{3\times32}{8}=12$

(c) $\frac{3}{5}\times45=\frac{3\times45}{5}=27$ (d) $\frac{7}{50}\times2000=\frac{7\times2000}{50}=280$

(e) $\frac{3}{20}\times1040=\frac{3\times1040}{20}=156$ (f) $\frac{5}{11}\times$ ` $330=$ ` $\frac{5\times330}{11}=$ ` 150

(g) $\frac{4}{9}\times63\,\text{m}=\frac{4\times63}{9}\,\text{m}=28\,\text{m}$

(h) $\frac{6}{7}\times42\,\text{litres}=\frac{6\times42}{7}\,\text{litres}=36\,\text{litres}$

(i) $\frac{1}{12}\times1\,\text{hour}=\frac{1\times60}{12}\,\text{minutes}=5\,\text{minutes}$

(j) $\frac{3}{4}\times1\,\text{year}=\frac{3}{4}\times12\,\text{months}=9\,\text{months}$

(k) $\frac{7}{25} \times 1\text{kg} = \frac{7}{25} \times 1000\,\text{g} = \frac{7 \times 1000}{25}\,\text{g} = 280\,\text{g}$

(l) $\frac{7}{20} \times 1\text{m} = \frac{7}{20} \times 100\,\text{cm} = 35\,\text{cm}$

(m) $\frac{7}{12} \times 1\text{day} = \frac{7}{12} \times 24\,\text{hours} = \frac{7 \times 24}{12}\,\text{hours} = 14\,\text{hours}$

(n) $\frac{2}{7} \times 1\text{week} = \frac{2}{7} \times 7\,\text{days} = 2\,\text{days}$

(o) $\frac{11}{50} \times 1\text{litre} = \frac{11}{50} \times 1000\,\text{ml} = \frac{11 \times 1000}{50}\,\text{ml} = 220\,\text{ml}$

4. 1 tin holds ghee $= 12\frac{3}{4}$ kg

26 tins hold ghee $= \left(12\frac{3}{4} \times 26\right)$ kg

$= \left(\frac{51}{4} \times 26\right)$ kg $= 331\frac{1}{2}$ kg

26 tins hold $331\frac{1}{2}$ kg of ghee.

5. Cost of 1 kg mangoes = ` $48\frac{4}{5}$

Cost of $3\frac{3}{4}$ kg mangoes = $\left(48\frac{4}{5} \times 3\frac{3}{4}\right) = \left(\frac{244}{5} \times \frac{15}{4}\right)$

$= \left(\frac{244 \times 15}{5 \times 4}\right) =$ ` 183

Hene, the cost of $3\frac{3}{4}$ kg mangoes is ` 183.

6. Cost of 1 m of cloth = ` $42\frac{1}{2}$

Cost of $5\frac{3}{5}$ m of cloth = $\left(42\frac{1}{2} \times 5\frac{3}{5}\right) = \left(\frac{85}{2} \times \frac{28}{5}\right)$

$= \left(\frac{85 \times 28}{2 \times 5}\right) =$ ` 238

Hene, the cost of $5\frac{3}{5}$ m of cloth is ` 238.

7. Distance covered in 1 hour = $66\frac{2}{3}$ km

Distance covered in 9 hours $= \left(66\frac{2}{3} \times 9\right)$ km

$= \left(\frac{200}{3} \times 9\right)$ km

$= \frac{200 \times 9}{3}$ km $= 600$ km

Hence, motorbike covers 600 km in 9 hours.

8. Thickness of 1 board $= 3\frac{2}{3}$ cm.

Height of stack $= 9 \times$ thickness of 1 board

$= \left(9 \times 3\frac{2}{3}\right)$ cm $= \left(9 \times \frac{11}{3}\right)$ cm

$= 33$ cm

Hence, height of stack is 33 cm.

9. Cost of 1 ticket $= ₹\ 35\frac{1}{2}$

Cost of 308 tickets $= ₹\left(308 \times 35\frac{1}{2}\right) = ₹\left(308 \times \frac{71}{2}\right)$

$= ₹\ 10934$

Thus, the amount of ₹ 10934 is collected.

10. Total number of students $= 42$

Number of girls $= \frac{5}{7}$ of 42

$= \frac{5}{7} \times 42 = 30$

Now, the number of boys $=$ Total student $-$ Total girls

$= 42 - 30 = 12$

Here, there are 12 boys in the class.

11. Sonali takes time to complete 1 round $= 4\frac{4}{5}$ minutes

Sonali will take time to complete 15 rounds $= \left(4\frac{4}{5} \times 15\right)$ minutes

$= \left(\frac{24}{5} \times 15\right)$ minutes

$= 72$ minutes

Hence, Sonali will take 72 minutes to take 15 rounds.

12. Weight of Nidhi = 35 kg

Weight of Harish = $\left(\frac{3}{5}\right) \times 35\frac{\ddot{0}}{\phi}$ kg = 21 kg

Hence, Harish weights 21 kg.

13. Side of square field = $4\frac{2}{3}$ m

Its area = side × side

$= \left(4\frac{2}{3} \times 4\frac{2}{3}\right)\ddot{\div}\phi\ m^2 = \left(\frac{14}{3} \times \frac{14}{3}\right)\ddot{\div}\phi\ m^2$

$= \frac{196}{9}\ m^2 = 21\frac{7}{9}\ m^2$

Hence, the area of square field is $21\frac{7}{9}\ m^2$.

14. Length of park = $41\frac{2}{3}$ m

Breadth of park = $18\frac{3}{5}$ m

Area of rectangular park = $l \times b$

$= \left(41\frac{2}{3} \times 18\frac{3}{5}\right)\ddot{\div}\phi\ m^2$

$= \left(\frac{125}{3} \times \frac{93}{5}\right)\ddot{\div}\phi\ m^2$

$= 775\ m^2$

Hence, the area of park is 775 m^2.

15. Income of Bindu = ` 24000 per month

Expenditure = $\frac{7}{8}$ of income = $` \left(\frac{7}{8}\right) \times 24000\ddot{\div}\phi$

= ` 21000

Money deposited in bank = (Income − expenditure)

= ` (24000 − 21000)

= ` 3000

Hence, Bindu deposited ` 3000 in the bank each month.

EXERCISE 2C

1. (a) Reciprocal of $\frac{4}{9} = \frac{9}{4}$ (b) Reciprocal of $5 = \frac{1}{5}$

(c) Reciprocal of $\frac{1}{15} = 15$

(d) $3\frac{17}{21} = \frac{80}{21}$

Reciprocal of $3\frac{17}{21} = \frac{21}{80}$

2. (a) $\frac{7}{10} \div \frac{3}{5} = \frac{7}{10} \times \frac{5}{3}$ $\left(\because \text{ reciprocal of } \frac{3}{5} \text{ is } \frac{5}{3}\right)$

$= \frac{7 \times 5}{10 \times 3} = \frac{7}{6}$

(b) $\frac{4}{7} \div \frac{9}{14} = \frac{4}{7} \times \frac{14}{9}$ $\left(\because \text{ reciprocal of } \frac{9}{14} \text{ is } \frac{14}{9}\right)$

$= \frac{4 \times 14}{7 \times 9} = \frac{8}{9}$

(c) $9 \div \frac{1}{3} = \frac{9}{1} \times \frac{3}{1}$ $\left(\because \text{ reciprocal of } \frac{1}{3} \text{ is } \frac{3}{1}\right)$

$= \frac{9 \times 3}{1 \times 1} = \frac{27}{1} = 27$

(d) $24 \div \frac{6}{7} = 24 \times \frac{7}{6}$ $\left(\because \text{ reciprocal of } \frac{6}{7} \text{ is } \frac{7}{6}\right)$

$= \frac{24 \times 7}{6} = 28$

(e) $\frac{8}{9} \div 16 = \frac{8}{9} \times \frac{1}{16}$ $\left(\because \text{ reciprocal of } 16 \text{ is } \frac{1}{16}\right)$

$= \frac{8 \times 1}{9 \times 16} = \frac{1}{18}$

(f) $3\frac{3}{7} \div \frac{8}{21} = \frac{24}{7} \times \frac{21}{8}$ $\left(\because \text{ reciprocal of } \frac{8}{21} \text{ is } \frac{21}{8}\right)$

$= \frac{24 \times 21}{7 \times 8} = 9$

(g) $3\frac{3}{5} \div \frac{4}{5} = \frac{18}{5} \times \frac{5}{4}$ $\left(\because \text{ reciprocal of } \frac{4}{5} \text{ is } \frac{5}{4}\right)$

$= \frac{18 \times 5}{5 \times 4} = \frac{9}{2} = 4\frac{1}{2}$

(h) $15\frac{3}{7} \div 1\frac{23}{49} = \frac{108}{7} \div \frac{72}{49} = \frac{108}{7} \times \frac{49}{72}$ $\left(\because \text{ reciprocal of } \frac{72}{49} \text{ is } \frac{49}{72}\right)$

$= \frac{108 \times 49}{7 \times 72} = \frac{21}{2} = 10\frac{1}{2}$

(i) $5\frac{4}{7} \div 1\frac{3}{10} = \frac{39}{7} \div \frac{13}{10} = \frac{39}{7} \times \frac{10}{13}$ ∵ reciprocal of $\frac{13}{10}$ is $\frac{10}{13}$

$= \frac{39 \times 10}{7 \times 13} = \frac{30}{7} = 4\frac{2}{3}$

3. (a) $\frac{7}{15} \div \frac{14}{15} = \frac{7}{15} \times \frac{15}{14}$ ∵ reciprocal of $\frac{14}{15}$ is $\frac{15}{14}$

$= \frac{7 \times 15}{15 \times 14} = \frac{1}{2}$

(b) $32 \div 1\frac{3}{5} = 32 \div \frac{8}{5} = 32 \times \frac{5}{8}$ ∵ reciprocal of $\frac{8}{5}$ is $\frac{5}{8}$

$= \frac{32 \times 5}{8} = 20$

(c) $45 \div 1\frac{4}{5} = 45 \div \frac{9}{5} = 45 \times \frac{5}{9}$ ∵ reciprocal of $\frac{9}{5}$ is $\frac{5}{9}$

$= \frac{45 \times 5}{9} = 25$

(d) $63 \div 2\frac{1}{4} = 63 \div \frac{9}{4} = 63 \times \frac{4}{9}$ ∵ reciprocal of $\frac{9}{4}$ is $\frac{4}{9}$

$= \frac{63 \times 4}{9} = 28$

(e) $6\frac{7}{8} \div \frac{11}{16} = \frac{55}{8} \times \frac{16}{11}$ ∵ reciprocal of $\frac{11}{16}$ is $\frac{16}{11}$

$= \frac{55 \times 16}{8 \times 11} = 10$

(f) $5\frac{5}{9} \div 3\frac{1}{3} = \frac{50}{9} \div \frac{10}{3} = \frac{50}{9} \times \frac{3}{10}$ ∵ reciprocal of $\frac{10}{3}$ is $\frac{3}{10}$

$= \frac{50 \times 3}{9 \times 10} = \frac{5}{3}$

4. Product of two numbers = 42

One of the numbers = $9\frac{4}{5}$

Other number = $42 \div 9\frac{4}{5} = 42 \div \frac{49}{5}$

$= 42 \times \frac{5}{49}$ ∵ reciprocal of $\frac{49}{5}$ is $\frac{5}{49}$

$= \frac{42 \times 5}{49} = \frac{30}{7} = 4\frac{2}{3}$

5. Quotient $= 4\frac{2}{3}$, Dividend $= 6\frac{2}{9}$

Divisor = Dividend ÷ Quotient

$$= 6\frac{2}{9} \div 4\frac{2}{3} = \frac{56}{9} \div \frac{14}{3}$$

$$= \frac{56}{9} \times \frac{3}{14} \qquad \left(\because \text{ reciprocal of } \frac{14}{3} \text{ is } \frac{3}{14}\right)$$

$$= \frac{56 \times 3}{9 \times 14} = \frac{4}{3} = 1\frac{1}{3}$$

6. Product of two numbers $= 15\frac{5}{6}$

One of the numbers $= 6\frac{1}{3}$

Other numbers $= 15\frac{5}{6} \div 6\frac{1}{3} = \frac{95}{6} \div \frac{19}{3}$

$$= \frac{95}{6} \times \frac{3}{19} \qquad \left(\because \text{ reciprocal of } \frac{19}{3} \text{ is } \frac{3}{19}\right)$$

$$= \frac{95 \times 3}{6 \times 19} = \frac{5}{2} = 2\frac{1}{2}$$

7. Total length of wire $= 13\frac{1}{2}$ m

Number of pieces $= 9$

length of each piece $= \left(13\frac{1}{2} \div 9\right)$ m

$$= \left(\frac{27}{2} \times \frac{1}{9}\right) \text{m} \qquad \left(\because \text{ reciprocal of } 9 \text{ is } \frac{1}{9}\right)$$

$$= \frac{27 \times 1}{2 \times 9} \text{ m} = \frac{3}{2} \text{ m} = 1\frac{1}{2} \text{ m}$$

Hence, the length of each piece is $1\frac{1}{2}$ m.

8. Total weight of 18 boxes $= 49\frac{1}{2}$ kg

Weight of each box $= \left(49\frac{1}{2} \div 18\right)$

$$= \left(\frac{99}{2} \times \frac{1}{18}\right) \text{kg} \qquad \left(\because \text{ reciprocal of } 18 \text{ is } \frac{1}{18}\right)$$

$$= \left(\frac{99 \times 1}{2 \times 18}\right) \text{kg} = \frac{11}{4} \text{ kg} = 2\frac{3}{4} \text{ kg}$$

9. Total amount of money = ` $249\frac{3}{4}$

Cost of each book = ` $27\frac{3}{4}$

Number of book were purchased for ` $249\frac{3}{4}$

$$= \left(249\frac{3}{4} \div 27\frac{3}{4}\right) \text{books}$$

$$= \left(\frac{999}{4} \div \frac{111}{4}\right) \text{books}$$

$$= \left(\frac{999}{4} \times \frac{4}{111}\right) \text{books} \quad \left(\because \text{reciprocal of } \frac{111}{4} \text{ is } \frac{4}{111}\right)$$

$$= \left(\frac{999 \times 4}{4 \times 111}\right) \text{books}$$

$$= 9 \text{ books}$$

Hence, 9 books can be purchased for ` $249\frac{3}{4}$.

10. Cost of $8\frac{1}{2}$ kg of sugar = ` $242\frac{1}{4}$

Cost of 1 kg of sugar = ` $\left(242\frac{1}{4} \div 8\frac{1}{2}\right) = ` \left(\frac{969}{4} \div \frac{17}{2}\right)$

$$= ` \left(\frac{969}{4} \times \frac{2}{17}\right) = ` \left(\frac{969 \times 2}{4 \times 17}\right)$$

$$= ` \frac{57}{2} = ` 28\frac{1}{2}$$

Hence, the cost of 1 kg of sugar is ` $28\frac{1}{2}$.

11. Total cost of pens sold = ` 378

Cost of 1 pen = ` $6\frac{3}{4}$

Number of pens $= \left(378 \div 6\frac{3}{4}\right) \text{pens}$

$$= \left(378 \div \frac{27}{4}\right) \text{pens}$$

$$= \left(378 \times \frac{4}{27}\right) \text{pens} \quad \because \text{ reciprocal of } \frac{27}{4} \text{ is } \frac{4}{27}$$

$$= \frac{378 \times 4}{27} \text{ pens} = 56 \text{ pens}$$

Hence, 56 pens were sold by shopkeeper.

12. Total weight of apples available for = ` $326\frac{1}{4}$

1 kg of apple costs = ` $43\frac{1}{2}$

Total weight of apples = $` \left(326\frac{1}{4} \div 43\frac{1}{3}\right) \text{kg} = \left(\frac{1305}{4} \div \frac{87}{2}\right) \text{kg}$

$$= \left(\frac{1305}{4} \times \frac{2}{87}\right) \text{kg} \quad \because \text{ reciprocal of } \frac{87}{2} \text{ is } \frac{2}{87}$$

$$= \frac{1305 \times 2}{4 \times 87} \text{kg} = \frac{15}{2} \text{kg} = 7\frac{1}{2} \text{ kg}$$

Hence, $7\frac{1}{2}$ kg of apples is available for ` $326\frac{1}{4}$.

13. Distance covered in $7\frac{3}{4}$ hours $= 20\frac{2}{3}$ km

Distance covered in 1 hours $= \left(20\frac{2}{3} \div 7\frac{3}{4}\right) \text{km} = \left(\frac{62}{3} \div \frac{31}{4}\right) \text{km}$

$$= \left(\frac{62}{3} \times \frac{4}{31}\right) \text{km} \quad \because \text{ reciprocal of } \frac{31}{4} \text{ is } \frac{4}{31}$$

$$= \frac{62 \times 4}{3 \times 31} \text{ km} = \frac{8}{3} \text{ km} = 2\frac{2}{3} \text{ km}$$

Hence, Atul walks $2\frac{2}{3}$ km per hour.

14. Total juice distributed among all students = 24 litres

Each students gets = $\frac{2}{5}$ litre

Number of students in hostel $= \left(24 \div \frac{2}{5}\right)$

$$= \left(24 \times \frac{5}{2}\right) \quad \because \text{ reciprocal of } \frac{2}{5} \text{ is } \frac{5}{2}$$

$$= 60$$

Hence, there are 60 students in the hostel.

15. Total contribution = ` $2876\frac{1}{2}$

Contribution of each student = ` $261\frac{1}{2}$

Number of students $= \left(2876\frac{1}{2} \div 261\frac{1}{2}\right) = \left(\frac{5753}{2} \div \frac{523}{2}\right)$

$= \left(\frac{5753}{2} \times \frac{2}{523}\right)$ $\because$ reciprocal of $\frac{523}{2}$ is $\frac{2}{523}$

$= \frac{5753 \times 2}{2 \times 523} = 11$

Hence, there are 11 students in the group.

16. Total amount was collected = ` $877\frac{1}{2}$

Price of each ticket = ` $32\frac{1}{2}$

Number of tickets were sold $= \left(877\frac{1}{2} \div 32\frac{1}{2}\right) = \left(\frac{1765}{2} \div \frac{65}{2}\right)$

$= \left(\frac{1755}{2} \times \frac{2}{65}\right)$

$\because$ reciprocal of $\frac{65}{2}$ is $\frac{2}{65}$

$= \frac{1755 \times 2}{2 \times 65} = 27$

Hence, 27 tickets were sold.

EXERCISE 2D

1. (c) **2.** (a) **3.** (c)

4. $1\frac{3}{4} = \frac{7}{4}$

reciprocal of $1\frac{3}{4} = \frac{4}{7}$

(d) is correct.

5. LCM of 10 and 15 $= 2 \times 3 \times 5 = 30$

$\frac{3}{10} + \frac{8}{15} = \frac{9+16}{30} = \frac{25}{30} = \frac{5}{6}$

(c) is correct.

2	10, 15
3	5, 15
5	5, 5
	1, 1

6. LCM of 4 and $3 = 4 \times 3 = 12$

$$3\frac{1}{4} - 2\frac{1}{3} = \frac{13}{4} - \frac{7}{3} = \frac{39-28}{12} = \frac{11}{12}$$

(d) is correct.

7. Required number $= 1\frac{1}{2} \div \frac{2}{3} = \frac{3}{2} \times \frac{3}{2} = \frac{9}{4} = 2\frac{1}{4}$

(d) is correct.

8. Required number $= 1\frac{6}{7} \div 2\frac{3}{5} = \frac{13}{7} \div \frac{13}{5}$

$$= \frac{13}{7} \times \frac{5}{13} = \frac{5}{7}$$

(b) is correct.

9. Mohit reads book everyday for $= 1\frac{3}{4}$ hours

He reads the entire book in $= 6$ days

$$\text{Total time taken} = \left(6 \times 1\frac{3}{4}\right) \text{hours} = 6 \times \frac{7}{4} \text{ hours}$$

$$= \frac{21}{2} \text{ hours} = 10\frac{1}{2} \text{ hours}$$

(a) is correct.

10. 1 *l* of petrol is required for $= 16$ km

$2\frac{3}{4}$ *l* of petrol is required for $= \left(16 \times 2\frac{3}{4}\right)$ km $= \left(16 \times \frac{11}{4}\right)$ km $= 44$ km

(a) is correct.

HOTS

- Amit has books $= 120$

He give away $= \frac{5}{6}$ of 120

$$= \frac{5}{6} \times 120 = 100 \text{ books}$$

Remaining books $= 120 - 100 = 20$

He sell books $= \frac{2}{5}$ of 20

$$= \frac{2}{5} \times 20 = 8 \text{ books}$$

Hence, Amit sold 8 books.

VALUE BASED

- Manish has sandwiches = 2
  Total friends = Manish + 2 = 3
  Each one get sandwiches $= 2 \div 3 = \frac{2}{3}$
  Hence, each one get $\frac{2}{3}$ sandwiches.

Chapter 3 Decimals

EXERCISE 3A

1. (a) 3.50, 0.67, 15.60, 4.00

(b) 6.500, 16.030, 0.274, 119, 400

2. (a) 685.124 → 600

(b) 221.005 → $\frac{5}{1000}$

(c) 62.215 → $\frac{2}{10}$

(d) 2347.580 → 7

3.

S.No.	Hundreds	Tens	Ones	Decimal point	Tenths	Hundredths	Thousandths
(a)	1	0	5	.	3	0	2
(b)			0	.	0	0	8
(c)			4	.	1	8	5
(d)		5	0	.	3	5	0

4. (a) $300 + 50 + \frac{0}{10} + \frac{5}{100} + \frac{8}{1000} = 350.058$

(b) $800 + 20 + 4 + \frac{9}{10} + \frac{0}{100} + \frac{2}{10000} = 824.9002$

5. (a) $17.306 = 10 + 7 + \frac{3}{10} + \frac{6}{1000}$

(b) $456.237 = 400 + 50 + 6 + \frac{2}{10} + \frac{3}{100} + \frac{7}{1000}$

(c) $100.006 = 100 + \frac{6}{1000}$

(d) $292.425 = 200 + 90 + 2 + \frac{4}{10} + \frac{2}{100} + \frac{5}{1000}$

6. (a) 0.5 (b) 0.88 (c) 3.46 (d) 4.40

7. (a) $0.98 \boxed{<} 1.07$ (b) $1.85 \boxed{>} 1.805$

(c) $5.68 \boxed{<} 5.86$ (d) $3.406 \boxed{<} 3.46$

(e) $14.05 \boxed{>} 14.005$ (f) $78.23 \boxed{>} 69.85$

8. (a) Converting the given decimals into like decimals, we get them as

2.200, 2.202. 2.020. 22.200. 2.002

Clearly, $2.002 < 2.020 < 2.200 > 2.202 < 22.200$

Hence, the given decimals in ascending order are :

2.002, 2.02, 2.2, 2.202, 22.2

(b) Converting the given decimals into like decimals, we get them as

4.60, 7.40, 4.58, 7.32, 4.06

Clearly, $4.06 < 4.58 < 4.60 < 7.32 < 7.40$

Hence, the given decimals in ascending order are :

4.06, 4.58, 4.6, 7.32, 7.4

(c) Converting the given decimals into like decimals, we get them as

0.50, 5.50, 5.05, 0.05, 5.55

Clearly, $0.05 < 0.50 < 5.05 < 5.50 < 5.55$

Hence, the given decimals in ascending order are :

0.05, 0.5, 5.05, 5.5, 5.55

(d) Converting the given decimals into like decimals, we get them as

6.84, 6.48, 6.80, 6.40, 6.08

Clearly, $6.08 < 6.40 < 6.48 < 6.80 < 6.84$

Hence, the given decimals in ascending order are :

6.08, 6.4, 6.48, 6.8, 6.84

9. (a) Converting the given decimals into like decimals, we get them as

2.600, 2.260, 2.060, 2.007, 2.300

Clearly, $2.600 > 2.300 > 2.260 > 2.060 > 2.007$

Hence, the given decimals in descending order are :

2.6, 2.3, 2.26, 2.06, 2.007

(b) Converting the given decimals into like decimals, we get them as

7.40, 8.34, 74.40, 7.44, 0.74

Clearly, $74.40 > 8.34 > 7.44 > 7.40 > 0.74$

Hence, the given decimals in descending order are :

74.4, 8.34, 7.44, 7.4, 0.74

10. (a) $0.6 = \frac{6}{10} = \frac{3}{5}$ (b) $0.25 = \frac{25}{100} = \frac{1}{4}$

(c) $0.05 = \frac{5}{100} = \frac{1}{20}$ (d) $0.175 = \frac{175}{1000} = \frac{7}{40}$

11. (a) $5.6 = \frac{56}{10} = \frac{28}{5} = 5\frac{3}{5}$ (b) $12.25 = \frac{1225}{100} = \frac{49}{4} = 12\frac{1}{4}$

(c) $4.625 = \frac{4625}{1000} = \frac{37}{8} = 4\frac{5}{8}$ (d) $6.004 = \frac{6004}{1000} = \frac{1501}{250} = 6\frac{1}{250}$

12. (a)
$$\begin{array}{r|l} 20 & 170 \\ -160 & 0.85 \\ \hline 100 & \\ -100 & \\ \hline \times & \end{array}$$
$\frac{17}{20} = 0.85$

(b)
$$\begin{array}{r|l} 8 & 25 \\ -24 & 3.125 \\ \hline 10 & \\ -8 & \\ \hline 20 & \\ -16 & \\ \hline 40 & \\ -40 & \\ \hline \times & \end{array}$$
$\frac{25}{8} = 3.125$

(c)
$$\begin{array}{r|l} 10 & 47 \\ -40 & 4.7 \\ \hline 70 & \\ -70 & \\ \hline \times & \end{array}$$
$\frac{47}{10} = 4.7$

(d)
$$\begin{array}{r|l} 100 & 156 \\ -100 & 1.56 \\ \hline 560 & \\ -500 & \\ \hline 600 & \\ -600 & \\ \hline \times & \end{array}$$
$\frac{156}{100} = 1.56$

(e)
$$\begin{array}{r|l} 100 & 2516 \\ -200 & 25.16 \\ \hline 516 & \\ -500 & \\ \hline 160 & \\ -100 & \\ \hline 600 & \\ -600 & \\ \hline \times & \end{array}$$
$\frac{2516}{100} = 25.16$

(f)
$$\begin{array}{r|l} 1000 & 3524 \\ -3000 & 3.524 \\ \hline 5240 & \\ -5000 & \\ \hline 2400 & \\ -2000 & \\ \hline 4000 & \\ -4000 & \\ \hline \times & \end{array}$$
$\frac{3524}{1000} = 3.524$

(g) $2\frac{2}{25} = \frac{52}{25}$ $25\overline{)52\,(2.08}$ -50 200 -200 $\times$

(h) $3\frac{2}{5} = \frac{17}{5}$ $5\overline{)17\,(3.4}$ -15 20 -20 $\times$

$2\frac{2}{25} = 2.08$ $3\frac{2}{5} = 3.4$

13. 45 mm in cm $= \frac{45}{10}$ cm (æçè $1\text{ mm} = \frac{1}{10}$ cm öø÷)

$= 4.5$ cm

45 mm in m $= \frac{45}{1000}$ m (æçè $1\text{ mm} = \frac{1}{1000}$ m öø÷)

$= 0.045$ m

45 mm in km $= \frac{45}{1000000}$ cm (æçè $1\text{ mm} = \frac{1}{1000000}$ km öø÷)

$= 0.000045$ km

14. (a) 4 paise = ` $\frac{4}{100}$ (æçè $1\text{ paisa} = ` \frac{1}{100}$ öø÷)

= ` 0.04

(b) 8 rupees 5 paise = ` $8 +$ ` $\frac{5}{100}$ (æçè $1\text{ paisa} = ` \frac{1}{100}$ öø÷)

= ` $8 +$ ` 0.05

= ` 8.05

(c) 9 rupees 75 paise = ` $9 +$ ` $\frac{75}{100}$ (æçè $1\text{ paisa} = ` \frac{1}{100}$ öø÷)

= ` $9 +$ ` $0.75 =$ ` 9.75

15. (a) 75 m $= \frac{75}{1000}$ km (æçè $1\text{ m} = \frac{1}{1000}$ km öø÷)

$= 0.075$ km

(b) 225 m $= \frac{225}{1000}$ km (æçè $1\text{ m} = \frac{1}{1000}$ km öø÷)

$= 0.225$ km

(c) 5 km 5 m $= 5\text{ km} + \frac{5}{1000}$ km (æçè $1\text{ m} = \frac{1}{1000}$ km öø÷)

$= 5\text{ km} + 0.005\text{ km}$

$= 5.005$ km

EXERCISE 3B

1. (a) Converting the given decimals into like decimals,

$$\begin{array}{r} 6.606 \\ 66.600 \\ 666.000 \\ 0.066 \\ +\ 0.660 \\ \hline 739.932 \end{array}$$

(b) Converting the given decimals into like decimals,

$$\begin{array}{r} 9.090 \\ 0.909 \\ 99.900 \\ 9.990 \\ +\ 0.099 \\ \hline 119.988 \end{array}$$

(c) Converting the given decimals into like decimals,

$$\begin{array}{r} 16.00 \\ 8.70 \\ 0.94 \\ 6.80 \\ +\ 7.77 \\ \hline 40.21 \end{array}$$

(d) Converting the given decimals into like decimals,

$$\begin{array}{r} 18.600 \\ 206.370 \\ 8.008 \\ 26.400 \\ +\ 6.900 \\ \hline 266.278 \end{array}$$

(e) Converting the given decimals into like decimals,

$$\begin{array}{r} 17.400 \\ 86.390 \\ 9.435 \\ 8.800 \\ +\ 0.060 \\ \hline 122.085 \end{array}$$

(f) Converting the given decimals into like decimals,

$$\begin{array}{r} 23.800 \\ 8.940 \\ 0.078 \\ +\ 214.600 \\ \hline 247.418 \end{array}$$

(g) Converting the given decimals into like decimals,

$$\begin{array}{r} 26.900 \\ 19.740 \\ 231.769 \\ +\ 0.048 \\ \hline 278.457 \end{array}$$

(h) Converting the given decimals into like decimals,

$$\begin{array}{r} 63.50 \\ 9.70 \\ 0.80 \\ 26.66 \\ +\ 12.17 \\ \hline 112.83 \end{array}$$

2. (a)

$$\begin{array}{r} 9.001 \\ -\ 6.732 \\ \hline 2.269 \end{array}$$

(b) Converting the given decimals into like decimals,

$$\begin{array}{r} 8.0000 \\ -\ 2.5307 \\ \hline 5.4693 \end{array}$$

(c) Converting the given decimals into like decimals,

$$\begin{array}{r} 5.0500 \\ -\ 0.4678 \\ \hline 4.5822 \end{array}$$

(d) Converting the given decimals into like decimals,

$$\begin{array}{r} 1.007 \\ -\ 0.680 \\ \hline 0.327 \end{array}$$

(e) Converting the given decimals into like decimals,

$$\begin{array}{r} 24.160 \\ -\ 15.079 \\ \hline 9.081 \end{array}$$

(f) Converting the given decimals into like decimals,

$$\begin{array}{r} 22.000 \\ -\ 13.876 \\ \hline 8.124 \end{array}$$

(g) Converting the given decimals into like decimals,

$$\begin{array}{r} 52.60 \\ -\ 36.74 \\ \hline 15.86 \end{array}$$

(h)

$$\begin{array}{r} 72.43 \\ -\ 14.79 \\ \hline 57.64 \end{array}$$

3. (a) $10.007 - 18.6324 + 76.3728 - 47.638$

$= 10.0070 - 18.6324 + 76.3728 - 47.6380$

$= (10.0070 + 76.3728) - (18.6324 + 47.6380)$

$= 86.3798 - 66.2704$

$= 20.1094$

$$\begin{array}{r} 10.0070 \\ +\ 76.3728 \\ \hline 86.3798 \end{array} \qquad \begin{array}{r} 18.6324 \\ +\ 47.6380 \\ \hline 66.2704 \end{array} \qquad \begin{array}{r} 86.3798 \\ -\ 66.2704 \\ \hline 20.1094 \end{array}$$

(b) $38.694 - 13.642 + 81.963 - 37.9214$

$= 38.6940 - 13.6420 + 81.9630 - 37.9214$

$= (38.6940 + 81.9630) - (13.6420 + 37.9214)$

$= 120.6570 - 51.5634$

$= 69.0936$

$$\begin{array}{r} 38.6940 \\ +\ 81.9630 \\ \hline 120.6570 \end{array} \qquad \begin{array}{r} 13.6420 \\ +\ 37.9214 \\ \hline 51.5634 \end{array} \qquad \begin{array}{r} 120.6570 \\ -\ 51.5634 \\ \hline 69.0936 \end{array}$$

(c) $50.6 + 37.916 - 15.428 - 38.639$

$= (50.600 + 37.916) - (15.428 + 38.639)$

$= 88.516 - 54.067 = 34.449$

$$\begin{array}{r} 50.600 \\ +\ 37.916 \\ \hline 88.516 \end{array} \qquad \begin{array}{r} 15.428 \\ +\ 38.639 \\ \hline 54.067 \end{array} \qquad \begin{array}{r} 88.516 \\ -\ 54.067 \\ \hline 34.449 \end{array}$$

(d) 141.374 + 89.639 – 75.638 – 28.016

= 141.374 + 89.639 – (75.638 + 28.016)

= 231.013 – 103.654

= 127.359

141.374	75.638	231.013
+ 89.639	+ 28.016	– 103.654
231.013	103.654	127.359

4. Converting the given decimals into like decimals,

9.100
– 5.746
3.354

5. Required decimal number

= 92 – 63.58

= 28.42

92.00
– 63.58
28.42

6. Required decimal number

= 8.1 – 0.813

= 7.287

8.100
– 0.813
7.287

7. Required decimal number

= 60.1 – 32.67

= 27.43

60.10
– 32.67
27.43

8. Required decimal number

= 74.3 – 26.87

= 47.43

74.30
– 26.87
47.43

9. Cost of notebook = ` 23.75

Cost of pencil = ` 2.85

Cost of pen = ` 15.90

Total cost = ` 42.50

₹ 23.75
₹ 2.85
+ ₹ 15.90
₹ 42.50

Sonam gave money to shopkeeper = ` 250

Amount got by Sonam back = ` 50 – ` 42.50

= ` 7.50

50.00
– 42.50
7.50

Hence, Sonam gets back ` 7.50.

10. Length of one piece = 37.65 m

Length of second piece = 19.39 m

Total length of these two pieces = 37.65 m + 19.39 m

= 57.04 m

```
  37.65
+ 19.39
-------
  57.04
```

Total length of wire = 100 m

Length of remaining wire = (100 − 57.04) m

= 42.96 m

```
 100.00
− 57.04
-------
  42.96
```

Hence, the length of remaining wire is 42.96 m.

EXERCISE 3C

1. (a) $62.81 \times 10 = 628.1$ (b) $6.43 \times 10 = 64.3$

(c) $73.002 \times 10 = 730.02$ (d) $0.72 \times 10 = 7.2$

(e) $0.6 \times 10 = 6$ (f) $0.021 \times 10 = 0.21$

2. (a) $3.286 \times 100 = 328.6$ (b) $5.72 \times 100 = 572$

(c) $3.8 \times 100 = 380$ (d) $0.07 \times 100 = 7$

(e) $0.8 \times 100 = 80$ (f) $0.004 \times 100 = 0.4$

3. (a) $5.6235 \times 1000 = 5623.5$ (b) $0.293 \times 1000 = 293$

(c) $0.065 \times 1000 = 65$ (d) $7.36 \times 1000 = 7360$

(e) $5.9 \times 1000 = 5900$ (f) $0.05 \times 1000 = 50$

4. (a) $43 \times 16 = 688$

$4.3 \times 16 = 68.8$

(b) $274 \times 19 = 5206$

$2.74 \times 19 = 52.06$

(c) $743 \times 12 = 8916$

$0.743 \times 12 = 8.916$

(d) $2562 \times 48 = 122976$

$25.62 \times 48 = 1229.76$

(e) $8131 \times 86 = 699266$

$8.131 \times 86 = 699.266$

(f) $20505 \times 75 = 1537875$

$205.05 \times 75 = 15378.75$

(g) $5021 \times 124 = 622604$

$5.021 \times 124 = 622.604$

(h) $252 \times 69 = 17388$

$0.0252 \times 69 = 1.7388$

(i) $236 \times 327 = 77172$

$0.00236 \times 327 = 0.77172$

5. (a) $345 \times 63 = 21735$

$3.45 \times 6.3 = 21.735$

(b) $54 \times 27 = 1458$

$0.54 \times 0.27 = 0.1458$

(c) $76 \times 24 = 1824$

$7.6 \times 2.4 = 18.24$

(d) $654 \times 9 = 5886$

$6.54 \times 0.09 = 0.5886$

(e) $387 \times 125 = 48375$

$3.87 \times 1.25 = 4.8375$

(f) $568 \times 49 = 27832$

$0.568 \times 4.9 = 2.7832$

(g) $14 \times 46 = 644$

$0.014 \times 0.46 = 0.00644$

(h) $6 \times 38 = 228$

$0.06 \times 0.38 = 0.0228$

(i) $623 \times 75 = 46725$ (j) $1245 \times 64 = 79680$

$0.623 \times 0.75 = 0.46725$ $1.245 \times 6.4 = 7.9680$

(k) $45 \times 24 = 1080$ (l) $545 \times 176 = 95920$

$0.045 \times 2.4 = 0.1080$ $54.5 \times 1.76 = 95.920$

6. (a) $(21 \times 21) \times 21 = 441 \times 21 = 9261$

$2.1 \times 0.21 \times 0.021 = 0.009261$

(b) $(111 \times 11) \times 11 = 1221 \times 11 = 13431$

$11.1 \times 1.1 \times 0.11 = 1.3431$

(c) $(2 \times 2) \times 2 = 4 \times 2 = 8$

$0.2 \times 0.02 \times 0.002 = 0.000008$

(d) $(8 \times 35) \times 5 = 280 \times 5 = 1400$

$0.8 \times 3.5 \times 0.05 = 0.1400$

(e) $(24 \times 15) \times 25 = 360 \times 25 = 9000$

$2.4 \times 1.5 \times 2.5 = 9.000$

(f) $(13 \times 13) \times 13 = 169 \times 13 = 2197$

$13 \times 1.3 \times 0.13 = 2.197$

7. Distance covered by car in 1 hour = 62.5 km

Distance covered by car in 18 hours = (62.5×18) km

$= 1125$ km

Hence, car can cover 1125 km in 18 hours.

```
  625
 ×18
 5000
 6250
11250
```

8. Weight of 1 bag = 48.450 kg

Weight of 16 bags = (48.450×16)

$= 775.200$ kg

Hence, the weight of 16 bags is 775.200 kg.

```
 48450
 ×16
290700
484500
775200
```

9. 1 tin of oil weighs = 16.8 kg

45 tins of oil weighs = (16.8×45) kg

$= 756.0$ kg

Hence, the weight of 45 tins of oil is 756 kg.

```
  168
 ×45
  840
 1680
 7560
```

10. 1 bag contains sugar = 97.8 kg

500 bags of contains sugar = (97.8×500) kg

$= 48900$ kg

Hence, 48900 kg of sugar is contained in 500 bags.

```
 978
 ×5
4890
```

11. 1 bottle holds jam = 925 g

25 bottles hold jam = (925 × 25) g

= 23125 g

= (23125 ÷ 1000) kg

= 23.125 kg

Hence, 23.125 kg of jam will be there in 25 bottles.

```
  925
 ×25
----
 4625
18500
-----
23125
-----
```

12. 1 small bottle holds sause = 0.845 kg

72 small bottle hold sause = (0.845 × 72) kg

= 60.840 kg

Hence, there will be 60.840 kg of sause in 72 bottles.

```
  845
 × 72
-----
 1690
59150
-----
60840
-----
```

13. Cost of 1 kg of sugar = ` 56.80

Cost of 16.25 kg of sugar = ` (56.80 × 16.25)

= ` 923

Hence, the cost of 16.25 kg of sugar will be ` 923.

```
 1625
 ×568
------
 13000
 97500
812500
------
923000
------
```

14. 1 drum can hold oil = 16.850 *l*

48 drums can hold oil = (16.850 × 48) *l*

= 80.800 *l*

Hence, 48 drums can hold 80.8 *l* of oil.

```
 1685
  ×48
-----
 13480
 67400
-----
 80800
-----
```

15. Cost of 1 m of cloth = ` 108.50

Cost of 18.5 m of cloth = ` (108.50 × 18.5)

= ` 2007.25

Hence, the cost of 18.5 m of cloth is ` 2007.25.

```
 1085
 ×185
------
  5425
 86800
108500
------
200725
------
```

EXERCISE 3D

1. (a) $242.7 \div 10 = \frac{242.7}{10} = 24.27$ (b) $43.67 \div 10 = \frac{43.67}{10} = 4.367$

(c) $5.49 \div 10 = \frac{5.49}{10} = 0.549$ (d) $0.45 \div 10 = \frac{0.45}{10} = 0.045$

(e) $0.09 \div 10 = \frac{0.09}{10} = 0.009$ (f) $0.073 \div 10 = \frac{0.073}{10} = 0.0073$

2. (a) $248.3 \div 100 = \frac{248.3}{100} = 2.483$ (b) $34.5 \div 100 = \frac{34.5}{100} = 0.345$

(c) $5.8 \div 100 = \frac{5.8}{100} = 0.058$ (d) $0.4 \div 100 = \frac{0.4}{100} = 0.004$

(e) $0.69 \div 100 = \frac{0.69}{100} = 0.0069$ (f) $0.05 \div 100 = \frac{0.05}{100} = 0.0005$

3. (a) $2397.6 \div 1000 = \frac{2397.6}{1000} = 2.3976$

(b) $465.27 \div 1000 = \frac{465.27}{1000} = 0.46527$

(c) $49.7 \div 1000 = \frac{49.7}{1000} = 0.0497$

(d) $5.7 \div 1000 = \frac{5.7}{1000} = 0.0057$

(e) $0.9 \div 1000 = \frac{0.9}{1000} = 0.0009$

(f) $4 \div 1000 = \frac{4}{1000} = 0.004$

4. (a) $16.46 \div 20 = \frac{16.46}{20} = \frac{16.46}{2} \times \frac{1}{10} = 8.23 \times \frac{1}{10} = 0.823$

(b) $403.8 \div 30 = \frac{403.8}{30} = \frac{403.8}{3} \times \frac{1}{10} = 134.6 \times \frac{1}{10} = 13.46$

(c) $19.2 \div 80 = \frac{19.2}{80} = \frac{19.2}{8} \times \frac{1}{10} = 2.4 \times \frac{1}{10} = 0.24$

(d) $156.8 \div 200 = \frac{156.8}{200} = \frac{156.8}{2} \times \frac{1}{100} = 78.4 \times \frac{1}{100} = 0.784$

(e) $18.08 \div 400 = \frac{18.08}{400} = \frac{18.08}{4} \times \frac{1}{100} = 4.52 \times \frac{1}{100} = 0.0452$

(f) $12.8 \div 500 = \frac{12.8}{500} = \frac{12.8}{5} \times \frac{1}{100} = 2.56 \times \frac{1}{100} = 0.0256$

5. (a)
$$\begin{array}{r|l} 8 & 20 \\ & -16 \\ \hline & 40 \\ & -40 \\ \hline & \times \end{array} \quad 2.5$$

$20 \div 8 = 2.5$

(b)
$$\begin{array}{r|l} 16 & 110 \\ & -96 \\ \hline & 140 \\ & -128 \\ \hline & 120 \\ & -112 \\ \hline & 80 \\ & -80 \\ \hline & \times \end{array} \quad 0.6875$$

$11 \div 16 = 0.6875$

(c) $40\overline{)310}\,(0.775$
-280
300
-280
200
-200
$\times$
$31 \div 40 = 0.775$

(d) $20\overline{)47}\,(2.35$
-40
70
-60
100
-100
$\times$
$47 \div 20 = 2.35$

(e) $15\overline{)63}\,(4.2$
-60
30
-30
$\times$
$63 \div 15 = 4.2$

(f) $25\overline{)101}\,(4.04$
-100
100
-100
$\times$
$101 \div 25 = 4.04$

6. (a) $8\overline{)6.08}\,(0.76$
-56
48
-48
$\times$
$6.08 \div 8 = 0.76$

(b) $9\overline{)0.765}\,(0.085$
-072
45
-45
$\times$
$0.765 \div 9 = 0.085$

(c) $6\overline{)43.2}\,(7.2$
-42
12
-12
$\times$
$43.2 \div 6 = 7.2$

(d) $12\overline{)60.48}\,(5.04$
-60
48
-48
$\times$
$60.48 \div 12 = 5.04$

(e) $21\overline{)117.6}\,(5.6$
-105
126
-126
$\times$
$117.6 \div 21 = 5.6$

(f) $18\overline{)217.44}\,(12.08$
-18
37
-36
144
-144
$\times$
$217.44 \div 18 = 12.08$

(g) $25\overline{)2.575}\,(0.103$
-25
075
-75
$\times$
$2.575 \div 25 = 0.103$

(h) $12\overline{)6.54}\,(0.545$
-60
54
-48
60
-60
$\times$
$6.54 \div 12 = 0.545$

(i) $15\overline{)2.13}\,(0.142$

-15

63

-60

30

-30

$\times$

$2.13 \div 15 = 0.142$

(j) $11\overline{)0.3322}\,(0.0302$

-033

022

-022

$\times$

$0.3322 \div 11 = 0.0302$

(k) $25\overline{)0.175}\,(0.007$

-0175

$\times$

$0.175 \div 25 = 0.007$

(l) $16\overline{)0.768}\,(0.048$

-064

128

-128

$\times$

$0.768 \div 16 = 0.048$

(m) $18\overline{)0.477}\,(0.0265$

-036

117

-108

90

-90

$\times$

$0.477 \div 18 = 0.0265$

(n) $14\overline{)1.001}\,(0.0715$

-98

21

-14

70

-70

$\times$

$1.001 \div 14 = 0.0715$

(o) $16\overline{)5.52}\,(0.345$

-48

72

-64

80

-80

$\times$

$5.52 \div 16 = 0.345$

7. (a) $\frac{0.288}{0.9} = \frac{0.288 \times 10}{0.9 \times 10}$

$= \frac{2.88}{9}$

$= 0.32$

$\frac{0.288}{0.9} = 0.32$

$9\overline{)2.88}\,(0.32$

-27

18

-18

$\times$

(b) $\frac{3.28}{0.8} = \frac{3.28 \times 10}{0.8 \times 10}$

$= \frac{32.8}{8}$

$= 4.1$

$\frac{3.28}{0.8} = 4.1$

$8\overline{)\ 32.8\ (4.1}$

-32

08

-8

$\times$

(c) $\frac{2.0484}{0.18} = \frac{2.0484 \times 100}{0.18 \times 100}$

$= \frac{204.84}{18}$

$= 11.38$

$\frac{2.0484}{0.18} = 11.38$

$18\overline{)\ 204.84\ (11.38}$

-18

24

-18

68

-54

144

-144

$\times$

(d) $\frac{0.228}{0.38} = \frac{0.228 \times 100}{0.38 \times 100}$

$= \frac{22.8}{38} = 0.6$

$\frac{0.228}{0.38} = 0.6$

$38\overline{)\ 22.8\ (0.6}$

-228

$\times$

(e) $\frac{0.8085}{0.35} = \frac{0.8085 \times 100}{0.35 \times 100}$

$= \frac{80.85}{35}$

$= 2.31$

$\frac{0.8085}{0.35} = 2.31$

$35\overline{)\ 80.85\ (2.31}$

-70

108

-105

35

-35

$\times$

(f) $\frac{25.395}{1.5} = \frac{25.395 \times 10}{1.5 \times 10}$

$= \frac{253.95}{1.5}$

$= 16.93$

$\frac{25.395}{1.5} = 16.93$

$15\overline{)\ 253.95\ (16.93}$

-15

103

-90

139

-135

45

-45

$\times$

(g) $\frac{11.04}{1.6} = \frac{11.04 \times 10}{1.6 \times 10}$

$= \frac{110.4}{16}$

$= 6.9$

$\frac{11.04}{1.6} = 6.9$

$16\overline{)\,110.4\,(6.9}$

-96

144

-144

$\times$

(h) $\frac{6.612}{11.6} = \frac{6.612 \times 10}{11.6 \times 10}$

$= \frac{66.12}{116}$

$= 0.57$

$\frac{6.612}{11.6} = 0.57$

$116\overline{)\,66.12\,(0.57}$

-580

812

-812

$\times$

(i) $\frac{21.976}{1.64} = \frac{21.976 \times 100}{1.64 \times 100}$

$= \frac{2197.6}{164}$

$= 13.4$

$164\overline{)\,2197.6\,(13.4}$

-164

557

-492

656

-656

$\times$

(j) $\frac{0.076}{0.19} = \frac{0.076 \times 100}{0.19 \times 100}$

$= \frac{7.6}{19}$

$= 0.4$

$19\overline{)\,7.6\,(0.4}$

-76

$\times$

(k) $\frac{16.578}{5.4} = \frac{16.578 \times 10}{5.4 \times 10}$

$= \frac{165.78}{54}$

$= 3.07$

$54\overline{)\,165.78\,(3.07}$

-162

378

-378

$\times$

(l) $\frac{148}{0.074} = \frac{148 \times 1000}{0.074 \times 1000}$

$= \frac{148000}{74}$

$= 2000$

$74\overline{)\,148000\,(2000}$

-148

000

(m) $\frac{204}{0.17} = \frac{204 \times 100}{0.17 \times 100}$

$= \frac{20400}{17}$

$= 1200$

$17\overline{)20400}(1200$
-17
34
-34
00

(n) $\frac{28}{0.56} = \frac{28 \times 100}{0.56 \times 100}$

$= \frac{2800}{56}$

$= 50$

$56\overline{)2800}(50$
-280
0

(o) $\frac{3}{80} = 0.0375$

$80\overline{)3.00}(0.0375$
-240
600
-560
400
-400
$\times$

8. Total length of piece of cloth = 45 m

Cloth required for 1 shirt = 1.8 m

Number of shirts can be made from the cloth = $\frac{45}{1.8}$ shirts

$= \frac{45 \times 10}{1.8 \times 10}$ shirts

$= \frac{450}{18}$ shirts

$= 25$ shirts

$18\overline{)450}(25$
-36
90
-90
$\times$

Hence, 25 shirts can be made from the piece of cloth.

9. Cost of 24 tables = ` 9255.60

Cost of each table = ` $\frac{9255.60}{24}$

= ` 385.65

$24\overline{)9255.60}(385.65$
-72
205
-192
135
-120
156
-144
120
-120
$\times$

Hence, the cost of each table is ` 385.65.

10. Weight of 37 bags of sugar = 3644.5 kg

Weight of each bag of sugar $= \frac{3644.5}{37}$ kg

$= 98.5$ kg

Hence, the weight of each bag of sugar is 98.5 kg.

$$\begin{array}{r|l} 37 & 3644.5 \,(98.5 \\ & -333 \\ \hline & 314 \\ & -296 \\ \hline & 185 \\ & -185 \\ \hline & \times \end{array}$$

11. Capacity of 69 buckets = 586.5 *l*

Capacity of 1 bucket $= \frac{586.5}{69}$ *l*

$= 8.5$ *l*

Hence, capacity of each bucket is 8.5 *l*.

$$\begin{array}{r|l} 69 & 586.5 \,(8.5 \\ & -552 \\ \hline & 345 \\ & -345 \\ \hline & \times \end{array}$$

12. Distance covered by car in 2.4 litres = 22.8 km

Distance covered by car in 1 litre $= \frac{22.8}{2.4}$ km

$= \frac{22.8 \times 10}{2.4 \times 10}$ km

$= \frac{228}{24}$ km $= 9.5$ km

Hence, the car covers 9.5 km in 1 hour.

$$\begin{array}{r|l} 24 & 228 \,(9.5 \\ & -216 \\ \hline & 120 \\ & -120 \\ \hline & \times \end{array}$$

13. Total amount of oil = 478.5 *l*

1 tin can hold oil = 16.5 *l*

Number of tins $= \frac{478.5}{16.5}$ tins

$= \frac{478.5 \times 10}{16.5 \times 10}$ tins

$= \frac{4785}{165}$ tins

$= 29$ tins

Hence, 29 tins will be required to hold 478.5 litres of oil.

$$\begin{array}{r|l} 165 & 4785 \,(29 \\ & -330 \\ \hline & 1485 \\ & -1485 \\ \hline & \times \end{array}$$

14. Total length of cloth = 46 m

Length of 1 piece = 1.15 m

Number of pieces $= \frac{46}{1.15} = \frac{46 \times 100}{1.15 \times 100}$

$= \frac{4600}{115} = 40$

Hence, Sapna gets 40 pieces.

$$\begin{array}{r|l} 115 & 4600 \,(40 \\ & -460 \\ \hline & 0 \end{array}$$

15. Product of two decimals = 261.36

One decimal = 17.6

$$\text{Other decimal} = \frac{261.36}{17.6}$$

$$= \frac{261.36 \times 10}{17.6 \times 10}$$

$$= \frac{2613.6}{176}$$

$$= 14.85$$

Hence, the other decimal is 14.85.

$$\begin{array}{r|l} 176 & 2613.6 \\ -176 & \\ \hline 853 & \\ -704 & \\ \hline 1496 & \\ -1408 & \\ \hline 880 & \\ -880 & \\ \hline \times & \end{array} \quad 14.85$$

EXERCISE 3E

1. $2\frac{2}{25} = \frac{52}{25} = 2.08$

(b) is correct.

$$\begin{array}{r|l} 25 & 52 \\ -50 & \\ \hline 200 & \\ -200 & \\ \hline \times & \end{array} \quad 2.08$$

2. $0.06 = \frac{6}{100} = \frac{3}{50}$

(b) is correct.

3. $1.04 = 1 + 0.04 = 1 + \frac{4}{100} = 1 + \frac{1}{25} = 1\frac{1}{25}$

(c) is correct.

4. $70 \text{ g} = \frac{70}{1000} \text{ kg} = 0.07 \text{ kg}$

(b) is correct.

5. $6 \text{ cm} = \frac{6}{100000} \text{ km} = 0.00006 \text{ km}$

(c) is correct.

6. $2 \text{ km} + 5 \text{ m} = 2 \text{ km} + \frac{5}{1000} \text{ km}$

$= 2 \text{ km} + 0.005 \text{ km}$

$= 2.005 \text{ km}$

(c) is correct.

7. $5 \text{ kg} + 6 \text{ g} = 5 \text{ kg} + \frac{6}{1000} \text{ kg}$

$= 5 \text{ kg} + 0.006 \text{ kg}$

$= 5.006 \text{ kg}$

(c) is correct.

8. Require number = 0.1 − 0.03
= 0.07
(b) is correct.

$$\begin{array}{r} 0.10 \\ -\ 0.03 \\ \hline 0.07 \end{array}$$

9. Require number = 3.5 − 3.07
= 0.43
(c) is correct.

$$\begin{array}{r} 3.50 \\ -\ 3.07 \\ \hline 0.43 \end{array}$$

10. Here, $25 \times 8 = 200$
$0.25 \times 0.8 = 0.2$
(b) is correct.

11. $0.02 \times 30 = 0.60$
(b) is correct.

12. $0.23 \times 0.3 = 0.069$
(c) is correct.

13. $0.4 \times 0.4 \times 0.4 = 0.064$
(c) is correct.

14. $\frac{1.02}{6} = 0.17$
(b) is correct.

$$\begin{array}{r} 6\overline{)\,1.02\,(0.17} \\ -6 \\ \hline 42 \\ -42 \\ \hline \times \end{array}$$

15. $\frac{2.73}{1.3} = \frac{2.73 \times 10}{1.3 \times 10}$
$= \frac{27.3}{13} = 2.1$
(b) is correct.

$$\begin{array}{r} 13\overline{)\,27.3\,(2.1} \\ -26 \\ \hline 13 \\ -13 \\ \hline \times \end{array}$$

HOTS

- Total people = 20
  Ordered meal for each = ` 360.00
  People whose forget money = 5
  Remaining people = 20 − 5 = 15
  Total bill amount = ` 360 × 20 = ` 7200
  Each paid in 15 people = ` 7200 ÷ 15
  = ` 480
  Each paid more money = ` 480 − ` 360
  = ` 120
  Hence, each paid ` 120 more.

VALUE BASED

- Milk rate per litre = ` 48.50
  Total quantity of milk = 450 *l*
  Sold milk = 430 *l*

Remaining milk = $450 - 430 = 20\,l$

Cost of remaining milk = ` 48.50×20

= ` 970

Hence, the cost of milk is ` 970 that he gives to the old age home.

Chapter 4 Rational Numbers

EXERCISE 4A

1. (c) $\frac{0}{1}$ (d) 0 (e) -3 (f) 6 (g) $\frac{-8}{-12}$ (h) $\frac{7}{15}$ (i) $\frac{-6}{11}$ (j) $\frac{5}{-8}$

2. (a) Numerator = 9, Denominator = 1

(b) Numerator = – 8, Denominator = –11

(c) Numerator = –13, Denominator = 15

(d) Numerator = 5, Denominator = – 8

3. (a) Rational number = $\frac{1}{1}$

Numerator = 1, Denominator = 1

(b) Rational number = $\frac{0}{1}$

Numerator = 0, Denominator = 1

(c) Rational number = $\frac{-23}{1}$

Numerator = -23, Denominator = 1

(d) Rational number = $\frac{-3}{1}$

Numerator = -3, Denominator = 1

4. (a) $\frac{0}{3}$ is a positive rational number.

(b) $\frac{-5}{-8} = \frac{(-5)\times(-1)}{(-8)\times(-1)} = \frac{5}{8}$

$\frac{-5}{-8}$ is a positive rational number.

(c) $\frac{-11}{15}$ is not a positive rational number.

(d) $\frac{37}{53}$ is a positive rational number.

5. (a) $\frac{-6}{1}$ is a negative rational number.

(b) $\frac{4}{-9} = \frac{(-1)\times 4}{(-1)\times 9} = \frac{-4}{9}$

$\frac{4}{-9}$ is a negative rational number.

(c) $0 = \frac{0}{1}$ is not a negative rational number.

(d) $\frac{-15}{-4} = \frac{(-15)\times(-1)}{(-4)\times(-1)} = \frac{15}{4}$

$\frac{-15}{-4}$ is not a negative rational number.

6. (a) $\frac{-1}{1} = \frac{(-1)\times 2}{1\times 2} = \frac{(-1)\times 3}{1\times 3} = \frac{(-1)\times 4}{1\times 4} = \frac{(-1)\times 5}{1\times 5}$

$-1 = \frac{-2}{2} = \frac{-3}{3} = \frac{-4}{4} = \frac{-5}{5}$

(b) $\frac{8}{1} = \frac{8\times 2}{1\times 2} = \frac{8\times 3}{1\times 3} = \frac{8\times 4}{1\times 4} = \frac{8\times 5}{1\times 5}$

$8 = \frac{16}{2} = \frac{24}{3} = \frac{32}{4} = \frac{40}{5}$

(c) $\frac{6}{11} = \frac{6\times 2}{11\times 2} = \frac{6\times 3}{11\times 3} = \frac{6\times 4}{11\times 4} = \frac{6\times 5}{11\times 5}$

$\frac{6}{11} = \frac{12}{22} = \frac{18}{33} = \frac{24}{44} = \frac{30}{55}$

(d) $\frac{-3}{8} = \frac{(-3)\times 2}{8\times 2} = \frac{(-3)\times 3}{8\times 3} = \frac{(-3)\times 4}{8\times 4} = \frac{(-3)\times 5}{8\times 5}$

$\frac{-3}{8} = \frac{-6}{16} = \frac{-9}{24} = \frac{-12}{32} = \frac{-15}{40}$

7. (a) $\frac{11}{-6} = \frac{(-1)\times 11}{(-1)\times(-6)} = \frac{-11}{6}$ (b) $\frac{-8}{-19} = \frac{(-1)\times(-8)}{(-1)\times(-19)} = \frac{8}{19}$

(c) $\frac{1}{-2} = \frac{(-1)\times 1}{(-1)\times(-2)} = \frac{-1}{2}$ (d) $\frac{12}{-17} = \frac{(-1)\times 12}{(-1)\times(-17)} = \frac{-12}{17}$

8. (a) Numerator of $\frac{5}{8} = 5$

We will multiply its numerator and denominator by $(-20)\div 5 = -4$

$$\frac{5\times(-4)}{8\times(-4)} = \frac{-20}{-32}$$

Hence, $$\frac{5}{8} = \frac{-20}{-32}$$

(b) Numerator of $\frac{5}{8} = 5$

We will multiply its numerator and denominator by $25 \div 5 = 5$

$$\frac{5 \times 5}{8 \times 5} = \frac{25}{40}$$

Hence, $$\frac{5}{8} = \frac{25}{40}$$

9. (a) Denominator of $\frac{4}{7} = 7$

We will multiply its numerator and denominator by $(-28) \div 7 = -4$

$$\frac{4 \times (-4)}{7 \times (-4)} = \frac{-16}{-28}$$

Hence, $$\frac{4}{7} = \frac{-16}{-28}$$

(b) Denominator of $\frac{4}{7} = 7$

We will multiply its numerator and denominator by $14 \div 7 = 2$

$$\frac{4 \times 2}{7 \times 2} = \frac{8}{14}$$

Hence, $$\frac{4}{7} = \frac{8}{14}$$

10. (a) Numerator of $\frac{-12}{13} = -12$

We will multiply its numerator and denominator by $36 \div (-12) = -3$

$$\frac{(-12) \times (-3)}{13 \times (-3)} = \frac{36}{-39}$$

Hence, $$\frac{-12}{13} = \frac{36}{-39}$$

(b) Numerator of $\frac{-12}{13} = -12$

We will multiply its numerator and denominator by $(-48) \div (-12) = 4$

$$\frac{(-12) \times 4}{13 \times 4} = \frac{-48}{52}$$

Hence, $$\frac{-12}{13} = \frac{-48}{52}$$

11. (a) Denominator of $\frac{-8}{11} = 11$

We will multiply its numerator and denominator by $(-44) \div 11 = -4$

$$\frac{(-8)\times(-4)}{11\times(-4)} = \frac{32}{-44}$$

Hence, $\frac{-8}{11} = \frac{32}{-44}$

(b) Denominator of $\frac{-8}{11} = 11$

We will multiply its numerator and denominator by $33 \div 11 = 3$

$$\frac{(-8)\times 3}{11\times 3} = \frac{-24}{33}$$

Hence, $\frac{-8}{11} = \frac{-24}{33}$

12. (a) Numerator of $\frac{14}{-5} = 14$

We will multiply its numerator and denominator by $(-84) \div 14 = -6$

$$\frac{14\times(-6)}{(-5)\times(-6)} = \frac{-84}{30}$$

Hence, $\frac{14}{-5} = \frac{-84}{30}$

(b) Numerator of $\frac{14}{-5} = 14$

We will multiply its numerator and denominator by $42 \div 14 = 3$

$$\frac{14\times 3}{(-5)\times 3} = \frac{42}{-15}$$

Hence, $\frac{14}{-5} = \frac{42}{-15}$

13. (a) Denominator of $\frac{13}{-8} = -8$

We will multiply its numerator and denominator by $48 \div (-8) = -6$

$$\frac{13\times(-6)}{(-8)\times(-6)} = \frac{-78}{48}$$

Hence, $\frac{13}{-8} = \frac{-78}{48}$

(b) Denominator of $\frac{13}{-8} = -8$

We will multiply its numerator and denominator by $(-24) \div (-8) = 3$

$$\frac{13\times 3}{(-8)\times 3}=\frac{39}{-24}$$

Hence, $\frac{13}{-8}=\frac{39}{-24}$

14. (a) Numerator of $\frac{-36}{24}=-36$

We will divide its numerator and denominator by $(-36)\div(-6)=6$

$$\frac{(-36)\div 6}{24\div 6}=\frac{-6}{4}$$

Hence, $\frac{-36}{24}=\frac{-6}{4}$

(b) Numerator of $\frac{-36}{24}=-36$

We will divide its numerator and denominator by $(-36)\div 9=-4$

$$\frac{(-36)\div(-4)}{24\div(-4)}=\frac{9}{-6}$$

Hence, $\frac{-36}{24}=\frac{9}{-6}$

15. (a) Denominator of $\frac{84}{-147}=-147$

We will divide its numerator and denominator by $(-147)\div(-7)=21$

$$\frac{84\div 21}{(-147)\div 21}=\frac{4}{-7}$$

Hence, $\frac{84}{-147}=\frac{4}{-7}$

(b) Denominator of $\frac{84}{-147}=-147$

We will divide its numerator and denominator by $(-147)\div 49=-3$

$$\frac{84\div(-3)}{(-147)\div(-3)}=\frac{-28}{49}$$

Hence, $\frac{84}{-147}=\frac{-28}{49}$

16. (a) $\frac{-14}{-49}=\frac{(-14)\times(-1)}{(-49)\times(-1)}=\frac{14}{49}$

HCF of 14 and 49 = 7

$$\begin{array}{r} 14\overline{)\,49\,(3} \\ -42 \\ \hline 7\overline{)\,14\,(2} \\ -14 \\ \hline \times \end{array}$$

$$\frac{14}{49} = \frac{14 \div 7}{49 \div 7} = \frac{2}{7}$$

Hence, $\frac{-14}{-49} = \frac{2}{7}$

(b) HCF of 27 and 45 = 9

$$\frac{-27}{45} = \frac{(-27) \div 9}{45 \div 9} = \frac{-3}{5}$$

Hence, $\frac{-27}{45} = \frac{-3}{5}$

$27\overline{)45}(1$
-27
$18\overline{)27}(1$
-18
$9\overline{)18}(2$
-18
$\times$

(c) $\frac{8}{-36} = \frac{8 \times (-1)}{(-36) \times (-1)} = \frac{-8}{36}$

HCF of 8 and 36 = 4

$$\frac{-8}{36} = \frac{(-8) \div 4}{36 \div 4} = \frac{-2}{9}$$

Hence, $\frac{-8}{36} = \frac{-2}{9}$

$8\overline{)36}(4$
-32
$4\overline{)8}(2$
-8
$\times$

(d) HCF of 35 and 49 = 7

$$\frac{35}{49} = \frac{35 \div 7}{49 \div 7} = \frac{5}{7}$$

Hence, $\frac{35}{49} = \frac{5}{7}$

$35\overline{)49}(1$
-35
$14\overline{)35}(2$
-28
$7\overline{)14}(2$
-14
$\times$

(e) HCF of 68 and 119 = 17

$$\frac{-68}{119} = \frac{-68 \div 17}{119 \div 17} = \frac{-4}{7}$$

Hence, $\frac{-68}{119} = \frac{-4}{7}$

$68\overline{)119}(1$
-68
$51\overline{)68}(1$
-51
$17\overline{)51}(3$
-51
$\times$

(f) $\frac{91}{-78} = \frac{91 \times (-1)}{(-78) \times (-1)} = \frac{-91}{78}$

HCF of 91 and 78 = 13

$$\frac{-91}{78} = \frac{(-91) \div 13}{78 \div 13} = \frac{-7}{6}$$

$78\overline{)91}(1$
-78
$13\overline{)78}(6$
-78
$\times$

Hence, $\frac{91}{-78} = \frac{-7}{6}$

(g) $\frac{299}{-161} = \frac{299 \times (-1)}{(-161) \times (-1)} = \frac{-299}{161}$

HCF of 299 and 161 = 23

$\frac{-299}{161} = \frac{(-299) \div 23}{161 \div 23} = \frac{-13}{7}$

Hence, $\frac{-299}{161} = \frac{-13}{7}$

$161\overline{)299}(1$
-161
$138\overline{)161}(1$
-138
$23\overline{)138}(6$
-138
$\times$

(h) HCF of 87 and 116 = 29

$\frac{-87}{116} = \frac{(-87) \div 29}{116 \div 29} = \frac{-3}{4}$

Hence, $\frac{-87}{116} = \frac{-3}{4}$

$87\overline{)116}(1$
-87
$29\overline{)87}(3$
-87
$\times$

17. (a) Let $\frac{-6}{11} = \frac{-18}{x} = \frac{y}{44}$

Here $\frac{-6}{11} = \frac{-18}{x}$

$x \times (-6) = 11 \times (-18)$

$-6x = -198$

$x = \frac{-198}{-6}$

$x = 33$

Now, $\frac{-18}{33} = \frac{y}{44}$

$33 \times y = (-18) \times 44$

$33y = -792$

$y = \frac{-792}{33}$

$y = -24$

Hence, $\frac{-6}{11} = \frac{-18}{33} = \frac{-24}{44}$

(b) Let $\frac{-9}{5} = \frac{x}{20} = \frac{27}{y} = \frac{-45}{z}$

Here, $\frac{-9}{5} = \frac{x}{20}$

$$5\times x=(-9)\times 20$$
$$5x=-180$$
$$x=\frac{-180}{5}$$
$$x=-36$$

Now, $\frac{-36}{20}=\frac{27}{y}$

$$(-36)\times y=20\times 27$$
$$-36y=540$$
$$y=\frac{540}{-36}$$
$$y=-15$$

Now, $\frac{27}{-15}=\frac{-45}{z}$

$$27\times z=(-45)\times(-15)$$
$$27z=675$$
$$z=\frac{675}{27}$$
$$z=25$$

Hence, $\frac{-9}{5}=\frac{-36}{20}=\frac{27}{-15}=\frac{-45}{25}$

18. (a) $\frac{2}{3}$ $\times$ $\frac{3}{2}$

$$2\times 2=4 \text{ and } 3\times 3=9$$
$$4\neq 9$$

Hence, $\frac{2}{3}$ and $\frac{3}{2}$ are not equivalent.

(b) $\frac{3}{12}$ $\times$ $\frac{-1}{4}$

$$3\times 4=12 \text{ and } 12\times(-1)=-12$$
$$12\neq -12$$

Hence, $\frac{3}{12}$ and $\frac{-1}{4}$ are not equivalent.

(c) $\frac{7}{15}$ $\times$ $\frac{-28}{60}$

$$7\times(-28)=-196 \text{ and } 7\times 60=420$$
$$-196\neq 420$$

Hence, $\frac{7}{15}$ and $\frac{-28}{60}$ are not equivalent.

(d) $\frac{9}{4} \times \frac{-36}{-16}$

$9 \times (-16) = -144$ and $4 \times (-36) = -144$

$-144 = -144$

Hence, $\frac{9}{4}$ and $\frac{-36}{-16}$ are equivalent.

(e) $\frac{3}{-8} \times \frac{-6}{16}$

$3 \times 16 = 48$ and $(-8) \times (-6) = 48$

$48 = 48$

Hence, $\frac{3}{-8}$ and $\frac{-6}{16}$ are equivalent.

(f) $\frac{-13}{7} \times \frac{39}{-21}$

$(-13) \times (-21) = 273$ and $7 \times 39 = 273$

$273 = 273$

Hence, $\frac{-13}{7}$ and $\frac{39}{-21}$ are equivalent.

19. (a) $\frac{-48}{x} = 2$

$-48 = x \times 2$

$x = \frac{-48}{2}$

$x = -24$

(b) $\frac{16}{x} = -4$

$16 = (-4) \times x$

$x = \frac{16}{-4}$

$x = -4$

(c) $\frac{13}{6} = \frac{-65}{x}$

$13 \times x = (-65) \times 6$

$13x = -390$

$x = \frac{-390}{13}$

$x = -30$

(d) $\frac{-1}{5} = \frac{8}{x}$

$(-1) \times x = 8 \times 5$

$-x = 40$

$x = -40$

(e) $\frac{7}{-3} = \frac{x}{6}$

$7 \times 6 = (-3) \times x$

$42 = -3x$

$x = \frac{42}{-3}$

$x = -14$

(f) $\frac{3}{5} = \frac{x}{-25}$

$3 \times (-25) = 5 \times x$

$-75 = 5x$

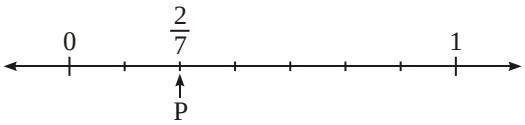
$x = \frac{-75}{5}$

$x = -15$

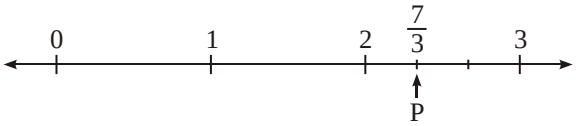
20. (a) F (b) T (c) T (d) T (e) F

EXERCISE 4B

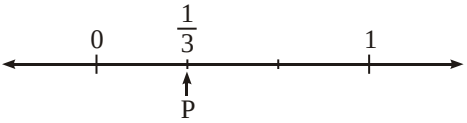
1. (a) $\frac{2}{7}$ will lie between 0 and 1.



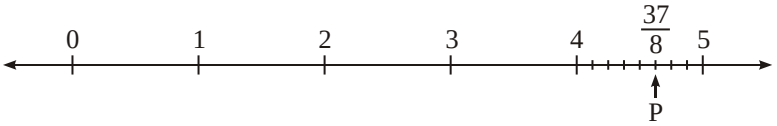
(b) $\frac{7}{3} = 2 + \frac{1}{3}$, so it will lie between 2 and 3.



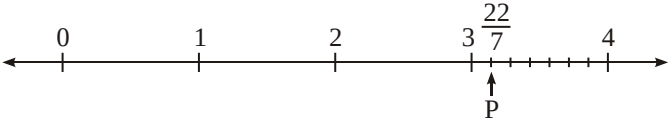
(c) $\frac{1}{3}$ will lie between 0 and 1.



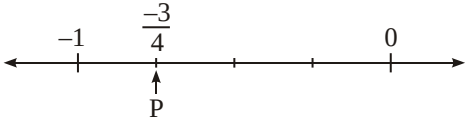
(d) $\frac{37}{8} = 4 + \frac{5}{8}$, so it will lie between 4 and 5.



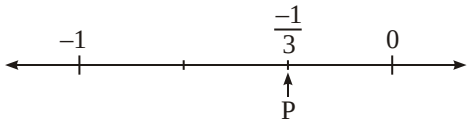
(e) $\frac{22}{7} = 3 + \frac{1}{7}$, so it will lie between 3 and 4.



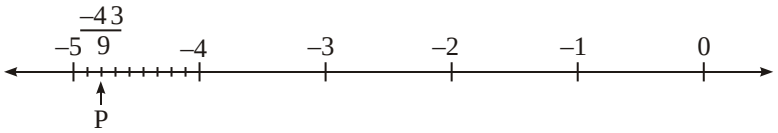
(f) $\frac{-3}{4}$ will lie between 0 and −1.



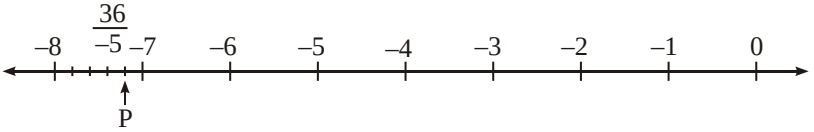
(g) $\frac{-1}{3}$ will lie between 0 and −1.



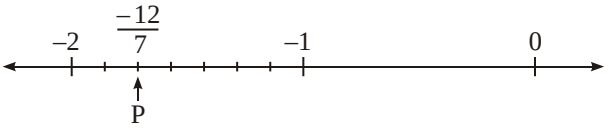
(h) $\frac{-43}{9} = -4\frac{7}{9}$ so it will lie between −4 and −5.



(i) $\frac{36}{-5} = -7\frac{1}{5}$ so it will lie between −7 and −8.



(j) $\frac{-12}{7} = -1\frac{5}{7}$ so it will lie between −1 and −2.



2. (a) Since every negative rational number is less than 0, we have : $\frac{-3}{5} < 0$.

(b) Since every positive rational number is greater than 0, we have : $\frac{5}{6} > 0$.

(c) Since every positive rational number is greater than every negative rational number, we have : $\frac{7}{9} > \frac{-5}{9}$.

(d) Since, $5 > 3$, therefore, $\frac{5}{8} > \frac{3}{8}$.

(e) Since, $-15 > -17$, therefore, $\frac{-15}{4} > \frac{-17}{4}$.

(f) One number $= \frac{-6}{11}$

Other number $= \frac{5}{-11} = \frac{5\times(-1)}{(-11)\times(-1)} = \frac{-5}{11}$

Since, $-6 < -5$, therefore, $\frac{-6}{11} < \frac{-5}{11}$

Hence, $\frac{-6}{11} < \frac{-5}{11}$

3. (a) First we write each of the given numbers with a positive denominator.

$$\frac{9}{-13} = \frac{9\times(-1)}{(-13)\times(-1)} = \frac{-9}{13} \text{ and } \frac{7}{-12} = \frac{7\times(-1)}{(-12)\times(-1)} = \frac{-7}{12}$$

Now, the LCM of the denominators 13 and 12 = 156

$$\frac{-9}{13} = \frac{(-9)\times 12}{13\times 12} = \frac{-108}{156} \text{ and } \frac{-7}{12} = \frac{(-7)\times 13}{12\times 13} = \frac{-91}{156}$$

Now, $-108 < -91$

$$\frac{-108}{156} < \frac{-91}{156}$$

$$\frac{9}{-13} < \frac{7}{-12}$$

(b) First we write the given numbers with a positive denominator.

$$\frac{4}{-5} = \frac{4\times(-1)}{(-5)\times(-1)} = \frac{-4}{5} \text{ and } \frac{-7}{8}$$

Now, LCM of 5 and 8 = 40

$$\frac{-4}{5} = \frac{(-4)\times 8}{5\times 8} = \frac{-32}{40} \text{ and } \frac{-7}{8} = \frac{(-7)\times 5}{8\times 5} = \frac{-35}{40}$$

Now, $-32 > -35$

$$\frac{-32}{40} > \frac{-35}{40}$$

$$\frac{4}{-5} > \frac{-7}{8}$$

(c) First we write each of the given numbers with a positive denominator.

$$\frac{7}{-9} = \frac{7\times(-1)}{(-9)\times(-1)} = \frac{-7}{9} \text{ and } \frac{-5}{8}$$

Now, LCM of 9 and 8 = 72

$$\frac{-7}{9} = \frac{(-7)\times 8}{9\times 8} = \frac{-56}{72} \text{ and } \frac{-5}{8} = \frac{(-5)\times 9}{8\times 9} = \frac{-45}{72}$$

Now, $-56 < -45$

$$\frac{-56}{72} < \frac{-45}{72}$$

$$\frac{7}{-9} < \frac{-5}{8}$$

(d) $\frac{-12}{5}$ and $\frac{-3}{1}$

Now, LCM of 5 and 1 = 5

$$\frac{-12}{5} \text{ and } \frac{(-3)\times 5}{1\times 5} = \frac{-15}{5}$$

Now, $-12 > -15$

$$-\frac{12}{5} > \frac{-15}{5}$$

$$-\frac{12}{5} > -3$$

(e) First we write the given numbers with a positive denominator.

$$\frac{4}{-3} = \frac{4\times(-1)}{(-3)\times(-1)} = \frac{-4}{3} \text{ and } \frac{-8}{7}$$

Now, LCM of 3 and 7 = 21

$$\frac{-4}{3} = \frac{(-4)\times 7}{3\times 7} = \frac{-28}{21} \text{ and } \frac{-8}{7} = \frac{(-8)\times 3}{7\times 3} = \frac{-24}{21}$$

Now, $-28 < -24$

$$\frac{-28}{21} < \frac{-24}{21}$$

$$\frac{4}{-3} < \frac{-8}{7}$$

(f) First we write the given numbers with a positive denominator.

$$\frac{5}{9} \text{ and } \frac{-3}{-8} = \frac{(-3)\times(-1)}{(-8)\times(-1)} = \frac{3}{8}$$

Now, LCM of 9 and 8 = 72

$$\frac{5}{9} = \frac{5\times 8}{9\times 8} = \frac{40}{72} \text{ and } \frac{3}{8} = \frac{3\times 9}{8\times 9} = \frac{27}{72}$$

Now, $40 > 27$

$$\frac{40}{72} > \frac{27}{72}$$

$$\frac{5}{9} > \frac{3}{8}$$

4. (a) LCM of 9 and 10 = 90

$$\frac{-8}{9} = \frac{(-8)\times 10}{9\times 10} = \frac{-80}{90} \text{ and } \frac{-9}{10} = \frac{(-9)\times 9}{10\times 9} = \frac{-81}{90}$$

Now, $-80 > -81$

$$\frac{-80}{90} > \frac{-81}{90}$$

$$\frac{-8}{9} \boxed{>} \frac{-9}{10}$$

(b) First we write the given numbers with a positive denominator.

$$0 = \frac{0}{1} \text{ and } \frac{-3}{-5} = \frac{(-3)\times(-1)}{(-5)\times(-1)} = \frac{3}{5}$$

Since, every positive rational number is greater than 0.

Therefore, $0 \boxed{<} \frac{-3}{-5}$

(c) First we convert the given numbers with a positive denominator.

$$\frac{-2}{3} \text{ and } \frac{5}{-8} = \frac{5\times(-1)}{(-8)\times(-1)} = \frac{-5}{8}$$

Now, LCM of 3 and 8 = 24

$$\frac{-2}{3} = \frac{(-2)\times 8}{3\times 8} = \frac{-16}{24} \text{ and } \frac{-5}{8} = \frac{-5\times 3}{8\times 3} = \frac{-15}{24}$$

Now, $-16 < -15$

$$\frac{-16}{24} < \frac{-15}{24}$$

$$\frac{-2}{3} \boxed{<} \frac{5}{-8}$$

(d) $-2 = \frac{-2}{1}$ and $\frac{-13}{5}$

Now, LCM of 1 and 5 = 5

$$\frac{-2}{1} = \frac{(-2)\times 5}{1\times 5} = \frac{-10}{5} \text{ and } \frac{-13}{5}$$

Now, $-10 > -13$

$$\frac{-10}{5} > \frac{-13}{5}$$

$$-2 \boxed{>} \frac{-13}{5}$$

(e) First we write the given numbers with a positive denominator.

$$\frac{5}{-13} = \frac{5\times(-1)}{(-13)\times(-1)} = \frac{-5}{13} \text{ and } \frac{-35}{91}$$

Now, LCM of 13 and 91 = 91

$$\frac{-5}{13} = \frac{(-5)\times 7}{13\times 7} = \frac{-35}{91} \text{ and } \frac{-35}{91}$$

Now, $\frac{-35}{91} = \frac{-35}{91}$

$$\frac{-5}{13} \boxed{=} \frac{-35}{91}$$

(f) First we write the given numbers with a positive denominator.

$$\frac{-3}{7} \text{ and } \frac{6}{-13} = \frac{6\times(-1)}{(-13)\times(-1)} = \frac{-6}{13}$$

Now, LCM of 7 and 13 = 91

$$\frac{-3}{7} = \frac{(-3)\times 13}{7\times 13} = \frac{-39}{91} \text{ and } \frac{-6}{13} = \frac{(-6)\times 7}{13\times 7} = \frac{-42}{91}$$

Now, $-39 > -42$

$$\frac{-39}{91} > \frac{-42}{91}$$

$$\frac{-3}{7} \boxed{>} \frac{6}{-13}$$

5. (a) First we express the given numbers with a positive denominator.

$$\frac{5}{-6} = \frac{5\times(-1)}{(-6)\times(-1)} = \frac{-5}{6}$$

So, the given numbers are $\frac{2}{3}, \frac{3}{4}, \frac{-5}{6}, \frac{-7}{12}$.

LCM of 3, 4, 6 and 12 = $2\times 2\times 3 = 12$

2	3, 4, 6, 12
2	3, 2, 3, 6
3	3, 1, 3, 3
	1, 1, 1, 1

$$\frac{2}{3} = \frac{2\times 4}{3\times 4} = \frac{8}{12}; \frac{3}{4} = \frac{3\times 3}{4\times 3} = \frac{9}{12}$$

$$\frac{-5}{6} = \frac{(-5)\times 2}{6\times 2} = \frac{-10}{12}; \frac{-7}{12} = \frac{(-7)\times 1}{12\times 1} = \frac{-7}{12}$$

Clearly, $\frac{-10}{12} < \frac{-7}{12} < \frac{8}{12} < \frac{9}{12}$

i.e., $\frac{5}{-6} < \frac{-7}{12} < \frac{2}{3} < \frac{3}{4}$

Hence, the ascending order of the given rational numbers is $\frac{5}{-6}, \frac{-7}{12}, \frac{2}{3}, \frac{3}{4}$.

(b) LCM of 5, 10, 15 and 30 = $2\times 3\times 5 = 30$

$$\frac{2}{5} = \frac{2\times 6}{5\times 6} = \frac{12}{30}; \frac{7}{10} = \frac{7\times 3}{10\times 3} = \frac{21}{30}$$

$$\frac{8}{15}=\frac{8\times 2}{15\times 2}=\frac{16}{30};\ \frac{13}{30}=\frac{13\times 1}{30\times 1}=\frac{13}{30}$$

2	5, 10, 15, 30
	5, 5, 15, 15
	5, 5, 5, 5
	1, 1, 1, 1

Clearly, $\frac{12}{30}<\frac{13}{30}<\frac{16}{30}<\frac{21}{30}$

i.e., $\frac{2}{5}<\frac{13}{30}<\frac{8}{15}<\frac{7}{10}$

Hence, the ascending order of the given rational numbers is $\frac{2}{5},\frac{13}{30},\frac{8}{15},\frac{7}{10}$.

(c) First we write the given numbers with a positive denominator.

$$\frac{5}{-12}=\frac{5\times(-1)}{(-12)\times(-1)}=\frac{-5}{12}\text{ and }\frac{9}{-24}=\frac{9\times(-1)}{(-24)\times(-1)}=\frac{-9}{24}$$

Now, LCM of 4, 12, 16 and 24 $=2\times 2\times 2\times 2\times 3=48$

$$\frac{-3}{4}=\frac{(-3)\times 12}{4\times 12}=\frac{-36}{48}$$

$$\frac{-5}{12}=\frac{(-5)\times 4}{12\times 5}=\frac{-20}{48}$$

$$\frac{-7}{16}=\frac{(-7)\times 3}{16\times 3}=\frac{-21}{48}$$

$$\frac{-9}{24}=\frac{(-9)\times 2}{24\times 2}=\frac{-18}{48}$$

2	4, 12, 16, 24
2	2, 6, 8, 12
2	1, 3, 4, 6
2	1, 3, 2, 3
3	1, 3, 1, 3
	1, 1, 1, 1

Clearly, $\frac{-36}{48}<\frac{-21}{48}<\frac{-20}{48}<\frac{-18}{48}$

i.e., $\frac{-3}{4}<\frac{-7}{16}<\frac{5}{-12}<\frac{9}{-24}$

Hence, the ascending order of the given rational numbers is $\frac{-3}{4},\frac{-7}{16},\frac{5}{-12},\frac{9}{-24}$.

(d) First we write the given numbers with a positive denominator.

$$\frac{7}{-15}=\frac{7\times(-1)}{(-15)\times(-1)}=\frac{-7}{15}\text{ and }\frac{17}{-30}=\frac{17\times(-1)}{(-30)\times(-1)}=\frac{-17}{30}$$

Now, LCM of 10, 15, 20 and 30 $=2\times 2\times 3\times 5=60$

$$\frac{-3}{10}=\frac{(-3)\times 6}{10\times 6}=\frac{-18}{60}$$

$$\frac{-7}{15}=\frac{(-7)\times 4}{15\times 4}=\frac{-28}{60}$$

$$\frac{-11}{20}=\frac{(-11)\times 3}{20\times 3}=\frac{-33}{60}$$

2	10, 15, 20, 30
	5, 15, 10, 15
	5, 15, 5, 15
	5, 5, 5, 5
	1, 1, 1, 1

$$\frac{-17}{30} = \frac{(-17)\times 2}{30\times 2} = \frac{-34}{60}$$

Clearly, $\frac{-34}{60} < \frac{-33}{60} < \frac{-28}{60} < \frac{-18}{60}$

i.e., $\frac{17}{-30} < \frac{-11}{20} < \frac{7}{-15} < \frac{-3}{10}$

Hence, the ascending order of the given rational numbers is $\frac{17}{-30}, \frac{-11}{20}, \frac{7}{-15}, \frac{-3}{10}$.

6. (a) First we write the given rational numbers with a positive denominator.

$$\frac{8}{-3} = \frac{8\times(-1)}{(-3)\times(-1)} = \frac{-8}{3}$$

So, the given rational numbers are $\frac{-2}{1}, \frac{-13}{6}, \frac{-8}{3}, \frac{1}{3}$.

LCM of 1, 6, 3 and $3 = 2\times 3 = 6$

$$\frac{-2}{1} = \frac{(-2)\times 6}{1\times 6} = \frac{-12}{6}; \frac{-13}{6} = \frac{(-13)\times 1}{6\times 1} = \frac{-13}{6}$$

$$\frac{-8}{3} = \frac{(-8)\times 2}{3\times 2} = \frac{-16}{6}; \frac{1}{3} = \frac{1\times 2}{3\times 2} = \frac{2}{6}$$

2	1, 6, 3, 3
	1, 3, 3, 3
	1, 1, 1, 1

Clearly, $\frac{2}{6} > \frac{-12}{6} > \frac{-13}{6} > \frac{-16}{6}$

i.e., $\frac{1}{3} > \frac{-2}{1} > \frac{-13}{6} > \frac{8}{-3}$

Hence, the descending order of the given rational numbers is $\frac{1}{3}, -2, \frac{-13}{6}, \frac{8}{-3}$.

(b) First we write the given rational numbers with a positive denominator.

$$\frac{5}{-12} = \frac{5\times(-1)}{(-12)\times(-1)} = \frac{-5}{12}; \frac{2}{-3} = \frac{2\times(-1)}{(-3)\times(-1)} = \frac{-2}{3}$$

So, the given rational numbers are $\frac{-4}{9}, \frac{-5}{12}, \frac{-7}{18}, \frac{-2}{3}$.

LCM of 9, 12, 18 and $3 = 2\times 2\times 3\times 3 = 36$

$$\frac{-4}{9} = \frac{(-4)\times 4}{9\times 4} = \frac{-16}{36}; \frac{-5}{12} = \frac{(-5)\times 3}{12\times 3} = \frac{-15}{36}$$

$$\frac{-7}{18} = \frac{(-7)\times 2}{18\times 2} = \frac{-14}{36}; \frac{-2}{3} = \frac{(-2)\times 12}{3\times 12} = \frac{-24}{36}$$

2	9, 12, 18, 3
2	9, 6, 9, 3
3	9, 3, 9, 3
3	3, 1, 3, 1
	1, 1, 1, 1

Clearly, $\frac{-14}{36} > \frac{-15}{36} > \frac{-16}{36} > \frac{-24}{36}$

i.e., $\frac{-7}{8} > \frac{5}{-12} > \frac{-4}{9} > \frac{2}{-3}$

Hence, the ascending order of the given rational numbers is $\frac{-7}{18}, \frac{5}{-12}, \frac{-4}{9}, \frac{2}{-3}$.

(c) First we write the given rational numbers with a positive denominator.

$$\frac{17}{-30} = \frac{17\times(-1)}{(-30)\times(-1)} = \frac{-17}{30}, \frac{11}{-15} = \frac{11\times(-1)}{(-15)\times(-1)} = \frac{-11}{15}$$

So, the given rational numbers are $\frac{-17}{30}, \frac{-11}{15}, \frac{-7}{10}, \frac{3}{5}$.

Now, LCM of 30, 15, 10 and $5 = 2\times3\times5 = 30$

2	30, 15, 10, 5
	15, 15, 5, 5
	5, 5, 5, 5
	1, 1, 1, 1

$$\frac{-17}{30} = \frac{(-17)\times1}{30\times1} = \frac{-17}{30}$$

$$\frac{-11}{15} = \frac{(-11)\times2}{15\times2} = \frac{-22}{30}$$

$$\frac{-7}{10} = \frac{(-7)\times3}{10\times3} = \frac{-21}{30}; \frac{3}{5} = \frac{3\times6}{5\times6} = \frac{18}{30}$$

Clearly, $\frac{18}{30} > \frac{-17}{30} > \frac{-21}{30} > \frac{-22}{30}$

i.e., $\frac{3}{5} > \frac{17}{-30} > \frac{-7}{10} > \frac{11}{-15}$

Hence, the descending order of the given rational numbers is $\frac{3}{5}, \frac{17}{-30}, \frac{-7}{10}, \frac{11}{-15}$.

(d) First we write the given rational numbers with a positive denominator.

$$\frac{7}{-10} = \frac{7\times(-1)}{(-10)\times(-1)} = \frac{-7}{10}, \frac{19}{-30} = \frac{19\times(-1)}{(-30)\times(-1)} = \frac{-19}{30}$$

So, the given rational numbers are $\frac{-2}{5}, \frac{-7}{10}, \frac{-11}{15}, \frac{-19}{30}$.

Now, LCM of 5, 10, 15 and $30 = 2\times3\times5 = 30$

2	5, 10, 15, 30
3	5, 5, 15, 15
5	5, 5, 5, 5
	1, 1, 1, 1

$$\frac{-2}{5} = \frac{(-2)\times6}{5\times6} = \frac{-12}{30}$$

$$\frac{-7}{10} = \frac{(-7)\times3}{10\times3} = \frac{-21}{30}$$

$$\frac{-11}{15}=\frac{(-11)\times 2}{15\times 2}=\frac{-22}{30};\ \frac{-19}{30}=\frac{(-19)\times 1}{30\times 1}=\frac{-19}{30}$$

Clearly, $\frac{-12}{30}>\frac{-19}{30}>\frac{-21}{30}>\frac{-22}{30}$

i.e., $\frac{-2}{5}>\frac{19}{-30}>\frac{7}{-10}>\frac{-11}{15}$

Hence, the descending order of the given rational numbers is $\frac{-2}{5},\frac{19}{-30},\frac{7}{-10},\frac{-11}{15}$.

7. We may write $-3=\frac{-3}{1}$ and $-2=\frac{-2}{1}$.

We multiply the numerator and denominator of each fraction by $5+1=6$.

So, $\frac{-3}{1}=\frac{(-3)\times 6}{1\times 6}=\frac{-18}{6}$ and $\frac{-2}{1}=\frac{(-2)\times 6}{1\times 6}=\frac{-12}{6}$

Clearly, $\frac{-18}{6}<\frac{-17}{6}<\frac{-16}{6}<\frac{-15}{6}<\frac{-14}{6}<\frac{-13}{6}<\frac{-12}{6}$

Hence, five rational numbers between -3 and -2 are $\frac{-17}{6},\frac{-16}{6},\frac{-15}{6},\frac{-14}{6},\frac{-13}{6}$.

8. We may write $-1=\frac{-1}{1}$ and $1=\frac{1}{1}$.

We multiply the numerator and denominator of each fraction by $5+1=6$.

So, $\frac{-1}{1}=\frac{(-1)\times 6}{1\times 6}=\frac{-6}{6}$ and $\frac{1}{1}=\frac{1\times 6}{1\times 6}=\frac{6}{6}$

Clearly, $\frac{-6}{6}<\frac{-5}{6}<\frac{-4}{6}<\frac{-3}{6}<\frac{-2}{6}<\frac{-1}{6}<0<\frac{1}{6}<\frac{2}{6}<\frac{3}{6}<\frac{4}{6}<\frac{5}{6}<\frac{6}{6}$

Hence, five rational numbers between -1 and 1 are $\frac{-2}{6},\frac{-1}{6},0,\frac{1}{6},\frac{2}{6}$.

9. LCM of 5 and $2=10$

$$\frac{-3}{5}=\frac{(-3)\times 2}{5\times 2}=\frac{-6}{10},\ \frac{-1}{2}=\frac{(-1)\times 5}{2\times 5}=\frac{-5}{10}$$

We multiply the numerator and denominator of each fraction by $5+1=6$.

So, $\frac{-6}{10}=\frac{(-6)\times 6}{10\times 6}=\frac{-36}{60}$ and $\frac{-5}{10}=\frac{(-5)\times 6}{10\times 6}=\frac{-30}{60}$

Clearly, $\frac{-36}{60}<\frac{-35}{60}<\frac{-34}{60}<\frac{-33}{60}<\frac{-32}{60}<\frac{-31}{60}<\frac{-30}{60}$

Hence, five rational numbers between $\frac{-3}{5}$ and $\frac{-1}{2}$ are $\frac{-35}{60}, \frac{-34}{60}, \frac{-33}{60}, \frac{-32}{60}, \frac{-31}{60}$.

10. (a) T (b) F (c) T (d) F (e) T

EXERCISE 4C

1. (a) $\frac{(-3)}{7}+\frac{5}{(-7)}=\frac{(-3)}{7}+\frac{(-5)}{7}=\frac{(-3)+(-5)}{7}=\frac{-8}{7}$

(b) $\frac{(-17)}{9}+\frac{(-11)}{9}=\frac{(-17)+(-11)}{9}=\frac{-28}{9}$

(c) $\frac{(-2)}{9}+\frac{(-5)}{9}=\frac{(-2)+(-5)}{9}=\frac{-7}{9}$

(d) $\frac{9}{(-13)}+\left(\frac{-11}{-13}\right)=\frac{-9}{13}+\frac{11}{13}=\frac{(-9)+11}{13}=\frac{2}{13}$

(e) $\frac{(-5)}{11}+\frac{7}{(-11)}=\frac{-5}{11}+\frac{(-7)}{11}=\frac{(-5)+(-7)}{11}=\frac{-12}{11}$

(f) $\frac{3}{(-8)}+\frac{1}{8}=\frac{(-3)}{8}+\frac{1}{8}=\frac{(-3)+1}{8}=\frac{-2}{8}=\frac{-1}{4}$

(g) $\frac{(-2)}{5}+\frac{1}{5}=\frac{(-2)+1}{5}=\frac{-1}{5}$

(h) $\frac{12}{7}+\frac{3}{7}=\frac{12+3}{7}=\frac{15}{7}$

2. (a) $-4=\frac{-4}{1}$

LCM of 1 and 2 = 2

$\frac{-4}{1}=\frac{(-4)\times 2}{1\times 2}=\frac{-8}{2}$

$-4+\frac{1}{2}=\frac{-8}{2}+\frac{1}{2}=\frac{(-8)+1}{2}=\frac{-7}{2}$

(b) LCM of 4 and $5 = 5\times 4 = 20$

$\frac{-2}{5}=\frac{(-2)\times 4}{5\times 4}=\frac{-8}{20}$

and $\frac{3}{4}=\frac{3\times 5}{4\times 5}=\frac{15}{20}$

$\frac{-2}{5}+\frac{3}{4}=\frac{-8}{20}+\frac{15}{20}=\frac{(-8)+15}{20}=\frac{7}{20}$

(c) LCM of 9 and 3 = 9

$$\frac{2}{3}=\frac{2\times3}{3\times3}=\frac{6}{9}$$

$$\frac{-5}{9}+\frac{2}{3}=\frac{-5}{9}+\frac{6}{9}$$

$$=\frac{(-5)+6}{9}$$

$$=\frac{1}{9}$$

(d) LCM of 36 and 12 = 36

$$\frac{-7}{12}=\frac{(-7)\times3}{12\times3}=\frac{-21}{36}$$

$$\frac{-5}{36}+\frac{(-7)}{12}=\frac{-5}{36}+\frac{(-21)}{36}$$

$$=\frac{(-5)+(-21)}{36}$$

$$=\frac{-26}{36}=\frac{-13}{18}$$

(e) LCM of 27 and 18 = 54

$$\frac{-7}{27}=\frac{(-7)\times2}{27\times2}=\frac{-14}{54};$$

$$\frac{5}{18}=\frac{5\times3}{18\times3}=\frac{15}{54}$$

$$\frac{-7}{27}+\frac{5}{18}=\frac{-14}{54}+\frac{15}{54}$$

$$=\frac{-14+15}{54}=\frac{1}{54}$$

(f) LCM of 4 and 8 = 8

$$\frac{27}{-4}=\frac{27\times(-2)}{(-4)\times(-2)}=\frac{-54}{8}$$

$$\frac{27}{-4}+\frac{(-15)}{8}=\frac{-54}{8}+\frac{(-15)}{8}$$

$$=\frac{-54+(-15)}{8}$$

$$=\frac{-69}{8}$$

(g) LCM of 24 and 18 = 72

$$\frac{-9}{24}=\frac{(-9)\times3}{24\times3}=\frac{-27}{72}$$

and $\frac{-1}{18}=\frac{(-1)\times4}{18\times4}=\frac{-4}{72}$

$$\frac{-9}{24}+\frac{(-1)}{18}=\frac{-27}{72}+\frac{(-4)}{72}$$

$$=\frac{-27+(-4)}{72}$$

$$=\frac{-31}{72}$$

(h) LCM of 9 and 27 = 27

$$\frac{1}{-9}=\frac{1\times(-3)}{(-9)\times(-3)}=\frac{-3}{27}$$

and $\frac{4}{-27}=\frac{4\times(-1)}{(-27)\times(-1)}=\frac{-4}{27}$

$$\frac{1}{-9}+\frac{4}{(-27)}=\frac{-3}{27}+\frac{(-4)}{27}$$

$$=\frac{-3+(-4)}{27}$$

$$=\frac{-7}{27}$$

3. (a) LCM of 8, 16, 4 = 16

$$\frac{-13}{8}=\frac{(-13)\times2}{8\times2}=\frac{-26}{16}$$

and $\frac{-1}{4}=\frac{(-1)\times4}{4\times4}=\frac{-4}{16}$

$$\frac{-13}{8}+\frac{5}{16}+\frac{(-1)}{4}=\frac{-26}{16}+\frac{5}{16}+\frac{(-4)}{16}$$

$$=\frac{-26+5+(-4)}{16}=\frac{-30+5}{16}=\frac{-25}{16}$$

(b) LCM of 8 and 5 = 40

$$\frac{-3}{1} = \frac{(-3)\times 40}{1\times 40} = \frac{-120}{40}, \frac{1}{8} = \frac{1\times 5}{8\times 5} = \frac{5}{40}$$

and $$\frac{-2}{5} = \frac{(-2)\times 8}{5\times 8} = \frac{-16}{40}$$

$$-3 + \frac{1}{8} + \frac{(-2)}{5} = \frac{-120}{40} + \frac{5}{40} + \frac{(-16)}{40}$$

$$= \frac{(-120) + 5 + (-16)}{40}$$

$$= \frac{-136 + 5}{40} = \frac{-131}{40}$$

(c) LCM of 9, 12 and 18 = 36

$$\frac{-16}{9} = \frac{(-16)\times 4}{9\times 4} = \frac{-64}{36}, \frac{-5}{12} = \frac{(-5)\times 3}{12\times 3} = \frac{-15}{36}$$

and $$\frac{7}{18} = \frac{7\times 2}{18\times 2} = \frac{14}{36}$$

$$\frac{-16}{9} + \frac{(-5)}{12} + \frac{7}{18} = \frac{-64}{36} + \frac{-15}{36} + \frac{14}{36}$$

$$= \frac{-64 + (-15) + 14}{36}$$

$$= \frac{-79 + 14}{36} = \frac{-65}{36}$$

(d) $$\frac{-3}{5} + \frac{7}{5} + \frac{(-1)}{5} = \frac{(-3) + 7 + (-1)}{5} = \frac{-4 + 7}{5} = \frac{3}{5}$$

(e) $$\frac{-12}{7} + \frac{3}{7} + \frac{-2}{7} = \frac{-12 + 3 + (-2)}{7} = \frac{-14 + 3}{7} = \frac{-11}{7}$$

(f) LCM of 12, 8, 4 = 24

$$\frac{11}{-12} = \frac{11\times(-2)}{(-12)\times(-2)} = \frac{-22}{24}, \frac{3}{-8} = \frac{3\times(-3)}{(-8)\times(-3)} = \frac{-9}{24}$$

and $$\frac{1}{4} = \frac{1\times 6}{4\times 6} = \frac{6}{24}$$

$$\frac{11}{-12} + \frac{3}{-8} + \frac{1}{4} = \frac{-22}{24} + \frac{-9}{24} + \frac{6}{24}$$

$$= \frac{(-22) + (-9) + 6}{24}$$

$$= \frac{-31 + 6}{24} = \frac{-25}{24}$$

4. (a) LCM of 15 and 3 = 15

$$\frac{2}{-3} = \frac{2\times(-5)}{(-3)\times(-5)} = \frac{-10}{15}$$

$$\frac{-8}{15} + \frac{2}{(-3)} = \frac{-8}{15} + \frac{(-10)}{15}$$

$$= \frac{(-8)+(-10)}{15} = \frac{-18}{15} = \frac{-6}{5}$$

(b) LCM of 39 and 26 = 78

$$\frac{-11}{39} = \frac{(-11)\times 2}{39\times 2} = \frac{-22}{78}, \frac{5}{26} = \frac{5\times 3}{26\times 3} = \frac{15}{78}$$

and $\frac{2}{1} = \frac{2\times 78}{1\times 78} = \frac{156}{78}$

$$\frac{-11}{39} + \frac{5}{26} + 2 = \frac{-22}{78} + \frac{15}{78} + \frac{156}{78}$$

$$= \frac{-22+15+156}{78}$$

$$= \frac{-22+171}{78} = \frac{149}{78}$$

(c) LCM of 2 and 4 = 4

$$\frac{2}{1} = \frac{2\times 4}{1\times 4} = \frac{8}{4} \text{ and } \frac{-1}{2} = \frac{(-1)\times 2}{2\times 2} = \frac{-2}{4}$$

$$2 + \frac{(-1)}{2} + \frac{(-3)}{4} = \frac{8}{4} + \frac{(-2)}{4} + \frac{(-3)}{4}$$

$$= \frac{8+(-2)+(-3)}{4} = \frac{8+(-5)}{4} = \frac{3}{4}$$

(d) LCM of 9 and 12 = 36

$$\frac{-1}{1} = \frac{(-1)\times 36}{1\times 36} = \frac{-36}{36}, \frac{7}{-9} = \frac{7\times(-4)}{(-9)\times(-4)} = \frac{-28}{36}$$

and $\frac{11}{12} = \frac{11\times 3}{12\times 3} = \frac{33}{36}$

$$-1 + \frac{7}{-9} + \frac{11}{12} = \frac{-36}{36} + \frac{(-28)}{36} + \frac{33}{36}$$

$$= \frac{(-36)+(-28)+33}{36}$$

$$= \frac{(-64)+33}{36} = \frac{-31}{36}$$

(e) LCM of 11, 3 and 4 = 132

$$\frac{-9}{11}=\frac{(-9)\times 12}{11\times 12}=\frac{-108}{132},\ \frac{2}{3}=\frac{2\times 44}{3\times 44}=\frac{88}{132}$$

and $$\frac{-3}{4}=\frac{(-3)\times 33}{4\times 33}=\frac{-99}{132}$$

$$\frac{-9}{11}+\frac{2}{3}+\frac{(-3)}{4}=\frac{-108}{132}+\frac{88}{132}+\frac{(-99)}{132}$$

$$=\frac{(-108)+88+(-99)}{132}$$

$$=\frac{-207+88}{132}=\frac{-119}{132}$$

(f) LCM of 10, 15 and 20 = 60

$$\frac{-7}{10}=\frac{(-7)\times 6}{10\times 6}=\frac{-42}{60},\ \frac{13}{-15}=\frac{13\times(-4)}{(-15)\times(-4)}=\frac{-52}{60}$$

and $$\frac{27}{20}=\frac{27\times 3}{20\times 3}=\frac{81}{60}$$

$$\frac{-7}{10}+\frac{13}{(-15)}+\frac{27}{20}=\frac{-42}{60}+\frac{(-52)}{60}+\frac{81}{60}$$

$$=\frac{(-42)+(-52)+81}{60}$$

$$=\frac{(-94)+81}{60}=\frac{-13}{60}$$

5. (a) $\frac{-11}{7}=-\left(\frac{11}{7}\right)=-\left(1+\frac{4}{7}\right)=-1+\left(-\frac{4}{7}\right)$

(b) $\frac{12}{5}=2\frac{2}{5}=2+\frac{2}{5}$

(c) $\frac{-103}{20}=-\left(\frac{103}{20}\right)=-\left(5+\frac{3}{20}\right)=-5+\left(-\frac{3}{20}\right)$

(d) $\frac{-25}{9}=-\left(\frac{25}{9}\right)=-\left(2+\frac{7}{9}\right)=-2+\left(-\frac{7}{9}\right)$

EXERCISE 4D

1. (a) Additive inverse of $\frac{1}{-6}=\frac{1}{6}$ (b) Additive inverse of $0=0$

(c) $\frac{-18}{-13}=\frac{(-18)\times(-1)}{(-13)\times(-1)}=\frac{18}{13}$ (d) Additive inverse of $\frac{15}{-4}=\frac{15}{4}$

Its additive inverse $=-\frac{18}{13}$

(e) Additive inverse of $\frac{-11}{15} = \frac{11}{15}$ (f) Additive inverse of $\frac{3}{14} = \frac{-3}{14}$

(g) Additive inverse of $-9 = 9$ (h) Additive inverse of $5 = -5$

2. (a) $-1 - \left(\frac{-9}{7}\right)$

LCM of 1 and 7 = 7

$$-1 = \frac{(-1)\times 7}{1\times 7} = \frac{-7}{7}$$

$$-1 - \left(\frac{-9}{7}\right) = \frac{-7}{7} - \frac{(-9)}{7}$$

$$= \frac{-7-(-9)}{7} = \frac{-7+9}{7} = \frac{2}{7}$$

(b) $\frac{-3}{5} - \left(\frac{-8}{9}\right)$

LCM of 5 and 9 = 45

$$\frac{-3}{5} = \frac{(-3)\times 9}{5\times 9} = \frac{-27}{45} \text{ and } \frac{-8}{9} = \frac{(-8)\times 5}{9\times 5} = \frac{-40}{45}$$

$$\frac{-3}{5} - \left(\frac{-8}{9}\right) = \frac{-27}{45} - \left(\frac{-40}{45}\right)$$

$$= \frac{-27}{45} - \frac{(-40)}{45} = \frac{(-27)-(-40)}{45}$$

$$= \frac{-27+40}{45} = \frac{13}{45}$$

(c) $\frac{1}{3} - \left(\frac{-5}{6}\right)$

LCM of 3 and 6 = 6

$$\frac{1}{3} = \frac{1\times 2}{3\times 2} = \frac{2}{6}$$

$$\frac{1}{3} - \left(\frac{-5}{6}\right) = \frac{2}{6} - \left(\frac{-5}{6}\right) = \frac{2}{6} - \frac{(-5)}{6}$$

$$= \frac{2-(-5)}{6} = \frac{2+5}{6} = \frac{7}{6}$$

(d) $\frac{1}{3} - \frac{3}{4}$

LCM of 3 and 4 = 12

$$\frac{1}{3} = \frac{1\times 4}{3\times 4} = \frac{4}{12} \text{ and } \frac{3}{4} = \frac{3\times 3}{4\times 3} = \frac{9}{12}$$

$$\frac{1}{3}-\frac{3}{4}=\frac{4}{12}-\frac{9}{12}=\frac{4-9}{12}=\frac{-5}{12}$$

(e) $\frac{-4}{7}-(-7)$

LCM of 7 and 1 = 7

$$-7=\frac{(-7)\times 7}{1\times 7}=\frac{-49}{7}$$

$$\frac{-4}{7}-(-7)=\frac{-4}{7}-\left(\frac{-49}{7}\right)$$

$$=\frac{(-4)-(-49)}{7}=\frac{-4+49}{7}=\frac{45}{7}$$

(f) $\frac{-6}{5}-\left(\frac{-32}{13}\right)$

LCM of 5 and 13 = 65

$$\frac{-6}{5}=\frac{(-6)\times 13}{5\times 13}=\frac{-78}{65} \text{ and } \frac{-32}{13}=\frac{(-32)\times 5}{13\times 5}=\frac{-160}{65}$$

$$\frac{-6}{5}-\left(\frac{-32}{13}\right)=\frac{-78}{65}-\left(\frac{-160}{65}\right)=\frac{-78}{65}-\frac{(-160)}{65}$$

$$=\frac{(-78)-(-160)}{65}=\frac{-78+160}{65}=\frac{82}{65}$$

(g) $0-\left(\frac{-13}{9}\right)=0+\frac{13}{9}=\frac{13}{9}$

(h) $1-\left(\frac{-18}{11}\right)$

LCM of 1 and 11 = 11

$$1=\frac{1\times 11}{1\times 11}=\frac{11}{11}$$

$$1-\left(\frac{-18}{11}\right)=\frac{11}{11}-\left(\frac{-18}{11}\right)=\frac{11}{11}-\frac{(-18)}{11}$$

$$=\frac{11-(-18)}{11}=\frac{11+18}{11}=\frac{29}{11}$$

3. (a) LCM of 15 and 20 = 60

$$\frac{14}{15}=\frac{14\times 4}{15\times 4}=\frac{56}{60} \text{ and } \frac{13}{20}=\frac{13\times 3}{20\times 3}=\frac{39}{60}$$

$$\frac{14}{15}-\frac{13}{20}=\frac{56}{60}-\frac{39}{60}=\frac{56-39}{60}=\frac{17}{60}$$

(b) LCM of 24 and 36 = 72

$$\frac{7}{24} = \frac{7\times 3}{24\times 3} = \frac{21}{72} \text{ and } \frac{19}{36} = \frac{19\times 2}{36\times 2} = \frac{38}{72}$$

$$\frac{7}{24} - \frac{19}{36} = \frac{21}{72} - \frac{38}{72} = \frac{21-38}{72} = \frac{-17}{72}$$

(c) LCM of 1 and 7 = 7

$$-3 = \frac{(-3)\times 7}{1\times 7} = \frac{-21}{7}$$

$$-3 - \frac{4}{7} = \frac{-21}{7} - \frac{4}{7} = \frac{-21-4}{7} = \frac{-25}{7}$$

(d) LCM of 4 and 5 = 20

$$\frac{3}{4} = \frac{3\times 5}{4\times 5} = \frac{15}{20} \text{ and } \frac{4}{5} = \frac{4\times 4}{5\times 4} = \frac{16}{20}$$

$$\frac{3}{4} - \frac{4}{5} = \frac{15}{20} - \frac{16}{20} = \frac{15-16}{20} = \frac{-1}{20}$$

(e) LCM of 8 and 4 = 8

$$\frac{-5}{8} = \frac{(-5)\times(-1)}{(-8)\times(-1)} = \frac{5}{8} \text{ and } \frac{-3}{4} = \frac{(-3)\times 2}{4\times 2} = \frac{-6}{8}$$

$$\frac{-5}{-8} - \left(\frac{-3}{4}\right) = \frac{5}{8} - \left(\frac{-6}{8}\right) = \frac{5}{8} - \frac{(-6)}{8}$$

$$= \frac{5-(-6)}{8} = \frac{5+6}{8} = \frac{11}{8}$$

(f) LCM of 14 and 7 = 14

$$\frac{-2}{7} = \frac{(-2)\times 2}{7\times 2} = \frac{-4}{14}$$

$$\frac{-5}{14} - \frac{-2}{7} = \frac{-5}{14} - \left(\frac{-4}{14}\right) = \frac{-5}{14} - \frac{(-4)}{14}$$

$$= \frac{-5-(-4)}{14} = \frac{-5+4}{14} = \frac{-1}{14}$$

(g) $\frac{7}{11} - \left(\frac{-4}{-11}\right) = \frac{7}{11} - \left[\frac{(-4)\times(-1)}{(-11)\times(-1)}\right]$

$$= \frac{7}{11} - \frac{4}{11} = \frac{7-4}{11} = \frac{3}{11}$$

(h) LCM of 9 and 3 = 9

$$\frac{2}{-3} = \frac{2\times(-3)}{(-3)\times(-3)} = \frac{-6}{9}$$

$$\frac{4}{9}-\left(\frac{2}{-3}\right)=\frac{4}{9}-\left(\frac{-6}{9}\right)=\frac{4}{9}-\frac{(-6)}{9}$$

$$=\frac{4-(-6)}{9}=\frac{4+6}{9}=\frac{10}{9}$$

4. Sum of $\frac{-36}{11}$ and $\frac{49}{22}=\frac{-36}{11}+\frac{49}{22}$

$$=\frac{-72+49}{22}=\frac{-23}{22}$$

Sum of $\frac{33}{8}$ and $\frac{-19}{4}=\frac{33}{8}+\left(\frac{-19}{4}\right)=\frac{33}{8}+\frac{(-19)}{4}$

$$=\frac{33+(-38)}{8}=\frac{33-38}{8}=\frac{-5}{8}$$

According to the question,

$$\left[\frac{33}{8}+\left(\frac{-19}{4}\right)\right]-\left[\frac{-36}{11}+\frac{49}{22}\right]=\frac{-5}{8}-\left(\frac{-23}{22}\right)$$

$$=\frac{-5}{8}-\frac{(-23)}{22}=\frac{-55-(-92)}{88}$$

$$=\frac{-55+92}{88}=\frac{37}{88}$$

5. Sum of two rational numbers $=\frac{-4}{3}$

One rational number $=-5$

Other rational number $=\frac{-4}{3}-(-5)=\frac{-4}{3}-\frac{(-5)}{1}$

$$=\frac{-4-(-15)}{3}=\frac{-4+15}{3}=\frac{11}{3}$$

Hence, the other rational number is $\frac{11}{3}$.

6. Sum of two rational numbers $=-3$

One rational number $=\frac{-15}{7}$

Other rational number $=-3-\left(\frac{-15}{7}\right)=\frac{-3}{1}-\frac{(-15)}{7}$

$$=\frac{-21-(-15)}{7}=\frac{-21+15}{7}=\frac{-6}{7}$$

Hence, the other rational number is $\frac{-6}{7}$.

7. Sum of two rational numbers $= \frac{-3}{8}$

One rational number $= \frac{3}{16}$

Other rational number $= \frac{-3}{8} - \frac{3}{16} = \frac{-6-3}{16} = \frac{-9}{16}$

Hence, the other rational number is $\frac{-9}{16}$.

8. Sum of two rational numbers $= \frac{4}{21}$

One rational number $= \frac{5}{7}$

Other rational number $= \frac{4}{21} - \frac{5}{7} = \frac{4-5}{21} = \frac{-11}{21}$

Hence, other rational number is $\frac{-11}{21}$.

9. Let the required number to be added be x.

$$\frac{2}{9} + x = -1$$

$$x = -1 - \frac{2}{9} = \frac{-1}{1} - \frac{2}{9}$$

$$= \frac{-9-2}{9} = \frac{-11}{9}$$

Hence, the required number is $\frac{-11}{9}$.

10. Let the required number to be added be x.

$$\frac{-5}{7} + x = \frac{-2}{3}$$

$$x = \frac{-2}{3} - \left(\frac{-5}{7}\right) = \frac{-2}{3} - \frac{(-5)}{7}$$

$$x = \frac{-14-(-15)}{21} = \frac{-14+15}{21} = \frac{1}{21}$$

Hence, the required number is $\frac{1}{21}$.

11. Let the required number to be added be x.

$$\frac{-12}{5} + x = 3$$

$$x = 3 - \left(\frac{-12}{5}\right) = \frac{3}{1} - \frac{(-12)}{5}$$

$$= \frac{15-(-12)}{5} = \frac{15+12}{5} = \frac{27}{5}$$

Hence, the required number is $\frac{27}{5}$.

12. Let the required number to be added be *x*.

$$\frac{-3}{8} + x = \frac{5}{12}$$

$$x = \frac{5}{12} - \left(\frac{-3}{8}\right) = \frac{5}{12} - \frac{(-3)}{8}$$

$$= \frac{10-(-9)}{24} = \frac{10+9}{24} = \frac{19}{24}$$

Hence, the required number is $\frac{19}{24}$.

13. Let the required number to be subtracted be *x*.

$$\frac{-3}{4} - x = 1$$

$$x = \frac{-3}{4} - 1 = \frac{-3}{4} - \frac{1}{1} = \frac{-3-4}{4} = \frac{-7}{4}$$

Hence, the required number is $\frac{-7}{4}$.

14. Let the required number to be subtracted be *x*.

$$\frac{-2}{3} - x = \frac{-5}{6}$$

$$x = \frac{-2}{3} - \left(\frac{-5}{6}\right) = \frac{-2}{3} - \frac{(-5)}{6}$$

$$= \frac{-4-(-5)}{6} = \frac{-4+5}{6} = \frac{1}{6}$$

Hence, the required number is $\frac{1}{6}$.

15. Let the required number to be subtracted be *x*.

$$\frac{-3}{4} - x = \frac{5}{6}$$

$$x = \frac{-3}{4} - \frac{5}{6} = \frac{-9-10}{12} = \frac{-19}{12}$$

Hence, the required number is $\frac{-19}{12}$.

EXERCISE 4E

1. (a) $\frac{7}{6}\times 24=\frac{7}{6}\times\frac{24}{1}=\frac{7\times 24}{6\times 1}=28$

(b) $\frac{9}{8}\times\frac{32}{3}=\frac{9\times 32}{8\times 3}=12$

(c) $\frac{3}{4}\times\frac{5}{7}=\frac{3\times 5}{4\times 7}=\frac{15}{28}$

(d) First we write the given fractions in standard form,

$$\frac{25}{-9}=\frac{25\times(-1)}{(-9)\times(-1)}=\frac{-25}{9} \text{ and } \frac{3}{-10}=\frac{3\times(-1)}{(-10)\times(-1)}=\frac{-3}{10}$$

$$\frac{25}{-9}\times\frac{3}{-10}=\frac{-25}{9}\times\frac{-3}{10}=\frac{(-25)\times(-3)}{9\times 10}$$

$$=\frac{25\times 3}{9\times 10}=\frac{75}{90}=\frac{5}{6}$$

(e) First we write $\frac{10}{-3}$ in standard form,

$$\frac{10}{-3}=\frac{10\times(-1)}{(-3)\times(-1)}=\frac{-10}{3}$$

$$\frac{-12}{5}\times\frac{10}{-3}=\frac{-12}{5}\times\frac{-10}{3}=\frac{(-12)\times(-10)}{5\times 3}=\frac{12\times 10}{5\times 3}=8$$

(f) $\frac{-2}{3}\times\frac{6}{7}=\frac{(-2)\times 6}{3\times 7}=\frac{-2\times 6}{3\times 7}=\frac{-4}{7}$

(g) $\frac{-13}{15}\times\frac{-25}{26}=\frac{(-13)\times(-25)}{15\times 26}=\frac{13\times 25}{15\times 26}=\frac{5}{6}$

(h) First we write $\frac{20}{-3}$ in standard form,

$$\frac{20}{-3}=\frac{20\times(-1)}{(-3)\times(-1)}=\frac{-20}{3}$$

$$\frac{-36}{5}\times\frac{20}{-3}=\frac{-36}{5}\times\frac{-20}{3}$$

$$=\frac{(-36)\times(-20)}{5\times 3}=\frac{36\times 20}{5\times 3}=48$$

(i) $\frac{-7}{10}\times\frac{-40}{21}=\frac{(-7)\times(-40)}{10\times 21}=\frac{7\times 40}{10\times 21}=\frac{4}{3}$

2. (a) $\frac{-13}{5}\times -10=\frac{-13}{5}\times\frac{-10}{1}=\frac{(-13)\times(-10)}{5\times 1}=26$

(b) $-13\times\frac{17}{26}=\frac{-13}{1}\times\frac{17}{26}=\frac{(-13)\times 17}{1\times 26}=\frac{-13\times 17}{1\times 26}=\frac{-17}{2}$

(c) $\frac{-19}{36}\times 16=\frac{-19}{36}\times\frac{16}{1}=\frac{(-19)\times 16}{36\times 1}=\frac{-19\times 16}{36\times 1}=\frac{-76}{9}$

(d) $\frac{7}{24}\times -48=\frac{7}{24}\times\frac{-48}{1}=\frac{7\times(-48)}{24\times 1}=\frac{-7\times 48}{24\times 1}=-14$

(e) $\frac{-3}{4}\times\frac{4}{3}=\frac{(-3)\times 4}{4\times 3}=\frac{-3\times 4}{4\times 3}=-1$

(f) $\frac{-9}{16}\times\frac{-64}{27}=\frac{-9\times(-64)}{16\times 27}=\frac{9\times 64}{16\times 27}=\frac{4}{3}$

3. (a) Clearly, $\frac{5}{-18}=\frac{5\times(-1)}{(-18)\times(-1)}=\frac{-5}{18}$

$$\frac{5}{-18}\times\frac{-9}{20}=\frac{-5}{18}\times\frac{-9}{20}$$

$$=\frac{(-5)\times(-9)}{18\times 20}=\frac{5\times 9}{18\times 20}=\frac{1}{8}$$

(b) $\frac{-7}{30}\times\frac{5}{14}=\frac{(-7)\times 5}{30\times 14}=\frac{-7\times 5}{30\times 14}=\frac{-1}{12}$

(c) $\frac{3}{20}\times\frac{4}{5}=\frac{3\times 4}{20\times 5}=\frac{3}{25}$

(d) $-32\times\frac{-7}{36}=\frac{-32}{1}\times\frac{-7}{36}=\frac{(-32)\times(-7)}{36}=\frac{32\times 7}{36}=\frac{56}{9}$

(e) Clearly, $\frac{16}{-21}=\frac{16\times(-1)}{(-21)\times(-1)}=\frac{-16}{21}$

$$\frac{16}{-21}\times\frac{-14}{5}=\frac{-16}{21}\times\frac{-14}{5}=\frac{(-16)\times(-14)}{21\times 5}=\frac{16\times 14}{21\times 5}=\frac{32}{15}$$

(f) $\frac{-9}{8}\times\frac{-16}{3}=\frac{(-9)\times(-16)}{8\times 3}=\frac{9\times 16}{8\times 3}=6$

4. (a) $\left(\frac{16}{5}\times\frac{-25}{8}\right)+\left(\frac{-14}{27}\times\frac{6}{7}\right)=\frac{16\times(-25)}{5\times 8}+\frac{(-14)\times 6}{27\times 7}$

$$=\frac{-16\times 25}{5\times 8}+\frac{-14\times 6}{27\times 7}$$

$$=-10+\frac{-4}{9}=-10+\frac{(-4)}{9}$$

$$=\frac{-90+(-4)}{9}=\frac{-90-4}{9}=\frac{-94}{9}$$

(b) $\left(\frac{13}{8}\times\frac{12}{13}\right)+\left(\frac{-4}{9}\times\frac{3}{-2}\right)=\frac{13}{8}\times\frac{12}{13}+\left\{\frac{-4}{9}\times\frac{3\times(-1)}{(-2)\times(-1)}\right\}$

$$=\frac{13\times 12}{8\times 13}+\left(\frac{-4}{9}\times\frac{-3}{2}\right)$$

$$= \frac{3}{2} + \frac{(-4)\times(-3)}{9\times 2} = \frac{3}{2} + \frac{4\times 3}{9\times 2}$$

$$= \frac{3}{2} + \frac{2}{3} = \frac{9+4}{6} = \frac{13}{6}$$

(c) $\left(\frac{-12}{7} \times \frac{-14}{27}\right) \div \left(\frac{-8}{45} \times \frac{9}{16}\right) = \frac{(-12)\times(-14)}{7\times 27} - \frac{(-8)\times 9}{45\times 16}$

$$= \frac{12\times 14}{7\times 27} - \frac{-8\times 9}{45\times 16} = \frac{8}{9} - \left(\frac{-1}{10}\right)$$

$$= \frac{8}{9} + \frac{1}{10} = \frac{80+9}{90} = \frac{89}{90}$$

(d) $\left(\frac{6}{55} \times \frac{-22}{9}\right) \div \left(\frac{26}{125} \times \frac{-10}{39}\right) = \frac{6\times(-22)}{55\times 9} - \frac{26\times(-10)}{125\times 39}$

$$= \frac{-6\times 22}{55\times 9} - \frac{-26\times 10}{125\times 39} = \frac{-4}{15} - \frac{-4}{75}$$

$$= \frac{-20-(-4)}{75} = \frac{-20+4}{75} = \frac{-16}{75}$$

5. Distance covered in 1 hour $= 46\frac{2}{3}$ km

Distance covered in $2\frac{2}{5}$ hours $= \left(46\frac{2}{3} \times 2\frac{2}{5}\right)$ km

$$= \left(\frac{140}{3} \times \frac{12}{5}\right) \text{km} = \frac{140\times 12}{3\times 5} \text{ km}$$

$$= 112 \text{ km}$$

Hence, the bus will cover 112 km in $2\frac{1}{2}$ hours.

EXERCISE 4F

1. (a) Reciprocal of 0 does not exist.

(b) Reciprocal of $-1 = -1$

(c) Reciprocal of $-16 = \frac{-1}{16}$

(d) Reciprocal of $18 = \frac{1}{18}$

(e) Clearly, $\frac{-3}{-5} = \frac{(-3)\times(-1)}{(-5)\times(-1)} = \frac{3}{5}$

Reciprocal of $\frac{3}{5} = \frac{5}{3}$

(f) Reciprocal of $\frac{-6}{19} = \frac{-19}{6}$

(g) Reciprocal of $\frac{13}{25} = \frac{25}{13}$

(h) Reciprocal of $\frac{-17}{12} = \frac{-12}{17}$

2. (a) $-8 \div \left(\frac{-5}{16}\right) = \frac{-8}{1} \times \frac{-16}{5}$

$= \frac{(-8) \times (-16)}{1 \times 5}$

$= \frac{8 \times 16}{1 \times 5}$

$= \frac{128}{5}$

(b) $\frac{-12}{7} \div (-18) = \frac{-12}{7} \times \frac{-1}{18}$

$= \frac{(-12) \times (-1)}{7 \times 18}$

$= \frac{12 \times 1}{7 \times 18}$

$= \frac{2}{21}$

(c) $\frac{4}{9} \div \left(\frac{-5}{12}\right) = \frac{4}{9} \times \frac{-12}{5}$

$= \frac{4 \times (-12)}{9 \times 5}$

$= \frac{-4 \times 12}{9 \times 5}$

$= \frac{-16}{15}$

(d) $\left(\frac{-16}{35}\right) \div \left(\frac{-15}{14}\right) = \frac{-16}{35} \times \frac{-14}{15}$

$= \frac{(-16) \times (-14)}{35 \times 15}$

$= \frac{16 \times 14}{35 \times 15}$

$= \frac{32}{75}$

(e) $\left(\frac{-65}{14}\right) \div \left(\frac{13}{-7}\right) = \frac{-65}{14} \times \frac{-7}{13}$

$= \frac{(-65) \times (-7)}{14 \times 13}$

$= \frac{65 \times 7}{14 \times 13}$

$= \frac{5}{2}$

(f) $\left(\frac{-1}{10}\right) \div \left(\frac{-8}{5}\right) = \frac{-1}{10} \times \frac{-5}{8}$

$= \frac{(-1) \times (-5)}{10 \times 8}$

$= \frac{1 \times 5}{10 \times 8}$

$= \frac{1}{16}$

3. (a) Let the required number be $\frac{a}{b}$.

$\frac{a}{b} \div (-3) = \frac{-4}{15}$

$\frac{a}{b} = \frac{-4}{15} \times (-3)$

$$= \frac{(-4)\times(-3)}{15} = \frac{4\times 3}{15} = \frac{4}{5}$$

Hence, the required number is $\frac{4}{5}$.

(b) Let the required number be $\frac{a}{b}$.

$$\frac{a}{b} \div \left(\frac{-7}{5}\right) = \frac{10}{19}$$

$$\frac{a}{b} = \frac{10}{19} \times \frac{-7}{5}$$

$$= \frac{10\times(-7)}{19\times 5} = \frac{-10\times 7}{19\times 5} = \frac{-14}{19}$$

Hence, the required number is $\frac{-14}{19}$.

(c) Let the required number be $\frac{a}{b}$.

$$(-12) \div \frac{a}{b} = \frac{-6}{5}$$

$$\frac{-12}{1} \times \frac{b}{a} = \frac{-6}{5}$$

$$\frac{b}{a} = \frac{-6}{5} \div \left(\frac{-12}{1}\right) \qquad \frac{b}{a} = \frac{-6}{5} \times \frac{-1}{12}$$

$$\frac{b}{a} = \frac{(-6)\times(-1)}{5\times 12} \qquad \frac{b}{a} = \frac{6\times 1}{5\times 12}$$

$$\frac{b}{a} = \frac{1}{10} \qquad \frac{a}{b} = 10$$

Hence, the required number is 10.

(d) Let the required number be $\frac{a}{b}$.

$$\frac{9}{8} \div \frac{a}{b} = \frac{-3}{2}$$

$$\frac{9}{8} \times \frac{b}{a} = \frac{-3}{2}$$

$$\frac{b}{a} = \frac{-3}{2} \div \frac{9}{8} \qquad \frac{b}{a} = \frac{-3}{2} \times \frac{8}{9}$$

$$\frac{b}{a} = \frac{(-3)\times 8}{2\times 9} \qquad \frac{b}{a} = \frac{-3\times 8}{2\times 9}$$

$$\frac{b}{a}=\frac{-4}{3} \qquad \frac{a}{b}=\frac{-3}{4}$$

Hence, the required number is $\frac{-3}{4}$.

4. Let the required number be x.

$$\frac{-44}{9}\div x=\frac{-11}{3}$$

$$\frac{-44}{9}\times\frac{1}{x}=\frac{-11}{3}$$

$$\frac{1}{x}=\frac{-11}{3}\div\left(\frac{-44}{9}\right)$$

$$\frac{1}{x}=\frac{-11}{3}\times\frac{-9}{44} \qquad \frac{1}{x}=\frac{(-11)\times(-9)}{3\times 44}$$

$$\frac{1}{x}=\frac{11\times 9}{3\times 44} \qquad \frac{1}{x}=\frac{3}{4} \qquad x=\frac{4}{3}$$

Hence, the required number is $\frac{4}{3}$.

5. Let the required number be x.

$$\frac{-8}{15}\times x=24$$

$$x=24\div\left(\frac{-8}{15}\right)=\frac{24}{1}\times\frac{-15}{8}$$

$$=\frac{24\times(-15)}{1\times 8}=\frac{-24\times 15}{1\times 8}=-45$$

Hence, the required number is -45.

6. Product of two rational numbers $=10$

One number $=-8$

Other number $=10\div(-8)$

$$=\frac{10}{1}\times\frac{-1}{8}$$

$$=\frac{10\times(-1)}{1\times 8}=\frac{-5}{4}$$

Hence, the required number is $\frac{-5}{4}$.

7. Product of two rational numbers $=-9$

One number $=-12$

Other number $=(-9)\div(-12)$

$$= \frac{-9}{1} \times \frac{-1}{12} = \frac{(-9) \times (-1)}{1 \times 12}$$

$$= \frac{9 \times 1}{1 \times 12} = \frac{3}{4}$$

Hence, the required number is $\frac{3}{4}$.

8. Product of two rational numbers $= \frac{-16}{9}$

One number $= \frac{-4}{3}$

$$\text{Other number} = \left(\frac{-16}{9}\right) \div \left(\frac{-4}{3}\right) = \frac{-16}{9} \times \frac{-3}{4}$$

$$= \frac{(-16) \times (-3)}{9 \times 4} = \frac{16 \times 3}{9 \times 4} = \frac{4}{3}$$

Hence, the required number is $\frac{4}{3}$.

9. Cloth required for 24 pairs of trousers = 54 m

Cloth required for 1 pair of trousers $= (54 \div 24)$ m

$$= \frac{54}{1} \times \frac{1}{24} \text{ m}$$

$$= \frac{54}{24} \text{ m} = \frac{9}{4} \text{ m}$$

10. Cost of $2\frac{1}{2}$ m of cloth = ` $78\frac{3}{4}$

Cost of 1 m of cloth $= ` \left(78\frac{3}{4} \div 2\frac{1}{2}\right) = ` \left(\frac{315}{4} \div \frac{5}{2}\right)$

$$= ` \left(\frac{315}{4} \times \frac{2}{5}\right) = ` \frac{315 \times 2}{4 \times 5}$$

$$= ` \frac{63}{2} = ` 31\frac{1}{2}$$

Hence, the cost of cloth per metre is ` $31\frac{1}{2}$.

EXERCISE 4G

1. HCF of 102 and 119 = 17

$$\frac{-102}{119} = \frac{-102 \div 17}{119 \div 17} = \frac{-6}{7}$$

(b) is correct.

2. Required number $= 1 - \left(\frac{-5}{9}\right) = 1 + \frac{5}{9} = \frac{9+5}{9} = \frac{14}{9}$

(c) is correct.

3. Required number $= \frac{-3}{4} - \frac{5}{6} = \frac{-9-10}{12} = \frac{-19}{12}$

(b) is correct.

4. $\frac{x}{6} = \frac{7}{-3}$

$$x = \frac{6 \times 7}{-3}$$

$$x = -14$$

(a) is correct.

5. (c)

6. (b)

7. $\frac{-6}{13} - \left(\frac{-7}{15}\right) = \frac{-6}{13} + \frac{7}{15} = \frac{-90+91}{195} = \frac{1}{195}$

(c) is correct.

8. Let the required number be *x*.

$$\frac{-9}{14} + x = -1$$

$$x = -1 - \left(\frac{-9}{14}\right)$$

$$= -1 + \frac{9}{14} = \frac{-14+9}{14} = \frac{-5}{14}$$

(b) is correct.

9. Let the required number be *x*.

$$\frac{-3}{14} \times x = \frac{5}{12}$$

$$x = \frac{5}{12} \div \left(\frac{-3}{14}\right) = \frac{5}{12} \times \frac{-14}{3}$$

$$= \frac{5 \times (-14)}{12 \times 3} = \frac{-5 \times 14}{12 \times 3} = \frac{-35}{18}$$

(a) is correct.

10. $1 \div \frac{1}{2} = 1 \times 2 = 2$

(b) is correct.

HOTS

- Suppose total runs $= x$

$$\text{Highest score} = \frac{1}{9} \text{ of } x$$

$$= \frac{1}{9} \times x = \frac{x}{9}$$

$$\text{Remaning runs} = x - \frac{x}{9} = \frac{8x}{9}$$

$$\text{Second highest score} = \frac{1}{9} \text{ of } \frac{8x}{9} = \frac{1}{9} \times \frac{8x}{9} = \frac{8x}{81}$$

According to question,

$$\frac{x}{9} - \frac{8x}{81} = 7$$

$$\frac{9x - 8x}{81} = 7$$

$$x = 7 \times 81 = 567$$

Hence, the total runs scored is 567.

VALUE BASED

- $\frac{7}{4}$ litres of water coming in $= 1$ hour

$$1 \text{ litre of water coming in} = \frac{1}{\frac{7}{4}} \text{ hour} = \frac{4}{7} \text{ hour}$$

$$20 \text{ litres of water coming in} = \frac{4}{7} \times 20 = \frac{80}{7} \text{ hours}$$

Hence, bucket of 20 litres fill in $\frac{80}{7}$ hours.

Chapter 5 Exponents

EXERCISE 5A

1. (a) $\frac{7}{9} \times \frac{7}{9} \times \frac{7}{9} \times \frac{7}{9} \times \frac{7}{9} = \left(\frac{7}{9}\right)^5$

(b) $\left(\frac{-5}{7}\right) \times \left(\frac{-5}{7}\right) \times \left(\frac{-5}{7}\right) \times \left(\frac{-5}{7}\right) = \left(\frac{-5}{7}\right)^4$

(c) $\left(\frac{-1}{3}\right) \times \left(\frac{-1}{3}\right) \times \left(\frac{-1}{3}\right) = \left(\frac{-1}{3}\right)^3$

(d) $(-6)\times(-6)\times(-6)\times(-6)\times(-6)\times(-6)=(-6)^6$

2. (a) $\frac{9}{16}=\frac{3\times3}{4\times4}=\frac{3}{4}\times\frac{3}{4}=\left(\frac{3}{4}\right)^2$

(b) $\frac{-8}{27}=\frac{(-2)\times(-2)\times(-2)}{3\times3\times3}=\left(\frac{-2}{3}\right)\times\left(\frac{-2}{3}\right)\times\left(\frac{-2}{3}\right)=\left(\frac{-2}{3}\right)^3$

(c) $\frac{16}{81}=\frac{2\times2\times2\times2}{3\times3\times3\times3}=\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}=\left(\frac{2}{3}\right)^4$

(d) $\frac{-1}{512}=\frac{(-1)\times(-1)\times(-1)\times(-1)\times(-1)\times(-1)\times(-1)\times(-1)\times(-1)}{2\times2\times2\times2\times2\times2\times2\times2\times2}$

$=\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right)\times\left(\frac{-1}{2}\right)$

$=\left(\frac{-1}{2}\right)^9$

3. (a) $(-1)^9=-1$ (Since, the power is an odd number)

(b) $\left(\frac{-4}{7}\right)^3=\frac{(-4)^3}{7^3}=\frac{-64}{343}$

(c) $\left(\frac{-3}{2}\right)^4=\frac{(-3)^4}{2^4}=\frac{81}{16}$

(d) $\left(\frac{-1}{2}\right)^5=\frac{(-1)^5}{2^5}=\frac{-1}{32}$

(e) $\left(\frac{1}{6}\right)^3=\frac{1^3}{6^3}=\frac{1}{216}$

(f) $\left(\frac{-13}{11}\right)^2=\frac{(-13)^2}{(11)^2}=\frac{169}{121}$

(g) $\left(\frac{-8}{5}\right)^3=\frac{(-8)^3}{5^3}=\frac{-512}{125}$

(h) $\left(\frac{2}{3}\right)^5=\frac{2^5}{3^5}=\frac{32}{243}$

4. (a) $\left(\frac{-2}{3}\right)^{-1}=\frac{1}{\left(\frac{-2}{3}\right)}=\frac{3}{-2}=\frac{3\times(-1)}{(-2)\times(-1)}=\frac{-3}{2}$

(b) $\left(\frac{1}{3}\right)^{-1}=\frac{1}{\left(\frac{1}{3}\right)}=\frac{3}{1}=3$

(c) $(-6)^{-1}=\frac{1}{(-6)}=\frac{1\times(-1)}{(-6)\times(-1)}=\frac{-1}{6}$

(d) $(4)^{-1}=\frac{1}{4}$

5. (a) Reciprocal of $\left(\frac{5}{11}\right)^5 = \left(\frac{11}{5}\right)^5$

(b) Reciprocal of $\left(\frac{-7}{15}\right)^{19} = \left(\frac{-15}{7}\right)^{19}$

(c) Reciprocal of $7^9 = \frac{1}{7^9} = \left(\frac{1}{7}\right)^9$

(d) Reciprocal of $(-6)^7 = \frac{1}{(-6)^7} = \left(\frac{-1}{6}\right)^7$

6. (a) $11^0 = 1$ (b) $(-15)^0 = 1$

(c) $7^0 + 13^0 = 1 + 1 = 2$ (d) $9^0 \times 11^0 = 1 \times 1 = 1$

7. (a) $(-2)^{-5} = \frac{1}{(-2)^5}$ $\left[\because a^{-m} = \frac{1}{a^m}\right]$

$= \frac{1}{-32} = \frac{1 \times (-1)}{(-32) \times (-1)} = \frac{-1}{32}$

(b) $5^{-3} = \frac{1}{5^3}$ $\left[\because a^{-m} = \frac{1}{a^m}\right]$

$= \frac{1}{125}$

(c) $\left(\frac{-3}{4}\right)^{-3} = \left(\frac{-4}{3}\right)^3$ $\left[\because \left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m\right]$

$= \frac{(-4)^3}{3^3} = \frac{-64}{27}$

(d) $\left(\frac{1}{4}\right)^{-4} = \left(\frac{4}{1}\right)^4$ $\left[\because \left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m\right]$

$= 4^4$

$= 256$

(e) $(5^{-1} - 7^{-1})^{-1} = \left(\frac{1}{5} - \frac{1}{7}\right)^{-1}$ $\left[\because a^{-m} = \frac{1}{a^m}\right]$

$= \left(\frac{7-5}{35}\right)^{-1} = \left(\frac{2}{35}\right)^{-1}$

$= \frac{35}{2}$ $\left[\because \left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m\right]$

(f) $\left(\frac{23}{25}\right)^0 = 1$ $\left[\because \left(\frac{a}{b}\right)^0 = 1\right]$

(g) $(-3)^{-1} \times \left(\frac{1}{3}\right)^{-1} = \frac{-1}{3} \times 3$ $\left[\because a^{-m} = \frac{1}{a^m} \text{ and } \left(\frac{1}{a}\right)^{-m} = a^m\right]$

$= \frac{(-1) \times 3}{3} = \frac{-3}{3} = -1$

(h) $\left(\frac{5}{7}\right)^{-1} \times \left(\frac{7}{4}\right)^{-1} = \frac{7}{5} \times \frac{4}{7}$ $\left[\because \left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m\right]$

$= \frac{7 \times 4}{5 \times 7} = \frac{4}{5}$

(i) $\left[\left(\frac{3}{2}\right)^{-1} \div \left(\frac{-2}{5}\right)^{-1}\right] = \frac{2}{3} \div \frac{-5}{2}$ $\left[\because \left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m\right]$

$= \frac{2}{3} \times \frac{-2}{5} = \frac{2 \times (-2)}{3 \times 5} = \frac{-4}{15}$

8. (a) $\left(\frac{-2}{3}\right)^5 \times \left(\frac{-3}{7}\right)^3 = \frac{(-2)^5}{3^5} \times \frac{(-3)^3}{7^3} = \frac{-32}{243} \times \frac{-27}{343}$

$= \frac{(-32) \times (-27)}{243 \times 343} = \frac{32 \times 27}{243 \times 343} = \frac{32}{3087}$

(b) $\left(\frac{3}{2}\right)^4 \times \left(\frac{1}{5}\right)^2 = \frac{3^4}{2^4} \times \frac{1^2}{5^2} = \frac{81}{16} \times \frac{1}{25}$

$= \frac{81 \times 1}{16 \times 25} = \frac{81}{400}$

(c) $\left(\frac{-1}{2}\right)^5 \times 2^3 \times \left(\frac{3}{4}\right)^2 = \frac{(-1)^5}{2^5} \times 2^3 \times \frac{3^2}{4^2} = \frac{-1}{32} \times 8 \times \frac{9}{16}$

$= \frac{(-1) \times 8 \times 9}{32 \times 16} = \frac{-9}{64}$

9. (a) $\left(\frac{-7}{8}\right)^{-3} \times \left(\frac{-7}{8}\right)^2 = \left(\frac{-7}{8}\right)^{-3+2}$ $\left[\because \left(\frac{a}{b}\right)^m \times \left(\frac{a}{b}\right)^n = \left(\frac{a}{b}\right)^{m+n}\right]$

$= \left(\frac{-7}{8}\right)^{-1} = \frac{-8}{7}$ $\left[\because \left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m\right]$

(b) $\left(\frac{1}{3}\right)^{-3} \times \left(\frac{1}{3}\right)^{-2} = \left(\frac{1}{3}\right)^{-3+(-2)}$ $\left[\because \left(\frac{a}{b}\right)^m \times \left(\frac{a}{b}\right)^n = \left(\frac{a}{b}\right)^{m+n}\right]$

$$= \left(\frac{4}{3}\right)^{-3-2} = \left(\frac{4}{3}\right)^{-5}$$

$$= \left(\frac{3}{4}\right)^{5} \qquad \left[\because \left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^{m}\right]$$

$$= \frac{3^5}{4^5} = \frac{243}{1024}$$

(c) $\left(\frac{4}{9}\right)^{6} \times \left(\frac{4}{9}\right)^{-4} = \left(\frac{4}{9}\right)^{6+(-4)} \qquad \left[\because \left(\frac{a}{b}\right)^{m} \times \left(\frac{a}{b}\right)^{n} = \left(\frac{a}{b}\right)^{m+n}\right]$

$$= \left(\frac{4}{9}\right)^{6-4} = \left(\frac{4}{9}\right)^{2} = \frac{4^2}{9^2} = \frac{16}{81}$$

10. (a) $\left(\frac{-2}{3}\right)^{7} \div \left(\frac{-2}{3}\right)^{4} = \left(\frac{-2}{3}\right)^{7-4} \qquad \left[\because \left(\frac{a}{b}\right)^{m} \div \left(\frac{a}{b}\right)^{n} = \left(\frac{a}{b}\right)^{m-n}, m > n\right]$

$$= \left(\frac{-2}{3}\right)^{3} = \frac{(-2)^3}{3^3} = \frac{-8}{27}$$

(b) $\left(\frac{-3}{2}\right)^{3} \div \left(\frac{-3}{2}\right)^{6} = \frac{1}{\left(\frac{-3}{2}\right)^{6-3}} \qquad \left[\because \left(\frac{a}{b}\right)^{m} \div \left(\frac{a}{b}\right)^{n} = \frac{1}{\left(\frac{a}{b}\right)^{n-m}}, m < n\right]$

$$= \frac{1}{\left(\frac{-3}{2}\right)^{3}} = \frac{1}{\frac{(-3)^3}{2^3}} = \frac{2^3}{(-3)^3}$$

$$= \frac{8}{-27} = \frac{8 \times (-1)}{(-27) \times (-1)} = \frac{-8}{27}$$

(c) $\left[\left(\frac{-1}{4}\right)^{2}\right]^{-2} = \left[\left(\frac{-1}{4}\right)^{2\times(-2)}\right]^{-1} \qquad \left[\because \left[\left(\frac{a}{b}\right)^{m}\right]^{n} = \left(\frac{a}{b}\right)^{m \times n}\right]$

$$= \left[\left(\frac{-1}{4}\right)^{-4}\right]^{-1} = \left(\frac{-1}{4}\right)^{(-4)\times(-1)}$$

$$= \left(\frac{-1}{4}\right)^{4} = \frac{(-1)^4}{4^4} = \frac{1}{256}$$

11. Let the required number be x.

$$3^{-3} \times x = 4$$

$$x = 4 \div 3^{-3}$$

$$= 4 \times \frac{1}{3^{-3}} = 4 \times 3^3 \qquad \left[\because \frac{1}{a^{-m}} = a^m\right]$$

$$= 4 \times 27$$

$$= 108$$

Hence, the required number is 108.

12. Let the required number be x.

$$(-30)^{-1} \div x = 6^{-1}$$

$$(-30)^{-1} \times \frac{1}{x} = 6^{-1}$$

$$\frac{1}{x} = 6^{-1} \div (-30)^{-1}$$

$$\frac{1}{x} = \frac{1}{6} \div \left(\frac{1}{-30}\right) \qquad \left[\because a^{-m} = \frac{1}{a^m}\right]$$

$$\frac{1}{x} = \frac{1}{6} \times (-30)$$

$$\frac{1}{x} = \frac{-30}{6}$$

$$\frac{1}{x} = -5 \qquad x = (-5)^{-1}$$

Hence, the required number is $(-5)^{-1}$.

13. $\left(\frac{3}{5}\right)^3 \times \left(\frac{3}{5}\right)^{-6} = \left(\frac{3}{5}\right)^{2x-1}$

$$\left(\frac{3}{5}\right)^{3+(-6)} = \left(\frac{3}{5}\right)^{2x-1} \qquad \left[\because \left(\frac{a}{b}\right)^m \times \left(\frac{a}{b}\right)^n = \left(\frac{a}{b}\right)^{m+n}\right]$$

$$\left(\frac{3}{5}\right)^{-3} = \left(\frac{3}{5}\right)^{2x-1}$$

$$-3 = 2x - 1$$

$$-3 + 1 = 2x$$

$$-2 = 2x$$

$$x = \frac{-2}{2}$$

$$x = -1$$

14. (a) $5^{2n} \times 5^3 = 5^9$

$5^{2n+3} = 5^9$

$2n + 3 = 9$

$2n = 9 - 3$

$2n = 6$

$n = \frac{6}{2}$

$n = 3$

(b) $6^{2n+1} \div 36 = 6^3$

$6^{2n+1} \div 6^2 = 6^3$

$6^{2n+1-2} = 6^3$

$6^{2n-1} = 6^3$

$2n - 1 = 3$

$2n = 3 + 1$

$2n = 4$

$n = \frac{4}{2}$

$n = 2$

(c) $8 \times 2^{n+2} = 32$

$2^3 \times 2^{n+2} = 2^5$

$2^{3+n+2} = 2^5$

$2^{n+5} = 2^5$

$n + 5 = 5$

$n = 5 - 5$

$n = 0$

15. $\frac{16 \times 2^{n+1} - 4 \times 2^n}{16 \times 2^{n+2} - 2 \times 2^{n+2}} = \frac{2^4 \times 2^{n+1} - 2^2 \times 2^n}{2^4 \times 2^{n+2} - 2^1 \times 2^{n+2}}$

$= \frac{2^{4+n+1} - 2^{2+n}}{2^{4+n+2} - 2^{1+n+2}} = \frac{2^{n+5} - 2^{n+2}}{2^{n+6} - 2^{n+3}}$

$= \frac{2^n \times 2^5 - 2^n \times 2^2}{2^n \times 2^6 - 2^n \times 2^3} = \frac{2^n(2^5 - 2^2)}{2^n(2^6 - 2^3)}$

$= \frac{32 - 4}{64 - 8} = \frac{28}{56} = \frac{1}{2}$

EXERCISE 5B

1. (a) $82934000000 = 8.2934 \times 10^{10}$

(b) $940000000000 = 9.4 \times 10^{11}$

(c) $0.000000693 = 6.93 \times 10^{-7}$

(d) $0.00000000814 = 8.14 \times 10^{-9}$

2. (a) The present age of universe $= 1.2 \times 10^{10}$ years

(b) Number of stars in a galaxy $= 1.0 \times 10^{11}$

(c) Distance between Earth and Moon $= 3.84 \times 10^8$ m

(d) Diameter of Earth $= 1.2756 \times 10^7$ m

(e) 1 pico $= \frac{1}{10^{12}}$ m $= 1.0 \times 10^{-12}$ m

3. (a) $7.82 \times 10^5 = 782000$

(b) $6.94 \times 10^8 = 694000000$

(c) $3.52 \times 10^{-6} = 0.00000352$

(d) $1.923 \times 10^{-9} = 0.000000001923$

4. (a) $50074 = 5 \times 10^4 + 7 \times 10^1 + 4 \times 10^0$

(b) $5807294 = 5 \times 10^6 + 8 \times 10^5 + 7 \times 10^3 + 2 \times 10^2 + 9 \times 10^1 + 4 \times 10^0$

(c) $4007185 = 4 \times 10^6 + 7 \times 10^3 + 1 \times 10^2 + 8 \times 10^1 + 5 \times 10^0$

(d) $684502 = 6 \times 10^5 + 8 \times 10^4 + 4 \times 10^3 + 5 \times 10^2 + 2 \times 10^0$

5. (a) $8 \times 10^5 + 6 \times 10^4 + 4 \times 10^3 + 2 \times 10^2 + 9 \times 10^1 + 6 \times 10^0$

$= 8 \times 100000 + 6 \times 10000 + 4 \times 1000 + 2 \times 100 + 9 \times 10 + 6 \times 1$

$= 800000 + 60000 + 4000 + 200 + 90 + 6$

$= 864296$

(b) $6 \times 10^4 + 3 \times 10^3 + 0 \times 10^2 + 7 \times 10^1 + 8 \times 10^0$

$= 6 \times 10000 + 3 \times 1000 + 0 \times 100 + 7 \times 10 + 8 \times 1$

$= 60000 + 3000 + 0 + 70 + 8$

$= 63078$

(c) $9 \times 10^6 + 7 \times 10^5 + 0 \times 10^4 + 3 \times 10^3 + 4 \times 10^2 + 6 \times 10^1 + 2 \times 10^0$

$= 9 \times 1000000 + 7 \times 100000 + 0 \times 10000 + 3 \times 1000 + 4 \times 100 + 6 \times 10 + 2 \times 1$

$= 9000000 + 700000 + 0 + 3000 + 400 + 60 + 2$

$= 9703462$

EXERCISE 5C

1. $(5^{-1} \times 3^{-1})^{-1} = \left(\frac{1}{5} \times \frac{1}{3}\right)^{-1}$

$= \left(\frac{1 \times 1}{5 \times 3}\right)^{-1} = \left(\frac{1}{15}\right)^{-1} = 15$

(c) is correct.

2. $(6^{-1} - 8^{-1})^{-1} = \left(\frac{1}{6} - \frac{1}{8}\right)^{-1} = \left(\frac{8-6}{48}\right)^{-1} = \left(\frac{2}{48}\right)^{-1}$

$= \left(\frac{1}{24}\right)^{-1} = 24$

(d) is correct.

3. $\left(-\frac{1}{2}\right)^{-6} = (-2)^6 = 64$

(b) is correct.

4. (c)

5. $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2} = 2^2 + 3^2 + 4^2$

$= 4 + 9 + 16$

$= 29$

(b) is correct.

6. $\left[\left(\frac{1}{3}\right)^2\right]^4 = \left(\frac{1}{3}\right)^{2\times 4} = \left(\frac{1}{3}\right)^8$

(b) is correct.

7. $\left[\left(-\frac{1}{2}\right)^2\right]^{-2}\Big]^{-1} = \left[\left(-\frac{1}{2}\right)^{2\times(-2)}\right]^{-1}$

$= \left[\left(-\frac{1}{2}\right)^{-4}\right]^{-1} = \left(-\frac{1}{2}\right)^{(-4)\times(-1)}$

$= \left(-\frac{1}{2}\right)^4 = \frac{1}{16}$

(a) is correct.

8. $\left(-\frac{2}{5}\right)^7 \div \left(-\frac{2}{5}\right)^5 = \left(-\frac{2}{5}\right)^{7-5} = \left(-\frac{2}{5}\right)^2 = \frac{4}{25}$

(a) is correct.

9. $\left(\frac{5}{3}\right)^{-5} \times \left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$

$\left(\frac{5}{3}\right)^{-5+11} = \left(\frac{5}{3}\right)^{8x}$

$\left(\frac{5}{3}\right)^6 = \left(\frac{5}{3}\right)^{8x}$

$6 = 8x$

$x = \frac{6}{8}$

$$x = \frac{3}{4}$$

(c) is correct.

10. (c)

HOTS

- Distance between the Earth and the Moon = 384,000,000 m
  $= 3.84 \times 10^8$ m
  Distance between the Sun and the Earth = 146,900,000,000 m
  $= 1.469 \times 10^{11}$ m

  So, Sun has more distance from Earth.

VALUE BASED

- Total plants = 1024
  $= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
  $= 2^{10}$

Chapter 6 Algebraic Expression

EXERCISE 6A

1. (a) Variables: x, y; Constant : -8 (b) Variable: x; Constant: $\frac{15}{7}$

(c) Variables: a, b; Constant: $\frac{15}{9}$ (d) Constant: 15

2. (a) $13x, 31y, -13$ (b) $57x, 31y, -23z, 2$

(c) $127y, -128z$ (d) $6mn, -7m, mn^2, -n$

3. (a) $3y^2$ (b) 4 (c) $-m^2n$ (d) $-5x^2$

4. (a), (c)

5. (a) $5x + 7x + (-6x) = 12x - 6x$
$= x(12 - 6)$ [adding like terms]
$= 6x$

(b) $5a^2b + (-8a^2b) + 7a^2b$
$= 5a^2b - 8a^2b + 7a^2b$
$= (5 - 8 + 7)a^2b$ [adding like terms]
$= 4a^2b$

(c) $\frac{3}{5}x + \frac{2}{3}x + \left(-\frac{4}{5}x\right) = \frac{3}{5}x + \frac{2}{3}x - \frac{4}{5}x$

$$= \left(\frac{3}{5} + \frac{2}{3} - \frac{4}{5}\right)x \qquad \text{[adding like terms]}$$

$$= \left(\frac{9 + 10 - 12}{15}\right)x = \frac{7}{15}x$$

(d) $\frac{3}{4}x^2 + 5x^2 + (-3x^2) + \left(-\frac{1}{4}x^2\right)$

$$= \frac{3}{4}x^2 + 5x^2 - 3x^2 - \frac{1}{4}x^2$$

$$= \left(\frac{3}{4} + 5 - 3 - \frac{1}{4}\right)x^2 \qquad \text{[adding like terms]}$$

$$= \left(\frac{3 + 20 - 12 - 1}{4}\right)x^2$$

$$= \frac{10}{4}x^2 = \frac{5}{2}x^2$$

(e) $(5x - 2x^2 - 8) + (8x^2 - 7x - 9) + (3 + 7x^2 - 2x)$

$$= -2x^2 + 8x^2 + 7x^2 + 5x - 7x - 2x - 8 - 9 + 3$$

[collecting like terms]

$$= (-2 + 8 + 7)x^2 + (5 - 7 - 2)x + (-8 - 9 + 3)$$

[adding like terms]

$$= 13x^2 + (-4)x + (-14) = 13x^2 - 4x - 14$$

(f) $(x - 3y + 4z) + (y - 2x - 8z) + (5x - 2y - 3z)$

$$= (x - 2x + 5x) + (-3y + y - 2y) + (4z - 8z - 3z)$$

[collecting like terms]

$$= (1 - 2 + 5)x + (-3 + 1 - 2)y + (4 - 8 - 3)z$$

[adding like terms]

$$= 4x - 4y - 7z$$

(g) $(2x^2 - 3y^2) + (5x^2 + 6y^2) + (-3x^2 - 4y^2)$

$$= 2x^2 + 5x^2 - 3x^2 - 3y^2 + 6y^2 - 4y^2$$

[collecting like terms]

$$= (2 + 5 - 3)x^2 + (-3 + 6 - 4)y^2$$

[adding like terms]

$$= 4x^2 - y^2$$

(h) $\frac{8}{5}x + \frac{11}{7}y + \frac{9}{4}xy + \left(-\frac{3}{2}x - \frac{5}{3}y - \frac{9}{5}xy\right)$

$$= \frac{8}{5}x - \frac{3}{2}x + \frac{11}{7}y - \frac{5}{3}y + \frac{9}{4}xy - \frac{9}{5}xy$$

[collecting like terms]

$$= \left(\frac{8}{5} - \frac{3}{2}\right)x + \left(\frac{11}{7} - \frac{5}{3}\right)y + \left(\frac{9}{4} - \frac{9}{5}\right)xy$$

[adding like terms]

$$= \left(\frac{16-15}{10}\right)x + \left(\frac{33-35}{21}\right)y + \left(\frac{45-36}{20}\right)xy$$

$$= \frac{1}{10}x - \frac{2}{21}y + \frac{9}{20}xy$$

(i) $\frac{3}{2}x^3 - \frac{1}{4}x^2 + \frac{5}{3} + \left(-\frac{5}{4}x^3 + \frac{3}{5}x^2 - x + \frac{1}{5}\right) + \left(-x^2 + \frac{3}{8}x - \frac{8}{15}\right)$

$$= \frac{3}{2}x^3 - \frac{5}{4}x^3 - \frac{1}{4}x^2 + \frac{3}{5}x^2 - x^2 - x + \frac{3}{8}x + \frac{5}{3} + \frac{1}{5} - \frac{8}{15}$$

[collecting like terms]

$$= \left(\frac{3}{2} - \frac{5}{4}\right)x^3 + \left(-\frac{1}{4} + \frac{3}{5} - 1\right)x^2 + \left(-1 + \frac{3}{8}\right)x + \left(\frac{5}{3} + \frac{1}{5} - \frac{8}{15}\right)$$

[adding like terms]

$$= \left(\frac{6-5}{4}\right)x^3 + \left(\frac{-5+12-20}{20}\right)x^2 + \left(\frac{-8+3}{8}\right)x + \left(\frac{25+3-8}{15}\right)$$

$$= \frac{1}{4}x^3 - \frac{13}{20}x^2 + \frac{5}{8}x + \frac{20}{15}$$

$$= \frac{1}{4}x^3 - \frac{13}{20}x^2 + \frac{5}{8}x + \frac{4}{3}$$

6. (a) $-3x^2 - x^2 = -4x^2$

(b) $7xy - (-8xy) = 7xy + 8xy = 15xy$

(c) $(4y - 5x) - (x - y) = 4y - 5x - x + y$

$= 4y + y - 5x - x$

$= (4+1)y + (-5-1)x \quad = 5y - 6x$

(d) $(2x^2 - 3y^2 + 6xy) - (x^2 - y^2)$

$= 2x^2 - 3y^2 + 6xy - x^2 + y^2$

$= 2x^2 - x^2 - 3y^2 + y^2 + 6xy$

$= (2-1)x^2 + (-3+1)y^2 + 6xy$

$= x^2 - 2y^2 + 6xy$

(e) $(2z - x - 3y) - (x - y + 3z)$

$= 2z - x - 3y - x + y - 3z$

$= 2z - 3z - x - x - 3y + y$

$= (2-3)z + (-1-1)x + (-3+1)y$

$= -z - 2x - 2y = -2x - 2y - z$

(f) $(a^2 + b^2 + 2ab) - (a^2 + b^2 - 2ab)$

$= a^2 + b^2 + 2ab - a^2 - b^2 + 2ab$

$= a^2 - a^2 + b^2 - b^2 + 2ab + 2ab$

$= (1-1)a^2 + (1-1)b^2 + (2+2)ab = 4ab$

7. $-3 - [(8a - 6a^2 + 9) + (-10a - 8 + 8a^2)]$

$= -3 - [8a - 6a^2 + 9 - 10a - 8 + 8a^2]$

$= -3 - 8a + 6a^2 - 9 + 10a + 8 - 8a^2$

$= 6a^2 - 8a^2 - 8a + 10a - 3 - 9 + 8$

$= (6-8)a^2 + (-8+10)a - 3 - 9 + 8$

$= -2a^2 + 2a - 4$

8. $[(a + 3b - 4c) + (4a - b + 9c) + (-2b + 3c - a)] - (2a - 3b + 4c)$

$= [a + 3b - 4c + 4a - b + 9c - 2b + 3c - a] - 2a + 3b - 4c$

$= [a + 4a - a + 3b - b - 2b - 4c + 9c + 3c] - 2a + 3b - 4c$

$= 4a + 8c - 2a + 3b - 4c = 4a - 2a + 3b + 8c - 4c$

$= 2a + 3b + 4c$

9. $[(2m + 4n - 3p^2) + (-m - n - p^2)]$

$-[(8m - 7n + 6p^2) + (-3m - 4n - p^2)]$

$= [2m + 4n - 3p^2 - m - n - p^2] - [8m - 7n + 6p^2 - 3m - 4n - p^2]$

$= 2m + 4n - 3p^2 - m - n - p^2 - 8m + 7n - 6p^2 + 3m + 4n + p^2$

$= 2m - m - 8m + 3m + 4n - n + 7n + 4n - 3p^2 - p^2 - 6p^2 + p^2$

$= (2 - 1 - 8 + 3)m + (4 - 1 + 7 + 4)n + (-3 - 1 - 6 + 1)p^2$

$= -4m + 14n - 9p^2$

10. (a) $(x^2 - x) - \frac{1}{2}(x - 3 + 3x^2)$

$= x^2 - x - \frac{1}{2}x + \frac{3}{2} - \frac{3}{2}x^2 = x^2 - \frac{3}{2}x^2 - x - \frac{1}{2}x + \frac{3}{2}$

$= \left(1 - \frac{3}{2}\right)x^2 + \left(-1 - \frac{1}{2}\right)x + \frac{3}{2} = -\frac{1}{2}x^2 - \frac{3}{2}x + \frac{3}{2}$

(b) $(5x - 9y) - (-7x + y) = 5x - 9y + 7x - y$

$= 5x + 7x - 9y - y$

$= (5+7)x + (-9-1)y = 12x - 10y$

(c) $[7-2x+5y-(x-y)]-(5x+3y-7)$

$=[7-2x+5y-x+y]-5x-3y+7$

$=7-2x+5y-x+y-5x-3y+7$

$=7+7-2x-x-5x+5y+y-3y$

$=14-8x+3y$

EXERCISE 6B

1. $-6x^3\times 5x^2=(-6\times 5)\times(x^3\times x^2)=-30x^{(3+2)}=-30x^5$

2. $3a^2\times 8a^4=(3\times 8)\times(a^2\times a^4)=24a^{(2+4)}=24a^6$

3. $(2a^2b^3)\times(-3a^3b)=\{2\times(-3)\}\times(a^2\times a^3\times b^3\times b)$

$=-6a^{(2+3)}\times b^{(3+1)}=-6a^5b^4$

4. $(-4ab)\times(-3a^2bc)=(-4)\times(-3)\times(a\times a^2\times b\times b\times c)$

$=12a^{(1+2)}\times b^{(1+1)}\times c=12a^3b^2c$

5. $\frac{2}{3}x^2y\times\frac{3}{5}xy^2=\left(\frac{2}{3}\times\frac{3}{5}\right)\times(x^2\times x\times y\times y^2)$

$=\frac{2}{5}\times x^{(2+1)}\times y^{(1+2)}=\frac{2}{5}x^3y^3$

6. $\left(\frac{-18}{5}x^2z\right)\times\left(\frac{-25}{6}xz^2y\right)=\left(\frac{-18}{5}\right)\times\left(\frac{-25}{6}\right)\times(x^2\times x\times y\times z\times z^2)$

$=15\times x^{(2+1)}\times y\times z^{(1+2)}=15x^3yz^3$

7. $\left(\frac{-13}{5}ab^2c\right)\times\left(\frac{7}{3}a^2bc^2\right)=\left(-\frac{13}{5}\times\frac{7}{3}\right)\times(a\times a^2\times b^2\times b\times c\times c^2)$

$=\frac{-91}{15}\times a^{(1+2)}\times b^{(2+1)}\times c^{(1+2)}=-\frac{91}{15}a^3b^3c^3$

8. $\left(\frac{-1}{27}a^2b^2\right)\times\left(\frac{-9}{2}a^3bc^2\right)=\left\{\left(\frac{-1}{27}\right)\times\left(\frac{-9}{2}\right)\right\}\times(a^2\times a^3\times b^2\times b\times c^2)$

$=\frac{1}{6}\times a^{(2+3)}\times b^{(2+1)}\times c^2=\frac{1}{6}a^5b^3c^2$

9. $\left(-\frac{3}{14}xy^4\right)\times\left(\frac{7}{6}x^3y\right)=\left(\frac{-3}{14}\times\frac{7}{6}\right)\times(x\times x^3\times y^4\times y)$

$=\frac{-1}{4}\times x^{(1+3)}\times y^{(4+1)}=-\frac{1}{4}x^4y^5$

10. $\left(-\frac{3}{4}ab^3\right)\times\left(-\frac{2}{3}a^2b^4\right)=\left(\frac{-3}{4}\right)\times\left(-\frac{2}{3}\right)\times(a\times a^2\times b^3\times b^4)$

$=\frac{1}{2}\times a^{(1+2)}\times b^{(3+4)}=\frac{1}{2}a^3b^7$

11. $(2a^2b)\times(-5ab^2c)\times(-6bc^2)$

$$=\{2\times(-5)\times(-6)\}\times(a^2\times a\times b\times b^2\times c\times c^2)$$

$$=60\times a^{(2+1)}\times b^{(1+2)}\times c^{(1+2)}=60a^3b^3c^3$$

12. $(-4x^2)\times(-6xy^2)\times(-3y)=\{(-4)\times(-6)\times(-3)\}\times\{x^2\times x\times y^2\times y\}$

$$=-72\times x^{(2+1)}\times y^{(2+1)}=-72x^3y^3$$

13. $(ab^2)\times(-b^2c)\times(-a^2c^3)\times(-3abc)$

$$=(-3)\times\{a\times(-a^2)\times a\times b^2\times(-b)^2\times b\times c\times c^3\times c\}$$

$$=(-3)\times\{-a^{(1+2+1)}\times(-b^{(2+2+1)})\times c^{1+3+1}\}$$

$$=(-3)\times a^4\times b^5\times c^5=-3a^4b^5c^5$$

14. $\left(\frac{4}{3}x^2yz\right)\times\left(\frac{1}{3}y^2zx\right)\times(-6xyz^2)$

$$=\left\{\frac{4}{3}\times\frac{1}{3}\times(-6)\right\}\times\{x^2\times x\times y\times y^2\times y\times z\times z\times z^2\}$$

$$=-\frac{8}{3}\times x^{(2+1)}\times y^{(1+2+1)}\times z^{(1+1+2)}=-\frac{8}{3}x^3y^4z^4$$

15. $(-8u^2v^6)\times(-20uv)=\{(-8)\times(-20)\}\times(u^2\times u\times v^6\times v)\}$

$$=160\times u^{2+1}\times v^{6+1}=160u^3v^7$$

When $u=2.5$ and $v=1$

$$160u^3v^7=160\times(2.5)^3\times(1)^7$$

$$=160\times15.625\times1=2500$$

16. $(2.3a^5b^2)\times(1.2a^2b^2)=(2.3\times1.2)\times(a^5\times a^2\times b^2\times b^2)$

$$=2.76\times a^{(5+2)}\times b^{(2+2)}=2.76\ a^7b^4$$

When $a=1$ and $b=0.5$

$$2.76a^7b^4=2.76\times(1)^7\times(0.5)^4$$

$$=2.76\times0.0625=0.1725$$

17. $-\frac{2}{3}a^2b\times\frac{6}{5}a^3b^2=\left(-\frac{2}{3}\times\frac{6}{5}\right)\times(a^2\times a^3\times b\times b^2)$

$$=\frac{-4}{5}\times a^{(2+3)}\times b^{(1+2)}=-\frac{4}{5}a^5b^3$$

Verification :

$$\text{L.H.S.}=-\frac{2}{3}a^2b\times\frac{6}{5}a^3b^2=-\frac{2}{3}\times4\times3\times\frac{6}{5}\times(2)^3\times(3)^2$$

$$=(-8)\times\frac{432}{5}=\frac{-3456}{5}$$

$$\text{R.H.S.} = \frac{-4}{5}a^5b^3 = -\frac{4}{5}\times(2)^5\times(3)^3$$

$$= -\frac{4}{5}\times 32\times 27 = \frac{-3456}{5}$$

$$\text{L.H.S.} = \text{R.H.S.}$$

$$-\frac{2}{3}a^2b\times\frac{6}{5}a^3b^2 = -\frac{4}{5}a^5b^3$$

18. $\left(-\frac{8}{21}x^2y^3\right)\times\left(-\frac{7}{16}xy^2\right) = \frac{8}{21}\times\frac{7}{16}\times(x^2\times x\times y^3\times y^2)$

$$= \frac{1}{6}\times x^{(2+1)}\times y^{(3+2)} = \frac{1}{6}x^3y^5$$

Verification: L.H.S. $= \left(-\frac{8}{21}x^2y^3\right)\times\left(-\frac{7}{16}xy^2\right)$

$$= -\frac{8}{21}\times(3)^2\times(2)^3\times\left\{-\frac{7}{16}\times 3\times(2)^2\right\}$$

$$= -\frac{8}{21}\times 9\times 8\times\left\{-\frac{7}{16}\times 12\right\} = -\frac{192}{7}\times\left(-\frac{21}{4}\right) = 144$$

$$\text{R.H.S.} = \frac{1}{6}x^3y^5$$

$$= \frac{1}{6}\times(3)^3\times(2)^5 = \frac{1}{6}\times 27\times 32 = 144$$

Thus, L.H.S. = R.H.S.

$$\left(-\frac{8}{21}x^2y^3\right)\times\left(-\frac{7}{16}xy^2\right) = \frac{1}{6}x^3y^5$$

19. $\left(\frac{1}{4}abc\right)\times(-6b^2c)\times\left(-\frac{1}{3}c^3\right)$

$$= \frac{1}{4}\times(-6)\times\left(-\frac{1}{3}\right)\times a\times b\times b^2\times c\times c\times c^3$$

$$= \frac{1}{2}\times a\times b^{(1+2)}\times c^{(1+1+3)} = \frac{1}{2}ab^3c^5$$

Verification : L.H.S. $= \left(\frac{1}{4}abc\right)\times(-6b^2c)\times\left(-\frac{1}{3}c^3\right)$

$$= \left(\frac{1}{4}\times 1\times 2\times 3\right)\times(-6\times 4\times 3)\times\left(-\frac{1}{3}\times 27\right)$$

$$= 972$$

$$\text{R.H.S.} = \frac{1}{2}ab^3c^5$$

$$= \frac{1}{2} \times (2)^3 \times (3)^5 = \frac{1}{2} \times 8 \times 243 = 972$$

Thus, L.H.S. = R.H.S.

$$\left(\frac{1}{4} abc\right) \times \left(-6b^2 c\right) \times \left(-\frac{1}{3} c^3\right) = \frac{1}{2} ab^3 c^5$$

20. $\left(\frac{2}{5} a^2 b\right) \times (-15b^2 ac) \times \left(-\frac{1}{2} c^2\right)$

$$= \left(\frac{2}{5} \times (-15) \times \left(-\frac{1}{2}\right)\right) \times \{a^2 \times a \times b \times b^2 \times c \times c^2\}$$

$$= 3 \times a^{(2+1)} \times b^{(1+2)} \times c^{(1+2)} = 3a^3 b^3 c^3$$

Verification :

$$\text{L.H.S.} = \left(\frac{2}{5} a^2 b\right) \times (-15b^2 ac) \times \left(-\frac{1}{2} c^2\right)$$

$$= \left(\frac{2}{5} \times 1 \times 4\right) \times (-15 \times 4 \times 1 \times 3) \times \left(-\frac{1}{2} \times 9\right) = 1296$$

$$\text{R.H.S.} = 3a^3 b^3 c^3 = 3 \times (1)^3 \times (2)^3 \times (3)^3$$

$$= 3 \times 8 \times 27 = 648$$

Thus, L.H.S. = R.H.S.

$$\left(\frac{2}{5} a^2 b\right) \times (-15b^2 ac) \times \left(-\frac{1}{2} c^2\right) = 3a^3 b^3 c^3$$

EXERCISE 6C

1. $5a(6a - 3b) = 5a \times 6a - 5a \times 3b = 30a^2 - 15ab$

2. $4a(3a + 7b) = 4a \times 3a + 4a \times 7b = 12a^2 + 28ab$

3. $ab(a^2 - b^2) = a^3 b - ab^3$

4. $2x^2(3x - 4x^2) = 2 \times 3 \times x^2 \times x - 2 \times 4 \times x^2 \times x^2 = 6x^3 - 8x^4$

5. $8a^2(2a + 5b) = 8 \times 2 \times a^2 \times a + 8 \times 5 \times a^2 \times b = 16a^3 + 40a^2 b$

6. $9x^2(5x + 7) = 9 \times 5 \times x^2 \times x + 9 \times 7 \times x^2 = 45x^3 + 63x^2$

7. $-17x^2(3x - 4) = -17 \times 3 \times x^2 \times x - 17 \times (-4) \times x^2 = -51x^3 + 68x^2$

8. $-4x^2 y(3x^2 - 5y) = -4 \times 3 \times x^2 \times x^2 \times y - 4 \times (-5) \times x^2 \times y \times y$

$$= -12x^4 y + 20x^2 y^2$$

9. $9t^2(t + 7t^3) = 9 \times t^2 \times t + 9 \times 7 \times t^2 \times t^3 = 9t^3 + 63t^5$

10. $\frac{3}{5} m^2 n(m + 5n) = \frac{3}{5} \times m^2 \times m \times n + \frac{3}{5} \times 5 \times m^2 \times n \times n = \frac{3}{5} m^3 n + 3m^2 n^2$

11. $\frac{7}{2}x^2\left(\frac{4}{7}x+2\right)=\frac{7}{2}\times\frac{4}{7}\times x^2\times x+\frac{7}{2}\times 2\times x^2=2x^3+7x^2$

12. $10a^2\,(0.1a-0.5b)$

$=10\times 0.1\times a^2\times a-10\times 0.5\times a^2\times b=a^3-5a^2b$

13. $\frac{2}{3}abc\,(a^2+b^2-3c^2)=\frac{2}{3}\times a\times a^2\times b\times c+\frac{2}{3}\times a\times b\times b^2\times c$

$-\frac{2}{3}\times 3\times a\times b\times c\times c^2$

$=\frac{2}{3}a^3bc+\frac{2}{3}ab^3c-2abc^3$

14. $24x^2(1-2x)=24\times x^2-24\times 2\times x^2\times x=24x^2-48x^3$

If $x=2$, then

$24x^2-48x^3=24\times(2)^2-48\times(2)^3$

$=24\times 4-48\times 8$

$=96-384=-288$

15. $-3y\,(xy+y^2)=-3\times x\times y\times y-3\times y\times y^2=-3xy^2-3y^3$

If $x=4$ and $y=5$

$-3xy^2-3y^3=-3\times 4\times(5)^2-3\times(5)^3$

$=-12\times 25-3\times 125$

$=-300-375=-675$

16. $a(b-c)-b(c-a)-c(a-b)$

$=ab-ac-bc+ab-ac+bc$

$=ab+ab-ac-ac-bc+bc=2ab-2ac$

17. $a\,(b-c)+b(c-a)+c(a-b)$

$=ab-ac+bc-ab+ac-bc$

$=ab-ab+bc-bc-ac+ac=0$

18. $2x^2+3x(1-2x^3)+x\,(x+1)$

$=2x^2+3x-2\times 3\times x\times x^3+x^2+x$

$=2x^2+3x-6x^4+x^2+x$

$=-6x^4+2x^2+x^2+3x+x$

$=-6x^4+3x^2+4x$

19. $3x^2+2\,(x+2)-3x(2x+1)$

$=3x^2+2x+4-6x^2-3x$

$=3x^2-6x^2+2x-3x+4$

$=-3x^2-x+4$

20. $x(x+4)+3x(2x^2-1)+4x^2+4$

$=x^2+4x+6x^3-3x+4x^2+4$

$=6x^3+x^2+4x^2+4x-3x+4$

$=6x^3+5x^2+x+4$

EXERCISE 6D

1. $(x-6)(4x+9)=x\times(4x+9)-6\times(4x+9)$

$=x\times 4x+x\times 9-6\times 4x-6\times 9$

$=4x^2+9x-24x-54$

$=4x^2-15x-54$

2. $(5x+7)(3x+4)=5x\times(3x+4)+7\times(3x+4)$

$=15x^2+20x+21x+28$

$=15x^2+41x+28$

3. $(4x-3)(2x+5)=4x(2x+5)-3(2x+5)$

$=8x^2+20x-6x-15$

$=8x^2+14x-15$

4. $(3m-4n)(2m-3n)=3m(2m-3n)-4n(2m-3n)$

$=6m^2-9mn-8mn+12n^2$

$=6m^2-17mn+12n^2$

5. $(9x+5y)(4x+3y)=9x(4x+3y)+5y(4x+3y)$

$=36x^2+27xy+20xy+15y^2$

$=36x^2+47xy+15y^2$

6. $(7x+2y)(x+4y)=7x(x+4y)+2y(x+4y)$

$=7x^2+28xy+2xy+8y^2$

$=7x^2+30xy+8y^2$

7. $(5y-1)(3y-8)=5y(3y-8)-1(3y-8)$

$=15y^2-40y-3y+8$

$=15y^2-43y+8$

8. $(0.08x-0.5y)(1.5x-3y)$

$=0.08x(1.5x-3y)-0.5y(1.5x-3y)$

$=0.12x^2-0.24xy-0.75xy+1.5y^2$

$=0.12x^2-0.99xy+1.5y^2$

9. $(x^4 + y^4)(x^2 - y^2) = x^4(x^2 - y^2) + y^4(x^2 - y^2)$
$= x^6 - x^4y^2 + x^2y^4 - y^6$

10. $(x^3 - y^3)(x^2 + y^2) = x^3(x^2 + y^2) - y^3(x^2 + y^2)$
$= x^5 + x^3y^2 - x^2y^3 - y^5$

11. $(2x^2 - 5y^2)(x^2 + 3y^2) = 2x^2(x^2 + 3y^3) - 5y^2(x^2 + 3y^2)$
$= 2x^4 + 6x^2y^2 - 5x^2y^2 - 15y^4$
$= 2x^4 + x^2y^2 - 15y^4$

12. $(3p^2 + q^2)(2p^2 - 3q^2) = 3p^2(2p^2 - 3q^2) + q^2(2p^2 - 3q^2)$
$= 6p^4 - 9p^2q^2 + 2p^2q^2 - 3q^4$
$= 6p^4 - 7p^2q^2 - 3q^4$

13. $(x^2 - a^2)(x - a) = x^2(x - a) - a^2(x - a)$
$= x^3 - ax^2 - xa^2 + a^3$

14. $(x^2 - y^2)(x + 2y) = x^2(x + 2y) - y^2(x + 2y)$
$= x^3 + 2x^2y - xy^2 - 2y^3$

15. $(5x - 3)(x + 4) - (2x + 5)(3x - 4)$
$= 5x(x + 4) - 3(x + 4) - 2x(3x - 4) - 5(3x - 4)$
$= 5x^2 + 20x - 3x - 12 - 6x^2 + 8x - 15x + 20$
$= -x^2 + 10x + 8$

16. $(3x + 4)(2x - 3) + (5x - 4)(x + 2)$
$= 3x(2x - 3) + 4(2x - 3) + 5x(x + 2) - 4(x + 2)$
$= 6x^2 - 9x + 8x - 12 + 5x^2 + 10x - 4x - 8$
$= 6x^2 + 5x^2 - 9x + 8x + 10x - 4x - 12 - 8$
$= 11x^2 + 5x - 20$

17. $(2x + 5y)(3x + 4y) - (7x + 3y)(2x + y)$
$= 2x(3x + 4y) + 5y(3x + 4y) - 7x(2x + y) - 3y(2x + y)$
$= 6x^2 + 8xy + 15xy + 20y^2 - 14x^2 - 7xy - 6xy - 3y^2$
$= 6x^2 - 14x^2 + 8xy + 15xy - 7xy - 6xy + 20y^2 - 3y^2$
$= -8x^2 + 10xy + 17y^2$

18. $(9x - 7)(2x - 5) - (3x - 8)(5x - 3)$
$= 9x(2x - 5) - 7(2x - 5) - 3x(5x - 3) + 8(5x - 3)$
$= 18x^2 - 45x - 14x + 35 - 15x^2 + 9x + 40x - 24$
$= 18x^2 - 15x^2 - 45x - 14x + 9x + 40x + 35 - 24$
$= 3x^2 - 10x + 11$

EXERCISE 6E

1. (d) **2.** (b) **3.** (d)

4. $3ab + (-2ab) + 8ab = 3ab - 2ab + 8ab = 9ab$

(a) is correct.

5. $4x^2y^2 = 4 \times x \times x \times y \times y$

(a) is correct.

HOTS

- Diameter of 1 spiral $= 2r = (12a + 6b)$

  Circumference of 1 spiral $= 2\pi r = \pi(12a + 6b)$

  Circumference of 8 spirals $= \pi(12a + 6b) \times 8$

  $= \pi(96a + 48b)$

  Hence, the total length of the chord is $\pi(96a + 48b)$.

VALUE BASED

- Almonds for the family members $= (3x + 5)$ kg

  Almonds for poor students $= (x + 1)$ kg

  Total weight of almonds $= (3x + 5) + (x + 1)$ kg

  $= 3x + x + 5 + 1$

  $= (4x + 6)$ kg

  Hence, Shikha bought $(4x + 6)$ kg almonds.

Chapter 7 Linear Equations

EXERCISE 7A

1. $3x - 5 = 0$

$3x = 5$ [transposing -5 to RHS]

$x = \frac{5}{3}$ [on dividing both sides by 3]

$x = \frac{5}{3}$ is a solution of the given equation.

Check : Substituting $x = \frac{5}{3}$ in the given equation, we get

$\text{LHS} = 3 \times \frac{5}{3} - 5 = 5 - 5 = 0$

$\text{RHS} = 0$

$\text{LHS} = \text{RHS}$

Hence, $x = \frac{5}{3}$ is a solution of the given equation.

2. $3+2x=1-x$

$2x+x=1-3$ [transposing 3 to RHS and $-x$ to LHS]

$3x=-2$

$x=\frac{-2}{3}$ [on dividing both sides by 3]

$x=\frac{-2}{3}$ is a solution of the given equation.

Check : Substituting $x=\frac{-2}{3}$ in the given equation, we get

$$\text{LHS}=3+2\times\left(\frac{-2}{3}\right)=3-\frac{4}{3}=\frac{9-4}{3}=\frac{5}{3}$$

$$\text{RHS}=1-\left(\frac{-2}{3}\right)=1+\frac{2}{3}=\frac{3+2}{3}=\frac{5}{3}$$

$\text{LHS}=\text{RHS}$

Hence, $x=\frac{-2}{3}$ is a solution of the given equation.

3. $8x-3=9-2x$

$8x+2x=9+3$ [transposing -3 to RHS and $-2x$ to LHS]

$10x=12$

$x=\frac{12}{10}=\frac{6}{5}$ [on dividing both sides by 10]

$x=\frac{6}{5}$ is a solution of the given equation.

Check : Substituting $x=\frac{6}{5}$ in the given equation, we get

$$\text{LHS}=8\times\frac{6}{5}-3=\frac{48}{5}-3=\frac{48-15}{5}=\frac{33}{5}$$

$$\text{RHS}=9-2\times\frac{6}{5}=9-\frac{12}{5}=\frac{45-12}{5}=\frac{33}{5}$$

$\text{LHS}=\text{RHS}$

Hence, $x=\frac{6}{5}$ is a solution of the given equation.

4. $7-5x=5-7x$

$-5x+7x=5-7$ [transposing 7 to RHS and $-7x$ to LHS]

$2x=-2$

$x=-1$ [on dividing both sides by 2]

$x=-1$ is a solution of the given equation.

Check : Substituting $x = -1$ in the given equation, we get

$$\text{LHS} = 7 - 5 \times (-1) = 7 + 5 = 12$$
$$\text{RHS} = 5 - 7 \times (-1) = 5 + 7 = 12$$
$$\text{LHS} = \text{RHS}$$

Hence, $x = -1$ is a solution of the given equation.

5. $5(2x - 3) - 3(3x - 7) = 5$

$$10x - 15 - 9x + 21 = 5$$
$$10x - 9x = 5 + 15 - 21 \qquad \text{[transposing } -15, 21 \text{ to RHS]}$$
$$x = -1$$

$x = -1$ is a solution of the given equation.

Check : Substituting $x = -1$ in the given equation, we get

$$\text{LHS} = 5\{2 \times (-1) - 3\} - 3\{3 \times (-1) - 7\}$$
$$= 5 \times (-5) - 3 \times (-10) = -25 + 30 = 5$$
$$\text{RHS} = 5$$
$$\text{LHS} = \text{RHS}$$

Hence, $x = -1$ is a solution of the given equation.

6. $2(x - 2) + 3(4x - 1) = 0$

$$2x - 4 + 12x - 3 = 0$$
$$2x + 12x = 4 + 3 \qquad \text{[transposing } -4 \text{ and } -3 \text{ to RHS]}$$
$$14x = 7$$
$$x = \frac{1}{2} \qquad \text{[on dividing both sides by 14]}$$

$x = \frac{1}{2}$ is a solution of the given equation.

Check : Substituting $x = \frac{1}{2}$ in the given equation, we get

$$\text{LHS} = 2\left(\frac{1}{2}\right) - 2 + 3\left(4 \times \frac{1}{2} - 1\right) = 1 - 4 + 6 - 3 = 0$$
$$\text{RHS} = 0$$
$$\text{LHS} = \text{RHS}$$

Hence, $x = \frac{1}{2}$ is a solution of the given equation.

7. $\frac{2m + 5}{3} = 3m - 10$

$$2m + 5 = 3(3m - 10) \qquad \text{[multiplying both sides by 3]}$$
$$2m + 5 = 9m - 30$$
$$2m - 9m = -30 - 5 \qquad \text{[by transposition]}$$
$$-7m = -35$$

$m = 5$ [on dividing both sides by -7]

$m = 5$ is a solution of the given equation.

Check : Substituting $m = 5$ in the given equation, we get

$$\text{LHS} = \frac{2\times 5+5}{3} = \frac{15}{3} = 5$$

$$\text{RHS} = 3\times 5 - 10 = 15 - 10 = 5$$

$$\text{LHS} = \text{RHS}$$

Hence, $m = 5$ is a solution of the given equation.

8. $\frac{x}{2} + \frac{x}{4} = \frac{1}{8}$

The LCM of the denominators 2, 4 and 8 is 8.

Multiplying both sides by 8, we get

$$4x + 2x = 1$$

$$6x = 1$$

$x = \frac{1}{6}$ [on dividing both sides by 6]

$x = \frac{1}{6}$ is a solution of the given equation.

Check : Substituting $x = \frac{1}{6}$ in the given equation, we get

$$\text{LHS} = \frac{1}{6\times 2} + \frac{1}{6\times 4} = \frac{1}{12} + \frac{1}{24} = \frac{2+1}{24} = \frac{3}{24} = \frac{1}{8}$$

$$\text{RHS} = \frac{1}{8}$$

$$\text{LHS} = \text{RHS}$$

Hence, $x = \frac{1}{6}$ is a solution of the given equation.

9. $\frac{1}{2}x - 3 = 5 + \frac{1}{3}x$

The LCM of the denominators 2 and 3 is 6.

Multiplying both sides by 6, we get

$$3x - 18 = 30 + 2x$$

$3x - 2x = 30 + 18$ [by transposition]

$$x = 48$$

$x = 48$ is a solution of the given equation.

Check : Substituting $x = 48$ in the given equation, we get

$$\text{LHS} = \frac{1}{2}\times 48 - 3 = 21$$

$$\text{RHS} = 5 + \frac{1}{3} \times 48 = 21$$

$$\text{LHS} = \text{RHS}$$

Hence, $x = 48$ is a solution of the given equation.

10. $2x - \frac{1}{3} = \frac{1}{5} - x$

$$2x + x = \frac{1}{5} + \frac{1}{3} \qquad \text{[by transposition]}$$

$$3x = \frac{3+5}{15} = \frac{8}{15}$$

$$x = \frac{8}{3 \times 15} = \frac{8}{45} \qquad \text{[on dividing both sides by 3]}$$

$x = \frac{8}{45}$ is a solution of the given equation.

Check : Substituting $x = \frac{8}{45}$ in the given equation, we get

$$\text{LHS} = 2 \times \frac{8}{45} - \frac{1}{3} = \frac{16}{45} - \frac{1}{3} = \frac{16-15}{45} = \frac{1}{45}$$

$$\text{RHS} = \frac{1}{5} - \frac{8}{45} = \frac{9-8}{45} = \frac{1}{45}$$

$$\text{LHS} = \text{RHS}$$

Hence, $x = \frac{8}{45}$ is a solution of the given equation.

11. $3x + 2(x + 2) = 20 - (2x - 5)$

$$3x + 2x + 4 = 20 - 2x + 5$$

$$3x + 2x + 2x = 20 + 5 - 4 \qquad \text{[by transposition]}$$

$$7x = 21$$

$$x = 3 \qquad \text{[on dividing both sides by 7]}$$

$x = 3$ is a solution of the given equation.

Check : Substituting $x = 3$ in the given equation, we get

$$\text{LHS} = 3 \times 3 + 2(3 + 2) = 9 + 10 = 19$$

$$\text{RHS} = 20 - (2 \times 3 - 5) = 20 - 1 = 19$$

$$\text{LHS} = \text{RHS}$$

Hence, $x = 3$ is a solution of the given equation.

12. $13(y - 4) - 3(y - 9) - 5(y + 4) = 0$

$$13y - 52 - 3y + 27 - 5y - 20 = 0$$

$$13y - 3y - 5y = 52 - 27 + 20 \qquad \text{[by transposition]}$$

$$5y = 45$$

$y = 9$ [on dividing both sides by 5]

$y = 9$ is a solution of the given equation.

Check : Substituting $y = 9$ in the given equation, we get

$$\text{LHS} = 13(9-4) - 3(9-9) - 5(9+4)$$
$$= 65 - 65 = 0$$
$$\text{RHS} = 0$$
$$\text{LHS} = \text{RHS}$$

Hence, $y = 9$ is a solution of the given equation.

13. $\frac{3x-1}{5} - \frac{x}{7} = 3$

The LCM of the denominators 5 and 7 is 35.

Multiplying both sides by 35, we get

$$7(3x-1) - 5x = 3 \times 35$$
$$21x - 7 - 5x = 105$$
$$21x - 5x = 105 + 7 \quad \text{[by transposition]}$$
$$16x = 112$$
$$x = 7 \quad \text{[on dividing both sides by 16]}$$

$x = 7$ is a solution of the given equation.

Check : Substituting $x = 7$ in the given equation, we get

$$\text{LHS} = \frac{3 \times 7 - 1}{5} - \frac{7}{7} = 4 - 1 = 3$$
$$\text{RHS} = 3$$
$$\text{LHS} = \text{RHS}$$

Hence, $x = 7$ is a solution of the given equation.

14. $2x - 3 = \frac{3}{10}(5x - 12)$

$$10(2x-3) = 3(5x-12) \quad \text{[multiplying both sides by 10]}$$
$$20x - 30 = 15x - 36$$
$$20x - 15x = 30 - 36 \quad \text{[by transposition]}$$
$$5x = -6$$
$$x = \frac{-6}{5} \quad \text{[on dividing both sides by 5]}$$

$x = \frac{-6}{5}$ is a solution of the given equation.

Check : Substituting $x = \frac{-6}{5}$ in the given equation, we get

$$\text{LHS} = 2 \times \left(\frac{-6}{5}\right) - 3 = \frac{-12}{5} - 3 = \frac{-12-15}{5} = \frac{-27}{5}$$

$$\text{RHS} = \frac{3}{10}\left[5 \times \left(\frac{-6}{5}\right) - 12\right] = \frac{3}{10}(-6-12)$$

$$= \frac{3}{10} \times (-18) = \frac{-27}{5}$$

$$\text{LHS} = \text{RHS}$$

Hence, $x = \frac{-6}{5}$ is a solution of the given equation.

15. $\frac{y-1}{3} - \frac{y-2}{4} = 1$

The LCM of the denominators 3 and 4 is 12.

Multiplying both sides by 12, we get

$$4(y-1) - 3(y-2) = 12$$

$$4y - 4 - 3y + 6 = 12$$

$$4y - 3y = 12 + 4 - 6 \qquad \text{[by transposition]}$$

$$y = 10$$

$y = 10$ is a solution of the given equation.

Check : Substituting $y = 10$ in the given equation, we get

$$\text{LHS} = \frac{10-1}{3} - \frac{10-2}{4} = 3 - 2 = 1$$

$$\text{RHS} = 1$$

$$\text{LHS} = \text{RHS}$$

Hence, $y = 10$ is a solution of the given equation.

16. $\frac{2}{7}(x-9) + \frac{x}{3} = 3$

The LCM of the denominators 7 and 3 is 21.

Multiplying both sides by 21, we get

$$6(x-9) + 7x = 63$$

$$6x - 54 + 7x = 63$$

$$6x + 7x = 63 + 54 \qquad \text{[by transposition]}$$

$$13x = 117$$

$$x = 9 \qquad \text{[on dividing both sides by 13]}$$

$x = 9$ is a solution of the given equation.

Check : Substituting $x = 9$ in the given equation, we get

$$\text{LHS} = \frac{2}{7}(9-9) + \frac{9}{3} = 3$$

$$\text{RHS} = 3$$

$$\text{LHS} = \text{RHS}$$

Hence, $x = 9$ is a solution of the given equation.

17. $\frac{y+7}{3} = 1 + \frac{3y-2}{5}$

The LCM of the denominators 3 and 5 is 15.

Multiplying both sides by 15, we get

$5(y+7) = 15 + 3(3y-2)$

$5y + 35 = 15 + 9y - 6$

$5y - 9y = 15 - 6 - 35$ [by transposition]

$-4y = -26$

$y = \frac{13}{2}$ [on dividing both sides by -4]

$y = \frac{13}{2}$ is a solution of the given equation.

Check : Substituting $y = \frac{13}{2}$ in the given equation, we get

$$\text{LHS} = \frac{\frac{13}{2} + 7}{3} = \frac{27}{6} = \frac{9}{2}$$

$$\text{RHS} = 1 + \frac{3 \times \frac{13}{2} - 2}{5} = 1 + \frac{35}{10} = \frac{45}{10} = \frac{9}{2}$$

$\text{LHS} = \text{RHS}$

Hence, $y = \frac{13}{2}$ is a solution of the given equation.

18. $\frac{x-2}{4} + \frac{1}{3} = x - \frac{2x-1}{3}$

The LCM of the denominators 4 and 3 is 12.

Multiplying both sides by 12, we get

$3(x-2) + 4 = 12x - 4(2x-1)$

$3x - 6 + 4 = 12x - 8x + 4$

$3x - 12x + 8x = 6 - 4 + 4$ [by transposition]

$-x = 6$

$x = -6$ [multiplying both sides by -1]

$x = -6$ is a solution of the given equation.

Check : Substituting $x = -6$ in the given equation, we get

$$\text{LHS} = \frac{-6-2}{4} + \frac{1}{3} = -2 + \frac{1}{3} = \frac{-5}{3}$$

$$\text{RHS} = -6 - \frac{2 \times (-6) - 1}{3} = \frac{-5}{3}$$

$\text{LHS} = \text{RHS}$

Hence, $x = -6$ is a solution of the given equation.

19. $\frac{2x-1}{3}-\frac{6x-2}{5}=\frac{1}{3}$

The LCM of the denominators 3 and 5 is 15.

Multiplying both sides by 15, we get

$5(2x-1)-3(6x-2)=5$

$10x-5-18x+6=5$

$10x-18x=5+5-6$ [by transposition]

$-8x=4$

$x=-\frac{1}{2}$ [on dividing both sides by −8]

$x=-\frac{1}{2}$ is a solution of the given equation.

Check : Substituting $x=-\frac{1}{2}$ in the given equation, we get

$$\text{LHS}=\frac{2\times\left(-\frac{1}{2}\right)-1}{3}-\frac{6\times\left(-\frac{1}{2}\right)-2}{5}=-\frac{2}{3}+1=\frac{1}{3}$$

$$\text{RHS}=\frac{1}{3}$$

LHS = RHS

Hence, $x=-\frac{1}{2}$ is a solution of the given equation.

20. $\frac{2x-3}{5}+\frac{x+3}{4}=\frac{4x+1}{7}$

The LCM of the denominators 5, 4 and 7 is 140.

Multiplying both sides by 140, we get

$28(2x-3)+35(x+3)=20(4x+1)$

$56x-84+35x+105=80x+20$

$56x+35x-80x=84-105+20$ [by transposition]

$11x=-1$

$x=\frac{-1}{11}$ [on dividing both sides by 11]

$x=\frac{-1}{11}$ is a solution of the given equation.

Check : Substituting $x=\frac{-1}{11}$ in the given equation, we get

$$\text{LHS}=\frac{2\times\left(-\frac{1}{11}\right)-3}{5}+\frac{\left(-\frac{1}{11}\right)+3}{4}=\frac{-\frac{2}{11}-3}{5}+\frac{-\frac{1}{11}+3}{4}$$

$$= \frac{-35}{11\times 5} + \frac{32}{11\times 4} = \frac{-35\times 4 + 32\times 5}{11\times 5\times 4}$$

$$= \frac{-140 + 160}{11\times 5\times 4} = \frac{20}{11\times 5\times 4} = \frac{1}{11}$$

$$\text{RHS} = \frac{4\times\left(-\frac{1}{11}\right)+1}{7} = \frac{-4+11}{11\times 7} = \frac{7}{11\times 7} = \frac{1}{11}$$

LHS = RHS

Hence, $x = -\frac{1}{11}$ is a solution of the given equation.

21. $2.4(3-x) - 0.6(2x-3) = 0$

$7.2 - 2.4x - 1.2x + 1.8 = 0$

$-3.6x = -7.2 - 1.8$ [by transposition]

$-3.6x = -9$

$x = \frac{-9}{-3.6} = 2.5$ [on dividing both sides by −3.6]

Check : Substituting $x = 2.5$ in the given equation, we get

$\text{LHS} = 2.4(3-2.5) - 0.6(2\times 2.5 - 3)$

$= 1.2 - 1.2$

$= 0$

$\text{RHS} = 0$

LHS = RHS

Hence, $x = 2.5$ is a solution of the given equation.

22. $0.18(5x-4) = 0.5x + 0.8$

$0.9x - 0.72 = 0.5x + 0.8$

$0.9x - 0.5x = 0.72 + 0.8$ [by transposition]

$x = 1.52$

$x = 3.8$ [on dividing both sides by 0.4]

Check : Substituting $x = 3.8$ in the given equation, we get

$\text{LHS} = 0.18(5\times 3.8 - 4) = 2.7$

$\text{RHS} = 0.5\times 3.8 + 0.8 = 2.7$

LHS = RHS

Hence, $x = 3.8$ is a solution of the given equation.

23. $0.5x - (0.8 - 0.2x) = 0.2 - 0.3x$

$0.5x - 0.8 + 0.2x = 0.2 - 0.3x$

$0.5x + 0.2x + 0.3x = 0.2 + 0.8$ [by transposition]

$x = 1$

Check : Substituting $x = 1$ in the given equation, we get

$$\text{LHS} = 0.5 \times 1 - (0.8 \times 1 - 0.2 \times 1)$$
$$= 0.5 - 0.6$$
$$= -0.1$$
$$\text{RHS} = 0.2 - 0.3 \times 1 = -0.1$$
$$\text{LHS} = \text{RHS}$$

Hence, $x = 1$ is a solution of the given equation.

24. $\frac{2x+5}{3x+4} = 3$

On cross multiplying, we get

$$2x + 5 = 3 \times (3x + 4)$$
$$2x + 5 = 9x + 12$$
$$2x - 9x = 12 - 5 \quad \text{[by transposition]}$$
$$-7x = 7$$
$$x = -1 \quad \text{[on dividing both sides by } -7\text{]}$$

$x = -1$ is a solution of the given equation.

Check : Substituting $x = -1$ in the given equation, we get

$$\text{LHS} = \frac{2 \times (-1) + 5}{3 \times (-1) + 4} = \frac{-2 + 5}{-3 + 4} = 3$$
$$\text{RHS} = 3$$
$$\text{LHS} = \text{RHS}$$

Hence, $x = -1$ is a solution of the given equation.

25. $\frac{x+2}{x-2} = \frac{7}{3}$

On cross multiplying, we get

$$3x + 6 = 7x - 14$$
$$3x - 7x = -14 - 6 \quad \text{[by transposition]}$$
$$-4x = -20$$
$$x = 5 \quad \text{[on dividing both sides by } -4\text{]}$$

$x = 5$ is a solution of the given equation.

Check : Substituting $x = 5$ in the given equation, we get

$$\text{LHS} = \frac{5+2}{5-2} = \frac{7}{3}$$
$$\text{RHS} = \frac{7}{3}$$
$$\text{LHS} = \text{RHS}$$

Hence, $x = 5$ is a solution of the given equation.

EXERCISE 7B

1. Let the required number be x.

Then, $3x + 5 = 44$

$$3x = 44 - 5 = 39$$

$$x = \frac{39}{3} = 13$$

Hence, the required number is 13.

2. Let the required number be x.

Then, $2x - 7 = 45$

$$2x = 45 + 7 = 52$$

$$x = \frac{52}{2} = 26$$

Hence, the required number is 26.

3. Let the required number be x.

Then, $x + \frac{2}{3}x = 55$

$$\frac{5x}{3} = 55$$

$$x = \frac{55 \times 3}{5} = 33$$

Hence, the required number is 33.

4. Let the required number be x.

Then, $2x + 4 = \frac{26}{5}$

$$2x = \frac{26}{5} - 4 = \frac{26 - 20}{5}$$

$$2x = \frac{6}{5}$$

$$x = \frac{3}{5}$$

Hence, the fraction is $\frac{3}{5}$.

5. Let the required number be x.

Then, $x + \frac{x}{2} = 72$

$$\frac{3x}{2} = 72$$

$$x = \frac{72 \times 2}{3} = 48$$

Hence, the required number is 48.

6. Let the required number be x.

Then, $4x = x + 45$

$$4x - x = 45$$

$$3x = 45$$

$$x = \frac{45}{3} = 15$$

Hence, the required number is 15.

7. Let the required number be x.

Then, $\frac{2}{3}x = \frac{1}{3}x + 3$

$$\frac{2}{3}x - \frac{1}{3}x = 3$$

$$\frac{x}{3} = 3$$

$$x = 9$$

Hence, the required number is 9.

8. Let the first number be x.

Second number $= \frac{2}{5}x$

Then, $x + \frac{2}{5}x = 70$

$$\frac{5x + 2x}{5} = 70$$

$$7x = 70 \times 5 = 350$$

$$x = \frac{350}{7} = 50$$

Hence, the first number $= 50$ and second number $= \frac{2}{5} \times 50 = 20$.

9. Let the number be x.

Then, $x - \frac{2}{3}x = 20$

$$\frac{3x - 2x}{3} = 20$$

$$x = 60$$

Hence, the required number is 60.

10. Let two consecutive natural numbers be x and $x+1$.

Then, $x+(x+1)=63$

$2x+1=63$

$2x=63-1=62$

$x=\frac{62}{2}=31$

So, $x=31$, $x+1=31+1=32$

Hence, two consecutive natural numbers are 31 and 32.

11. Let two consecutive positive odd integers be x and $x+2$.

Then, $x+(x+2)=76$

$2x+2=76$

$2x=76-2=74$

$x=37$

So, $x=37$, $x+2=37+2=39$

Hence, two consecutive positive odd integers are 37 and 39.

12. Let three consecutive positive even integers be x, $x+2$ and $x+4$.

Then, $x+(x+2)+(x+4)=90$

$3x+6=90$

$3x=90-6=84$

$x=\frac{84}{3}=28$

So, $x=28$, $x+2=28+2=30$, $x+4=28+4=32$

Hence, the three consecutive positive even integers are 28, 30 and 32.

13. Let the present age of the son be x years.

Then, the present age of the father $=(x+30)$ years.

Now, according to question,

$(x+30)+12=3(x+12)$

$x+30+12=3x+36$

$3x-x=30+12-36=6$

$2x=6 \qquad x=3$

Hence, the present age of the son = 3 years

and the present age of the father $=(3+30)$ years $=33$ years

14. Let the present age of Shyam cousin be x years.

Then, the present age of Shyam's $=(x-19)$ years.

After 5 years,

Age of Shyam's causin $=(x+5)$ years

Age of Shyam $=(x-19+5)$ years

$=(x-14)$ years

According to question,

$$\frac{x-14}{x+5}=\frac{2}{3}$$

$$3x-42=2x+10$$

$$3x-2x=10+42$$

$$x=52$$

Hence, the present age of Shyam's cousin is 52 years

and the present age of Shyam $=(52-19)$ years $=33$ years

15. Five years ago,

Let age of the son be x years.

Then, the age of the father $=7x$ years.

Present age of the son $=(x+5)$ years.

Present age of the father $=(7x+5)$ years.

Five years later,

Age of the son $=(x+5+5)$ years $=(x+10)$ years

Age of the father $=(7x+5+5)$ years $=(7x+10)$ years

According to question,

$$(7x+10)=3(x+10)$$

$$7x+10=3x+30$$

$$7x-3x=30-10=20$$

$$4x=20$$

$$x=\frac{20}{4}=5$$

Hence, the present age of the son $=(5+5)$ years $=10$ years

the present age of the father $=(7\times 5+5)$ years $=40$ years

16. Let the present age of Nitin be x years.

4 years ago, age of Nitin $=(x-4)$ years

After 12 years, age of Nitin $=(x+12)$ years

According to question,

$$(x+12)=3(x-4)$$

$$x+12=3x-12$$

$$3x-x=12+12=24$$

$$2x=24$$

$$x=\frac{24}{2}=12$$

Hence, the present age of Nitin is 12 years.

17. Let the total marks be x.

According to question,

$$185 + 15 = \frac{40}{100}x$$

$$200 = \frac{40}{100}x$$

$$x = \frac{200 \times 100}{40} = 500$$

Hence, the total marks is 500.

18. Let the digit in the units place be x.

Then, the digit in the tens place $= (8 - x)$

$$\text{Number} = 10 \times (8 - x) + x$$

$$= 80 - 10x + x = (80 - 9x)$$

The number with its digits interchanged $= 10x + (8 - x) = 9x + 8$

According to question,

$$(80 - 9x) + 18 = 9x + 8$$

$$98 - 9x = 9x + 8$$

$$9x + 9x = 98 - 8 = 90$$

$$18x = 90$$

$$x = \frac{90}{18} = 5$$

Hence, the number is $(80 - 9 \times 5) = 35$.

19. Let the cost price of the article be ` x.

Profit $= 10\%$

$$\text{Selling price} = ` \frac{110x}{100}$$

Now, $$\frac{110x}{100} = 495$$

$$x = \frac{495 \times 100}{110} = 450$$

Hence, the cost price of the article is ` 450.

20. Let the cost of a chair be ` x.

Then, the cost of a table = ` $(x + 75)$

According to question,

$$3(x + 75) + 2x = 1850$$

$$3x + 225 + 2x = 1850$$

$$5x = 1850 - 225 = 1625$$

$$x = \frac{1625}{5} = 325$$

Hence, the cost of one table = ` $(325 + 75) =$ ` 400

and the cost of one chair = ` 325

21. Let the breadth of the field be x metres.

Then, the length of the field = $2x$ metres.

According to question,

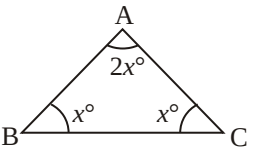
$$2(2x + x) = 150$$
$$4x + 2x = 150$$
$$6x = 150$$
$$x = \frac{150}{6} = 25$$

Hence, the breadth of the field = 25 metres

and the length of the field is = 2×25 metres = 50 metres

22. Let the measures of each base angle be x.

Then, third angle = $2x$



According to question,

$$x + x + 2x = 180°$$
$$4x = 180°$$
$$x = \frac{180°}{4} = 45°$$

Hence, $A = 2 \times 45° = 90°$, $B =$ $C = 45°$

23. Let the supplementary angles be x and $(180° - x)$.

According to question,

$$(180° - x) - x = 44°$$
$$180° - 2x = 44°$$
$$2x = 180° - 44° = 136°$$
$$x = \frac{136°}{2} = 68°$$

Hence, the angles are 68° and $(180° - 68°) = 112°$.

24. Let the complementary angles be x and $(90° - x)$.

According to question,

$$(90° - x) - x = 8°$$
$$90° - 2x = 8°$$
$$2x = 90° - 8° = 82°$$
$$x = \frac{82°}{2} = 41°$$

Hence, the angles are 41° and $(90° - 41°) = 49°$.

25. Let the third side be x metres.

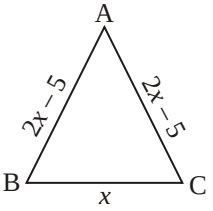
Length of two equal sides $= (2x-5)$ metres

According to question,

$$(2x-5)+(2x-5)+x=55$$

$$5x=55+10=65$$

$$x=13$$



Hence, the sides of the triangle are 13 m, $(2\times13-5)=21$ m and 21 m.

EXERCISE 7C

1. $(2n+5)=3(3n-10)$

$$2n+5=9n-30$$

$$9n-2n=5+30=35$$

$$7n=35$$

$$n=5$$

(a) is correct.

2. $8(2x-5)-6(3x-7)=1$

$$16x-40-18x+42=1$$

$$-2x=1+40-42$$

$$-2x=-1$$

$$x=\frac{1}{2}$$

(c) is correct.

3. $5x-\frac{3}{4}=2x-\frac{2}{3}$

$$5x-2x=\frac{3}{4}-\frac{2}{3}$$

$$3x=\frac{9-8}{12}=\frac{1}{12}$$

$$x=\frac{1}{36}$$

(d) is correct.

4. $\frac{x-1}{x+1}=\frac{7}{9}$

$$9x-9=7x+7$$

$$9x-7x=9+7$$

$$2x=16$$

$$x=8$$

(c) is correct.

5. Let the numbers be x and $(x+1)$.

$$x+(x+1)=53$$
$$2x=53-1=52$$
$$x=\frac{52}{2}=26$$

Smaller number = 26

(b) is correct.

6. Let the two consecutive odd numbers be x and $x+2$.

Then, $x+(x+2)=36$

$$2x=36-2=34$$
$$x=17$$

(b) is correct.

7. Let the two consecutive even numbers be $2x$ and $2(x+1)$.

Then, $2x+2(x+1)=86$

$$2x+2x+2=86$$
$$4x=86-2=84$$
$$x=\frac{84}{4}=21$$

Larger number $=2(21+1)=44$

(d) is correct.

8. Let the number be x.

Then, $3x+6=24$

$$3x=24-6=18$$
$$x=\frac{18}{3}=6$$

(a) is correct.

9. Let the whole number be x.

Then, $2x+9=31$

$$2x=31-9=22$$
$$x=\frac{22}{2}=11$$

(d) is correct.

10. Let the original number be x.

According to question,

$$x-\frac{2}{3}x=10$$
$$\frac{3x-2x}{3}=10$$

$$x = 3 \times 10 = 30$$

(a) is correct.

11. Let the two supplementary angles be x and $(180° - x)$.

Then,

$$(180° - x) - x = 20°$$
$$180° - 2x = 20°$$
$$2x = 180° - 20° = 160°$$
$$x = \frac{160°}{2} = 80°$$

(b) is correct.

12. Let the two supplementary angles be x and $(90° - x)$.

Then,

$$(90° - x) - x = 10°$$
$$90° - 2x = 10°$$
$$2x = 90° - 10° = 80°$$
$$x = \frac{80°}{2} = 40°$$

Larger number $= 90° - 40° = 50°$

(b) is correct.

13. Let the number be x.

Then,
$$5x = x + 80$$
$$5x - x = 80$$
$$4x = 80$$
$$x = \frac{80}{4} = 20$$

(b) is correct.

14. Let the width of the rectangle be x metre.

Then, the length of the rectangle $= 3x$ metres

According to question,

$$2(3x + x) = 96$$
$$8x = 96$$
$$x = \frac{96}{8} = 12$$

Length $= 3 \times 12$ metres $= 36$ metres

(c) is correct.

15. Let the present age of A and B be $5x$ years and $3x$ years respectively.

After 6 years,

Age of $A = (5x + 6)$ years

Age of $B = (3x + 6)$ years

According to question,

$$\frac{5x+6}{3x+6} = \frac{7}{5}$$

$$25x + 30 = 21x + 42$$

$$25x - 21x = 42 - 30$$

$$4x = 12$$

$$x = \frac{12}{4} = 3$$

Present age of $A = (5 \times 3)$ years $= 15$ years

(c) is correct.

HOTS

- Suppose number of 2 rupees coins $= x$

  Number of 1 rupee coins $= 3 \times x = 3x$ (According to question)

  Total value of 2 rupees coins $= 2 \times x = 2x$

  Total value of 1 rupee coins $= 1 \times 3x = 3x$

  So, $3x + 2x =$ ` 50

  $5x =$ ` 50

  $$x = \frac{50}{5} = 10$$

  Number of 1 rupee coins $= 3x = 3 \times 10 = 30$

  Number of 2 rupees coins $= x = 10$

VALUE BASED

- Students of class VII collected = ` 2100

  Suppose students of class VI collected = ` x

  According to question,

  $$x = \frac{2100 - 100}{2} = 1000$$

  Hence, ` 1000 was collected by class VI.

Chapter 8 Ratio and Proportion

EXERCISE 8A

1. (a) $24 : 40 = \frac{24}{40} = \frac{24 \div 8}{40 \div 8}$ [$\because$ HCF of 24 and 40 is 8]

$$= \frac{3}{5} = 3 : 5$$

(b) $13.5 : 15 = \frac{13.5}{15} = \frac{135}{150} = \frac{135 \div 15}{150 \div 15}$ [$\because$ HCF of 135 and 150 is 15]

$= \frac{9}{10} = 9 : 10$

(c) $6\frac{2}{3} : 7\frac{1}{2} = \frac{20}{3} : \frac{15}{2}$

$= \left(\frac{20}{3} \times 6\right) : \left(\frac{15}{2} \times 6\right)$ [$\because$ LCM of 3 and 2 is 6]

$= 40 : 45 = \frac{40}{45}$

$= \frac{40 \div 5}{45 \div 5} = \frac{8}{9}$ [$\because$ HCF of 40 and 45 is 5]

$= 8 : 9$

2. (a) $1 \text{ km} : 750 \text{ m} = (1 \times 1000) \text{ m} : 750 \text{ m}$

$= 1000 : 750$

$= \frac{1000}{750} = \frac{1000 \div 250}{750 \div 250}$ [$\because$ HCF of 1000 and 750 is 250]

$= \frac{4}{3} = 4 : 3$

(b) $(2 \text{ kg } 250 \text{ g}) : (3 \text{ kg}) = (2 \times 1000 + 250) \text{ g} : (3 \times 1000) \text{ g}$

$= 2250 \text{ g} : 3000 \text{ g}$

$= \frac{2250}{3000} = \frac{2250 \div 750}{3000 \div 750}$

[$\because$ HCF of 2250 and 3000 is 750]

$= \frac{3}{4} = 3 : 4$

(c) $8 \text{ months} : 1 \text{ year} = 8 \text{ months} : (1 \times 12) \text{ months}$

$= 8 \text{ months} : 12 \text{ months}$

$= \frac{8}{12} = \frac{8 \div 4}{12 \div 4}$ [$\because$ HCF of 8 and 12 is 4]

$= \frac{2}{3} = 2 : 3$

(d) $1 \text{ hour } 5 \text{ minutes} : 45 \text{ minutes}$

$= (1 \times 60 + 5) \text{ minutes} : 45 \text{ minutes}$

$= 65 \text{ minutes} : 45 \text{ minutes}$

$= \frac{65}{45} = \frac{65 \div 5}{45 \div 5}$ [$\because$ HCF of 65 and 45 is 5]

$= \frac{13}{9} = 13 : 9$

(e) $1\text{ m }5\text{ cm} : 63\text{ cm} = (1\times 100+5)\text{ cm} : 63\text{ cm}$

$= 105\text{ cm} : 63\text{ cm}$

$= \frac{105}{63} = \frac{105\div 21}{63\div 21}$ [$\because$ HCF of 105 and 63 is 21]

$= \frac{5}{3} = 5 : 3$

(f) $75\text{ paise} : 3\text{ rupees} = 75\text{ paise} : (3\times 100)\text{ paise}$

$= 75\text{ paise} : 300\text{ paise}$

$= \frac{75}{300} = \frac{75\div 75}{300\div 75}$ [$\because$ HCF of 75 and 300 is 75]

$= \frac{1}{4} = 1 : 4$

3. $A : B = 5 : 8$ and $B : C = 16 : 25$

$\frac{A}{B} = \frac{5}{8}$ and $\frac{B}{C} = \frac{16}{25}$

$\frac{A}{B}\times\frac{B}{C} = \frac{5}{8}\times\frac{16}{25}$

$\frac{A}{C} = \frac{2}{5}$

$A : C = 2 : 5$

4. $A : B = 5 : 6$

$B : C = 4 : 7 = 1 : \frac{7}{4}$

$= 6 : \left(\frac{7}{4}\times 6\right) = 6 : \frac{21}{2}$

$A : B : C = 5 : 6 : \frac{21}{2}$

$A : B : C = 10 : 12 : 21$

5. Sum of ratio terms $= 7 + 8 = 15$

Kunal's share $= ₹\left(360\times\frac{7}{15}\right) = ₹\ 168$

Mohit's share $= ₹\left(360\times\frac{8}{15}\right) = ₹\ 192$

6. Sum of ratio terms $= 1 + 3 + 4 = 8$

X's share $= ₹\left(5600\times\frac{1}{8}\right) = ₹\ 700$

Y's share $= ₹\left(5600\times\frac{3}{8}\right) = ₹\ 2100$

$$Z\text{'s share} = ₹\left(5600 \times \frac{4}{8}\right) = ₹\ 2800$$

7. Let the required number to be added be x.

Then, we have

$$(9+x):(16+x) = 2:3$$

$$\frac{9+x}{16+x} = \frac{2}{3}$$

$$27+3x = 32+2x$$

$$3x-2x = 32-27 = 5$$

$$x = 5$$

Hence, the required number is 5.

8. Let the required number to be subtracted be x.

Then, we have

$$(17-x):(33-x) = 7:15$$

$$\frac{17-x}{33-x} = \frac{7}{15}$$

$$255-15x = 231-7x$$

$$15x-7x = 255-231$$

$$8x = 24$$

$$x = \frac{24}{8} = 3$$

Hence, the required number is 3.

9. Let the present ages of A and B be $8x$ years and $3x$ years respectively.

Six years later,

$$\text{Age of } A = (8x+6) \text{ years}$$

$$\text{Age of } B = (3x+6) \text{ years}$$

According to question,

$$\frac{8x+6}{3x+6} = \frac{9}{4}$$

$$32x+24 = 27x+54$$

$$32x-27x = 54-24$$

$$5x = 30$$

$$x = \frac{30}{5} = 6$$

The present age of $A = (8\times 6)$ years $= 48$ years

and the present age of $B = (3\times 6)$ years $= 18$ years

10. Let the weight of copper and zinc be $9x$ grams and $5x$ grams respectively.
According to question,

$$9x = 48.6 \text{ grams}$$
$$x = 5.4 \text{ grams}$$
$$\text{Weight of the zinc} = (5 \times 5.4) \text{ grams} = 27 \text{ grams}$$

11. Let the number of boys and girls be $8x$ and $3x$ respectively.
According to question,

$$3x = 375$$
$$x = \frac{375}{3} = 125$$
$$\text{Number of boys} = 8 \times 125 = 1000$$

12. Let the income and savings be ` $11x$ and ` $2x$ respectively.
According to question,

$$2x = ` 2500$$
$$x = ` \frac{2500}{2} = ` 1250$$
$$\text{Income} = ` (11 \times 1250) = ` 13750$$
$$\text{Expenditure} = \text{Income} - \text{Savings}$$
$$= ` 13750 - ` 2 \times 1250$$
$$= ` 13750 - ` 2500$$
$$= ` 11250$$

13. Let the number of ` 1, 50 P and 25 P coins be $5x$, $8x$ and $4x$ respectively.

$$\text{Total value of these coins} = ` \left(5x \times 1 + 8x \times \frac{50}{100} + 4x \times \frac{25}{100}\right)$$
$$= ` (5x + 4x + 4x)$$
$$= ` 10x$$

Total value of these coins = ` 750

$$10x = 750$$
$$x = \frac{750}{10} = 75$$

Number of ` 1 coins $= 5 \times 75 = 375$
Number of 50 P coins $= 8 \times 75 = 600$
Number of 25 P coins $= 4 \times 75 = 300$

14. Let the number be $5x$ and $7x$.
According to question,

$$5x + 7x = 720$$
$$12x = 720$$

$$x = \frac{720}{12} = 60$$

First number $= 5 \times 60 = 300$

Second number $= 7 \times 60 = 420$

15. $(4x + 5) : (3x + 11) = 13 : 17$

$$\frac{4x+5}{3x+11} = \frac{13}{17}$$

$$68x + 85 = 39x + 143$$

$$68x - 39x = 143 - 85$$

$$29x = 58$$

$$x = \frac{58}{29} = 2$$

16. $x : y = 3 : 4$

$$\frac{x}{y} = \frac{3}{4}$$

$$(3x + 4y) : (5x + 6y) = \frac{3x + 4y}{5x + 6y}$$

$$= \frac{3\left(\frac{x}{y}\right) + 4}{5\left(\frac{x}{y}\right) + 6} = \frac{3 \times \frac{3}{4} + 4}{5 \times \frac{3}{4} + 6}$$

$$= \frac{9 + 16}{15 + 24} = \frac{25}{39} = 25 : 39$$

17. (a) $3 : 5 = \frac{3}{5}$ and $8 : 13 = \frac{8}{13}$

LCM of 5 and 13 is 65.

Now, $\frac{3}{5} = \frac{3 \times 13}{5 \times 13} = \frac{39}{65}; \frac{8}{13} = \frac{8 \times 5}{13 \times 5} = \frac{40}{65}$

Clearly, $\frac{39}{65} < \frac{40}{65}$ and hence, $(3 : 5) < (8 : 13)$

(b) $1 : 2 = \frac{1}{2}$ and $4 : 7 = \frac{4}{7}$

LCM of 2 and 7 is 14.

Now, $\frac{1}{2} = \frac{1 \times 7}{2 \times 7} = \frac{7}{14}; \frac{4}{7} = \frac{4 \times 2}{7 \times 2} = \frac{8}{14}$

Clearly, $\frac{7}{14} < \frac{8}{14}$ and hence, $(1 : 2) < (4 : 7)$

(c) $2 : 3 = \frac{2}{3}$ and $4 : 7 = \frac{4}{7}$

LCM of 3 and 7 is 21.

Now, $\frac{2}{3} = \frac{2\times 7}{3\times 7} = \frac{14}{21}; \frac{4}{7} = \frac{4\times 3}{7\times 3} = \frac{12}{21}$

Clearly, $\frac{14}{21} > \frac{12}{21}$ and hence, (2 : 3) > (4 : 7)

(d) $5 : 6 = \frac{5}{6}$ and $7 : 9 = \frac{7}{9}$

LCM of 6 and 9 is 18.

Now, $\frac{5}{6} = \frac{5\times 3}{6\times 3} = \frac{15}{18}; \frac{7}{9} = \frac{7\times 2}{9\times 2} = \frac{14}{18}$

Clearly, $\frac{15}{18} > \frac{14}{18}$ and hence, (5 : 6) > (7 : 9)

18. (a) $(5 : 6) = \frac{5}{6}$, $(8 : 9) = \frac{8}{9}$ and $(11 : 18) = \frac{11}{18}$

LCM of 6, 9 and 18 $= 2\times 3\times 3 = 18$

$$\frac{5}{6} = \frac{5}{6}\times\frac{3}{3} = \frac{15}{18}, \quad \frac{8}{9} = \frac{8}{9}\times\frac{2}{2} = \frac{16}{18}, \quad \frac{11}{18}$$

Clearly, $\frac{11}{18} < \frac{15}{18} < \frac{16}{18}$

$\frac{11}{18} < \frac{5}{6} < \frac{8}{9}$

2	6, 9, 18
	3, 9, 9
	1, 3, 3
	1, 1, 1

Hence, (11 : 18) < (5 : 6) < (8 : 9)

(b) $(11 : 14) = \frac{11}{14}$, $(17 : 21) = \frac{17}{21}$, $(5 : 7) = \frac{5}{7}$ and $(2 : 3) = \frac{2}{3}$

LCM of 14, 21, 7 and $3 = 2\times 3\times 7 = 42$

$$\frac{11}{14} = \frac{11}{14}\times\frac{3}{3} = \frac{33}{42}, \quad \frac{17}{21} = \frac{17}{21}\times\frac{2}{2} = \frac{34}{42}$$

$$\frac{5}{7} = \frac{5}{7}\times\frac{6}{6} = \frac{30}{42}, \quad \frac{2}{3} = \frac{2}{3}\times\frac{14}{14} = \frac{28}{42}$$

Clearly, $\frac{28}{42} < \frac{30}{42} < \frac{33}{42} < \frac{34}{42}$

$\frac{2}{3} < \frac{5}{7} < \frac{11}{14} < \frac{17}{21}$

2	14, 21, 7, 3
3	7, 21, 7, 3
7	7, 7, 7, 1
	1, 1, 1, 1

Hence, (2 : 3) < (5 : 7) < (11 : 14) < (17 : 21)

EXERCISE 8B

1. 36, 49, 6, 7

Product of extremes $= 36 \times 7 = 252$

Product of means $= 49 \times 6 = 294$

$\because$ Product of extremes $\neq$ Product of means

Hence, 36, 49, 6 and 7 are not in proportion.

2. 30, 40, 45, 60

Product of extremes $= 30 \times 60 = 1800$

Product of means $= 40 \times 45 = 1800$

$\because$ Product of extremes = Product of means

Hence, 30, 40, 45 and 60 are in proportion.

3. Given numbers are in proportion.

$\because$ Product of means = Product of extremes

$$x \times 16 = 8 \times 35$$

$$x = \frac{8 \times 35}{16} = 17.5$$

Hence, $x = 17.5$

4. Given numbers are in proportion.

$\because$ Product of means = Product of extremes

$$35 \times 48 = x \times 60$$

$$x = \frac{35 \times 48}{60} = 28$$

Hence, $x = 28$

5. Given numbers are in proportion.

$\because$ Product of means = Product of extremes

$$9 \times x = 2 \times 27$$

$$x = \frac{2 \times 27}{9} = 6$$

Hence, $x = 6$

6. 36, 54 and x are in continued proportion.

So, $36 : 54 :: 54 : x$

$$36 \times x = 54 \times 54$$

$$x = \frac{54 \times 54}{36} = 81$$

Hence, $x = 81$

7. 27, 36 and x are in continued proportion.

So, $27 : 36 :: 36 : x$

$$27 \times x = 36 \times 36$$

$$x = \frac{36 \times 36}{27} = 48$$

Hence, $x = 48$

8. Third proportional to 7 and x is 28.

Then, the fourth proportional to 7, x, x is 28.

$$7 : x :: x : 28$$

$$7 \times 28 = x \times x$$

$$x^2 = 7 \times 28$$

$$x = \sqrt{7 \times 28} = 14$$

Hence, $x = 14$

9. (a) Let the third proportional to 12 and 18 be x.

Then, the fourth proportional to 12, 18, 18 is x.

$$12 : 18 :: 18 : x$$

$$12 \times x = 18 \times 18$$

$$x = \frac{18 \times 18}{12} = 27$$

Hence, the third proportional to 12 and 18 is 27.

(b) Let the third proportional to 8 and 12 be x.

Then, the fourth proportional to 8, 12, 12 is x.

$$8 : 12 :: 12 : x$$

$$8 \times x = 12 \times 12$$

$$x = \frac{12 \times 12}{8} = 18$$

Hence, the third proportional to 8 and 12 is 18.

(c) Let the third proportional to 4.5 and 6 be x.

Then, the fourth proportional to 4.5, 6, 6 is x.

$$4.5 : 6 :: 6 : x$$

$$4.5 \times x = 6 \times 6$$

$$x = \frac{6 \times 6}{4.5} = 8$$

Hence, the third proportional to 4.5 and 6 is 8.

10. (a) Let the fourth proportional be x. Then,

$$5 : 7 :: 30 : x$$

$$5 \times x = 7 \times 30$$

$$x = \frac{7 \times 30}{5} = 42$$

Hence, the fourth proportional is 42.

(b) Let the fourth proportional be x. Then,

$$8 : 36 : : 6 : x$$
$$8 \times x = 36 \times 6$$
$$x = \frac{36 \times 6}{8} = 27$$

Hence, the fourth proportional is 27.

(c) Let the fourth proportional be x. Then,

$$2.8 : 14 : : 3.5 : x$$
$$2.8 \times x = 14 \times 3.5$$
$$x = \frac{14 \times 3.5}{2.8} = 17.5$$

Hence, the fourth proportional is 17.5.

11. (a) Let the mean proportional between 6 and 24 be x.

Then, $6 : x : : x : 24$

$$x \times x = 6 \times 24$$
$$x^2 = 144 = 12 \times 12$$
$$x = 12$$

Hence, the mean proportional between 6 and 24 is 12.

(b) Let the mean proportional between 3 and 27 be x.

Then, $3 : x : : x : 27$

$$x \times x = 3 \times 27$$
$$x^2 = 81 = 9 \times 9$$
$$x = 9$$

Hence, the mean proportional between 3 and 27 is 9.

(c) Let the mean proportional between 0.4 and 0.9 be x.

Then, $0.4 : x : : x : 0.9$

$$x \times x = 0.4 \times 0.9$$
$$x^2 = 0.36 = 0.6 \times 0.6$$
$$x = 0.6$$

Hence, the mean proportional between 0.4 and 0.9 is 0.6.

12. Let the number to be subtracted be x. Then,

$$(10 - x) : (12 - x) : : (19 - x) : (24 - x)$$
$$(10 - x)(24 - x) = (12 - x)(19 - x)$$
$$240 - 10x - 24x + x^2 = 228 - 12x - 19x + x^2$$
$$31x - 34x = 228 - 240$$
$$-3x = -12$$
$$x = 4$$

Hence, the required number is 4.

13. Let the number to be added be x. Then,

$$(5+x):(9+x)=(7+x):(12+x)$$
$$(5+x)(12+x)=(9+x)(7+x)$$
$$60+5x+12x+x^2=63+9x+7x+x^2$$
$$60+17x=63+16x$$
$$17x-16x=63-60$$
$$x=3$$

Hence, the required number is 3.

14. Let actual distance be x km.

Ratio of actual distance = Ratio of the map

$$50:x=1:4$$
$$x\times 1=50\times 4$$
$$x=200$$

Hence, the actual distance between two towns is 200 km.

EXERCISE 8C

1. $\frac{A}{B}=\frac{2}{3}$ and $\frac{B}{C}=\frac{4}{5}$

$$\frac{A}{B}\times\frac{B}{C}=\frac{2}{3}\times\frac{4}{5}=\frac{8}{15}$$
$$\frac{A}{C}=\frac{8}{15}$$
$$\frac{C}{A}=\frac{15}{8}$$
$$C:A=15:8$$

(a) is correct.

2. $\frac{a}{b}=\frac{3}{4}$ and $\frac{b}{c}=\frac{8}{9}$

$$\frac{a}{b}\times\frac{b}{c}=\frac{3}{4}\times\frac{8}{9}=\frac{2}{3}$$
$$\frac{a}{c}=\frac{2}{3} \qquad a:c=2:3$$

(d) is correct.

3. $A:B=5:7$

$$B:C=6:11=1:\frac{11}{6}$$
$$=7:\left(\frac{11}{6}\times 7\right)=7:\frac{77}{6}$$

$$A:B:C = 5:7:\frac{77}{6}$$

$$A:B:C = 30:42:77$$

(b) is correct.

4. $7:x::35:45$

$$x\times 35 = 7\times 45$$

$$x = \frac{7\times 45}{35} = 9$$

(c) is correct.

5. $(3a+5b):(3a-5b) = 5:1$

$$(3a+5b)\times 1 = (3a-5b)\times 5$$

$$3a+5b = 15a-25b$$

$$15a-3a = 5b+25b$$

$$12a = 30b$$

$$\frac{a}{b} = \frac{30}{12} = \frac{5}{2}$$

$$a:b = 5:2$$

(c) is correct.

6. $x:y = 3:4$ $\qquad \frac{x}{y} = \frac{3}{4}$

$$(7x+3y):(7x-3y) = \frac{7x+3y}{7x-3y}$$

$$= \frac{7\left(\frac{x}{y}\right)+3}{7\left(\frac{x}{y}\right)-3} = \frac{7\times\frac{3}{4}+3}{7\times\frac{3}{4}-3}$$

$$= \frac{21+12}{21-12} = \frac{33}{9} = \frac{11}{3} = 11:3$$

(c) is correct.

7. A's share $= ₹\ \frac{3\times 420}{3+4} = ₹\ \frac{3}{7}\times 420 = ₹\ 180$

(a) is correct.

8. Let third proportional be x.

Then, $\qquad 9:12::12:x$

$$9\times x = 12\times 12$$

$$x = \frac{12\times 12}{9} = 16$$

(c) is correct.

9. Let the mean proportional be x.

Then, $9 : x :: x : 16$

$x^2 = 9 \times 16 = 144$

$x^2 = 12 \times 12 \qquad x = 12$

(b) is correct.

10. $2 : 3 = \frac{2}{3}$ and $4 : 7 = \frac{4}{7}$

LCM of 3 and 7 = 21

$$\frac{2}{3} = \frac{2}{3} \times \frac{7}{7} = \frac{14}{21}, \frac{4}{7} = \frac{4}{7} \times \frac{3}{3} = \frac{12}{21}$$

Clearly, $\frac{12}{21} < \frac{14}{21}$

$\frac{4}{7} < \frac{2}{3}$

$(4 : 7) < (2 : 3)$

(a) is correct.

HOTS

- $a : b = \frac{2}{3} : 1;\ b : c = 5 : 7$

  $\frac{a}{b} = \frac{2}{3 \times 1} = \frac{2}{3}; \frac{b}{c} = \frac{5}{7}$

  We have to find $a : b : c$. For this we have to make b equal in both the ratios.

  LCM of two value of b, *i.e.*, 3 and 5 = 15

  $$a : b = \frac{2}{3} : 1 = \frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15} = 10 : 15$$

  and $b : c = 5 : 7 = \frac{5}{7} = \frac{5 \times 3}{7 \times 3} = \frac{15}{21} = 15 : 21$

  $a : b : c = 10 : 15 : 21$

  Sum of all terms $= 10 + 15 + 21 = 46$

  Part of $a = \frac{10}{46} \times 414 = 90$

  Part of $b = \frac{15}{46} \times 414 = 135$

  Part of $c = \frac{21}{46} \times 414 = 189$

  Hence, first, second and third parts are ` 90, ` 135 and ` 189 respectively.

VALUE BASED

- Ratio of milk and water = 5 : 2 :: 40 : water

  Water $= \frac{40 \times 2}{5} = 16$ litre

  16 litre of water will he add.

  Total quantity of milk = 40 + 16 = 56 litre

  Cost of pure milk = 40 × 52 = ` 2080

  Cost of mixed milk = 56 × 40 = ` 2240

  So, he earn by selling mixed milk = ` (2240 – 2080)

  = ` 160

Chapter 9 Unitary Method

EXERCISE 9A

1. For ` 260, rice bought = 8 kg

For ` 1, rice bought $= \frac{8}{260}$ kg

For ` 877.50, rice bought $= \left(\frac{8}{260} \times 877.50\right)$ kg $= 27$ kg

Hence, 27 kg rice can be bought for ` 877.50.

2. For ` 6290, silk purchased = 37 m

For ` 1, silk purchased $= \frac{37}{6290}$ m

For ` 4220, silk purchased $= \left(\frac{37}{6290} \times 4420\right)$ m $= 26$ m

Hence, 26 m of silk can be purchased for ` 4420.

3. Cost of 15 mangoes = ` 110

Cost of 1 mango = ` $\frac{110}{15}$

Cost of 39 mangoes = ` $\left(\frac{110}{15} \times 39\right) =$ ` 286

Hence, the cost of 39 mangoes is ` 286.

4. ` 1110 was paid for = 6 days

` 1 was paid for $= \frac{6}{1110}$ days

` 4625 was paid for $= \frac{6}{1110} \times 4625$ days $= 25$ days

Hence, the worker worked for 25 days.

5. Length of 85.5 kg of rod = 22.5 m

Length of 1 kg of rod = $\frac{22.5}{85.5}$ m

Length of 22.8 kg of rod = $\frac{22.5}{85.5} \times 22.8\,\text{m} = 6\,\text{m}$

Hence, the length of 22.8 kg of the rod is 6 m.

6. 13.5 kg = 13.5×1000 grams = 13500 grams

Number of sheets for 162 grams weight = 6

Number of sheets for 1 grams weight = $\frac{6}{162}$

Number of sheets for 13500 grams weight = $\frac{6}{162} \times 13500 = 500$

Hence, 500 sheets are required.

7. Number of Cartons required for 1152 bars = 8

Number of Cartons required for 1 bar = $\frac{8}{1152}$

Number of Cartons required for 3888 bars = $\frac{8}{1152} \times 3888 = 27$

Hence, 27 cartons will be required.

8. 71.5 cm = 71.5×10 mm = 715 mm

If thickness is 44 mm, number of cardboards = 16

If thickness is 1 mm, number of cardboards = $\frac{16}{44}$

If thickness is 715 mm, number of cardboards = $\frac{16}{44} \times 715 = 260$

Hence, 260 cardboards will be required.

9. Distance travelled on 42 *l* of petrol = 357 km

Distance travelled on 1 *l* of petrol = $\frac{357}{42}$ km

Distance travelled on 12 *l* of petrol = $\left(\frac{357}{42} \times 12\right)$ km = 102 km

Hence, car can travel 102 km on 12 litres of petrol.

10. Cost of travelling 900 km = ` 2520

Cost of travelling 1 km = ` $\frac{2520}{900}$

Cost of travelling 360 km = ` $\frac{2520}{900} \times 360$ = ` 1008

Hence, the required fare is ` 1008.

11. Time taken to cover a distance of 51 km = 45 minutes

Time taken to cover a distance of 1 km = $\frac{45}{51}$ minutes

Time taken to cover a distance of 221 km = $\left(\frac{45}{51} \times 221\right)$ minutes

= 195 minutes = 3 h 15 min

Hence, train will take 3 h 15 min to cover 221 km.

12. Number of men required to build 16.25 m of wall = 15

Number of men required to build 1 m of wall = $\frac{15}{16.25}$

Number of men required to build 26 m of wall = $\frac{15}{16.25} \times 26 = 24$

Hence, the required number of men are 24.

EXERCISE 9B

1. To finish the work in 30 days, men required = 16

To finish the work in 1 day, men required = (16×30)

[less days, more man]

To finish the work in 24 days, men required = $\frac{16 \times 30}{24} = 20$

[more days, less man]

Hence, the required number of men = 20.

2. 48 men can dig a trench in 14 days.

1 man can dig a trench in (48×14) days. [less persons, more days]

28 men can dig a trench in $\frac{(48 \times 14)}{28}$ days = 24 days.

[more persons, less days]

Hence, the required number of days = 24 days.

3. 16 horses can consume a certain quantity in 25 days.

1 horse can consume a certain quantity in (25×16) days.

[less horse, more days]

40 horses can consume a certain quantity in $\frac{(25 \times 16)}{40}$ days = 10 days.

[more horse, less days]

Hence, the required number of days = 10.

4. In 13 days, a field can be grazed by 45 cows.

In 1 day, a field can be grazed by (45×13) cows.

[less days, more cows]

In 9 days, a field can be grazed by $\frac{(45\times 13)}{9}$ cows = 65 cows.

[more days,less cows]

Hence, the required number of cows = 65.

5. Time taken by Sita at the speed of 40 words per minute = 24 minutes

Time taken by Sita at the speed of 1 word per minute

$= (24\times 40)$ minutes [less words, more time]

Time taken by Rita at the speed of 48 words per minute

$= \frac{(24\times 40)}{48}$ minutes

$= 20$ minutes [more words, less time]

Hence, the time taken by Rita = 20 minutes.

6. If she reads 18 pages per day, then time taken to finish a book = 25 days

If she reads 1 page per day, then time taken to finish a book

$= (25\times 18)$ days [less pages, more days]

If she reads 15 pages per day, then time taken to finish a book

$= \frac{(25\times 18)}{15}$ days $= 30$ days

[more pages, less days]

Hence, the required number of days = 30.

7. To make 240 tonnes of steel, material is enough for 30 days.

To make 1 tonn of steel, material is enough for $= (240\times 30)$ days.

[less steel, more days]

To make 300 tonnes of steel, material is enough for $= \frac{(240\times 30)}{300}$ days.

$= 24$ days

[more steel, less days]

Hence, the material will last for 24 days.

8. At 45 km/h, time taken to cover a distance = 3 h 20 min

$= 3\frac{1}{3}$ h $= \frac{10}{3}$ h

At 1 km/h, time taken to cover a distance $= \left(45\times \frac{10}{3}\right)$ h

[less speed, more time]

At 36 km/h, time taken to cover a distance $= \left(\frac{45\times 10}{36\times 3}\right)$ h $\approx$ 4 h 10 min

[more speed, less time]

Hence, the required time is 4 h 10 min.

9. To finish the provisions in 25 days, men required = 630

To finish the provisions in 1 day, men required = 630×25

[less days, more men]

To finish the provisions in 30 days, men required = $\frac{630 \times 25}{30} = 525$

[more days, less men]

Hence, number of men must be transferred = $630 - 525 = 105$.

10. 210 men can complete the remaining work in $(60 - 12)$ days = 48 days

After 12 days, total number of men = $210 + 70 = 280$

210 men can complete the remaining work in 48 days.

1 man can complete the remaining work in = (48×210) days

[less men, more days]

280 men can complete the remaining work in = $\frac{(48 \times 210)}{280}$ days

= 36 days

[more men, less days]

Hence, the remaining work will be finished in 36 days.

11. For $(28 - 4) = 24$ days, food is enough for 1200 soldiers.

For 1 day, food is enough for (1200×24) soldiers.

[less days, more soldiers]

For 32 days, food is enough for $\frac{(1200 \times 24)}{32}$ soldiers = 900 soldiers

[more days, less soldiers]

Hence, the number of soldiers left the fort = $1200 - 900 = 300$.

12. The remaining food is sufficient for 120 men for = $(200 - 5)$ days

= 195 days

When 30 men died, number of men left = $120 - 30 = 90$

The remaining food is sufficient for 120 men for 195 days.

The remaining food is sufficient for 1 man for (195×120) days.

[less men, more days]

The remaining food is sufficient for 90 men for $\frac{(195 \times 120)}{90}$ days

= 260 days

[more men, less days]

Hence, the remaining food will be last for 260 days.

EXERCISE 9C

1. Distance covered in 20 minutes = 5 km

Distance covered in 1 minute = $\frac{5}{20}$ km [less time, less distance]

Distance covered in 50 minutes = $\frac{5}{20} \times 50$ km = 12.5 km

[more time, more distance]

(c) is correct.

2. Weight of 4.5 m of rod = 17.1 kg

Weight of 1 m of rod = $\frac{17.1}{4.5}$ kg [less length, less weight]

Weight of 12 m of rod = $\frac{17.1}{4.5} \times 12$ kg = 45.6 kg

[more length, more weight]

(c) is correct.

3. For 500 men, provisions is enough for 24 days.

For 1 man, provisions is enough for (500×24) days.

[less persons, more days]

For 800 men, provisions is enough for $\frac{(500 \times 24)}{800}$ days = 15 days

[more persons, less days]

(d) is correct.

4. 132 eggs = $\frac{132}{12}$ dozen eggs = 11 dozen eggs

Cost of 6 dozen eggs = ` 108

Cost of 1 dozen eggs = ` $\frac{108}{6}$ [less eggs, less price]

Cost of 11 dozen eggs = ` $\frac{108}{6} \times 11$ [more eggs, more price]

= ` 198

(d) is correct.

5. Time taken by 12 workers = 4 hours

Time taken by 1 worker = (4×12) hours [less workers, more time]

Time taken by 15 workers = $\frac{4 \times 12}{15}$ hours = $\frac{48}{15}$ hours

= 3 hours 12 min [more workers, less time]

(b) is correct.

6. 16 men can reap a field in 30 days.

1 man can reap a field in (30×16) days. [less men, more days]

20 men can reap a field in $\frac{30\times 16}{20}$ days = 24 days. [more men, less days]

(b) is correct.

7. 10 pipes can fill the tank in 24 minutes.

1 pipe can fill the tank in (10×24) minutes. [less pipe, more time]

8 pipes can fill the tank in $\left(\frac{10\times 24}{8}\right)$ minutes = 30 minutes

[more pipe, less time]

(c) is correct.

8. 15 buffaloes eat as much as 21 cows.

1 buffalo eat as much as $\frac{21}{15}$ cows. [less buffaloes, less cows]

35 buffaloes eat as much as $\left(\frac{21\times 35}{15}\right)$ cows = 49 cows

[more buffaloes, more cows]

(a) is correct.

9. 8 men can finish a piece of work in 40 days.

1 man can finish a piece of work in (40×8) days.

[less persons, more days]

10 men can finish a piece of work in $\frac{(40\times 8)}{10}$ days = 32 days

[more persons, less days]

(b) is correct.

10. 4 m long shadow is casted by 6 m tall tree.

4 m long shadow is casted by $\frac{6}{4}$ m tall tree.

[less shadow, less height]

50 m long shadow is casted by $= \left(\frac{6}{4}\times 50\right)$ m tall tree

$= 75$ m tall tree

[more shadow, more height]

(b) is correct.

HOTS

- $26\times 15 = 390$ chocolates cost = ` 2145

  1 chocolates costs = ` $\frac{2145}{390}$

  $40\times 18 = 720$ chocolates cost = ` $\frac{2145}{390}\times 720$ = ` 3960

  Hence, the cost of 40 cartons of 18 chocolates each is ` 3960.

VALUE BASED

- Population of MP = 570 lakhs
  Area of MP = 3 lakhs km^2

  People are in MP per $km^2 = \frac{570}{3} = 190$

  Population of Bihar = 1660 lakhs
  Area of Bihar = 2 lakhs km^2

  People are in Bihar per $km^2 = \frac{1660}{2} = 830$

  (i) 190 people/km^2 are there in MP and 830 people/km^2 are there in Bihar.
  (ii) MP is less populated.

Chapter 10 Percentage

EXERCISE 10A

1. (a) $\frac{2}{3} = \left(\frac{2}{3} \times 100\right)\% = \frac{200}{3}\% = 66\frac{2}{3}\%$

(b) $\frac{3}{8} = \left(\frac{3}{8} \times 100\right)\% = \frac{75}{2}\% = 37\frac{1}{2}\%$

(c) $\frac{4}{15} = \left(\frac{4}{15} \times 100\right)\% = \frac{80}{3}\% = 26\frac{2}{3}\%$

(d) $\frac{9}{20} = \left(\frac{9}{20} \times 100\right)\% = 45\%$

(e) $\frac{8}{125} = \left(\frac{8}{125} \times 100\right)\% = \frac{32}{5}\% = 6.4\%$

(f) $1\frac{3}{5} = \left(\frac{8}{5} \times 100\right)\% = 160\%$

(g) $\frac{47}{100} = \left(\frac{47}{100} \times 100\right)\% = 47\%$

(h) $\frac{19}{500} = \left(\frac{19}{500} \times 100\right)\% = \frac{19}{5}\% = 3.8\%$

2. (a) $0.8\% = \frac{0.8}{100} = \frac{8}{1000} = \frac{1}{125}$

(b) $0.06\% = \frac{0.06}{100} = \frac{6}{10000} = \frac{3}{5000}$

(c) $6.25\% = \frac{6.25}{100} = \frac{625}{10000} = \frac{1}{16}$

(d) $22.75\% = \frac{22.75}{100} = \frac{2275}{10000} = \frac{91}{400}$

(e) $6\frac{1}{4}\% = \frac{25}{4}\% = \frac{25}{400} = \frac{1}{16}$

(f) $26\frac{2}{3}\% = \frac{80}{3}\% = \frac{80}{300} = \frac{4}{15}$

(g) $32\% = \frac{32}{100} = \frac{8}{25}$

(h) $120\% = \frac{120}{100} = \frac{6}{5} = 1\frac{1}{5}$

3. (a) $7.5\% = \frac{7.5}{100} = \frac{75}{1000} = \frac{3}{40} = 3 : 40$

(b) $36\% = \frac{36}{100} = \frac{9}{25} = 9 : 25$

(c) $125\% = \frac{125}{100} = \frac{5}{4} = 5 : 4$

(d) $43\% = \frac{43}{100} = 43 : 100$

4. (a) $3 : 5 = \frac{3}{5} = \left(\frac{3}{5} \times 100\right)\% = 60\%$

(b) $5 : 4 = \frac{5}{4} = \left(\frac{5}{4} \times 100\right)\% = 125\%$

(c) $16 : 25 = \frac{16}{25} = \left(\frac{16}{25} \times 100\right)\% = 64\%$

(d) $37 : 100 = \frac{37}{100} = \left(\frac{37}{100} \times 100\right)\% = 37\%$

5. (a) $0.23\% = \frac{0.23}{100} = \frac{23}{10000} = 0.0023$

(b) $3.6\% = \frac{3.6}{100} = \frac{36}{1000} = 0.036$

(c) $45\% = \frac{45}{100} = 0.45$

(d) $127\% = \frac{127}{100} = 1.27$

6. (a) $0.005 = (0.005 \times 100)\% = 0.5\%$

(b) $0.07 = (0.07 \times 100)\% = 7\%$

(c) $0.42 = (0.42 \times 100)\% = 42\%$

(d) $0.6 = (0.6 \times 100)\% = 60\%$

7. (a) 0.6% of $45 = \left(\frac{0.6}{100} \times 45\right) = \left(\frac{6}{100} \times 45\right) = \frac{27}{100} = 0.27$

(b) 2.8% of $35 = \left(\frac{2.8}{100} \times 35\right) = \left(\frac{28}{1000} \times 35\right) = \frac{49}{50} = 0.98$

(c) 6.5% of $400 = \left(\frac{6.5}{100} \times 400\right) = 26$

(d) $16\frac{2}{3}\%$ of $16 = \frac{50}{3}\%$ of $16 = \left(\frac{50}{3 \times 100} \times 16\right) = \frac{16}{6} = \frac{8}{3} = 2\frac{2}{3}$

(e) 32% of $425 = \left(\frac{32}{100} \times 425\right) = 136$

(f) 136% of $70 = \left(\frac{136}{100} \times 70\right) = \frac{476}{5} = 95.2$

8. (a) 7.5% of $600\text{ m} = \left(\frac{75}{100} \times \frac{1}{10} \times 600\right)\text{m} = 45\text{ m}$

(b) 8.5% of $5\text{ kg} = \left(\frac{85}{100} \times \frac{1}{10} \times 5\right)\text{kg} = 0.425\text{ kg}$

$= 0.425 \times 1000\text{ g} = 425\text{ g}$

(c) $3\frac{1}{3}\%$ of $90\text{ km} = \left(\frac{10}{3} \times \frac{1}{100} \times 90\right)\text{km} = 3\text{ km}$

(d) 20% of $12\text{ litres} = \left(\frac{20}{100} \times 12\right)\text{litres} = \frac{12}{5}\text{ litres} = 2.4\text{ litres}$

(e) 20% of ` $132 = ` \left(\frac{20}{100} \times 132\right) = ` \frac{132}{5} = ` 26.40$

(f) 25% of ` $76 = ` \left(\frac{25}{100} \times 76\right) = ` \frac{76}{4} = ` 19$

9. Let the required number be *x*.

Then, $6\frac{1}{4}\%$ of $x = 5$

$$\left(\frac{25}{4} \times \frac{1}{100} \times x\right) = 5$$

$$x = \frac{5 \times 4 \times 100}{25} = 80$$

Hence, the required number is 80.

10. Let the required number be x.

Then, 15% of $x = 45$

$$\frac{15}{100} \times x = 45$$

$$x = \frac{45 \times 100}{15} = 300$$

Hence, the required number is 300.

11. Let $x\%$ of $84 = 14$. Then,

$$\frac{x}{100} \times 84 = 14$$

$$x = \frac{14 \times 100}{84} = 16\frac{2}{3}$$

Hence, $16\frac{2}{3}\%$ of 84 is 14.

12. (a) Let $x\%$ of ` $4 = 25$ paise $= ` \frac{25}{100}$

Then, $\frac{x}{100} \times 4 = \frac{25}{100}$

$$x = \frac{25}{4} = 6\frac{1}{4}$$

Hence, $6\frac{1}{4}\%$ of ` $4 = 25$ paise

(b) Let $x\%$ of 1 litre $= 175$ ml $= \frac{175}{1000}$ litre

Then, $\frac{x}{100} \times 1 = \frac{175}{1000}$

$$x = \frac{175}{1000} \times 100 = 17.5$$

Hence, 17.5% of 1 litre $= 175$ ml

(c) Let $x\%$ of 4 km $= 160$ metres $= \frac{160}{1000}$ km

Then, $\frac{x}{100} \times 4 = \frac{160}{1000}$

$$x = \frac{160 \times 100}{1000 \times 4} = 4$$

Hence, 4% of 4 km $= 160$ metres

(d) Let $x\%$ of 2 days $= 8$ hours $= \frac{8}{24}$ days $= \frac{1}{3}$ days

Then, $\frac{x}{100} \times 2 = \frac{1}{3}$

$$x = \frac{100}{3 \times 2} = \frac{50}{3}$$

$$x = 16\frac{2}{3}$$

Hence, $16\frac{2}{3}$ % of 2 days = 8 hours

(e) Let x % of 2 hours = 36 minutes = $\frac{36}{60}$ hours = $\frac{3}{5}$ hours

Then, $\frac{x}{100} \times 2 = \frac{3}{5}$

$$x = \frac{3}{5} \times \frac{100}{2} = 30$$

Hence, 30% of 2 hours = 36 minutes

(f) Let x % of ` 120 = ` 15

Then, $\frac{x}{100} \times 120 = 15$

$$x = \frac{15 \times 100}{120} = 12.5$$

Hence, 12.5% of ` 120 = ` 15

13. 12.5% of $x = 6$

$$\frac{125}{100} \times \frac{1}{10} \times x = 6$$

$$\frac{x}{8} = 6$$

$$x = 8 \times 6 = 48$$

14. 3% of $x = 9$

$$\frac{3}{100} \times x = 9$$

$$x = \frac{9 \times 100}{3} = 300$$

15. Let the required amount be ` x.

Then, $x = 60 - 20\%$ of 60

$$x = 60 - \frac{20}{100} \times 60$$

$$x = 60 - 12$$

$$x = 48$$

Hence, x = ` 48

16. Let the required amount be ` x.

Then, $x = 90 + 10\%\text{ of } 90$

$$x = 90 + \frac{10}{100} \times 90$$

$$x = 90 + 9$$

$$x = 99$$

Hence, $x =$ ` 99

EXERCISE 10B

1. Percentage of marks obtained by Dinesh $= \left(\frac{495}{750} \times 100\right)\%$

$= 66\%$

2. Increment in salary $= 12\%$ of ` 15625

$= ` \left(\frac{12}{100} \times 15625\right)$

$= ` 1875$

New Salary = ` 15625 + ` 1875

= ` 17500

3. Let the total cost be ` x.

Then, $96\%\text{ of } x = 10464$

$$\frac{96}{100} \times x = 10464$$

$$x = \frac{10464 \times 100}{96}$$

$$x = 10900$$

Hence, the total cost of the TV is ` 10900.

4. Let the total number of students be x.

Percentage of boys $= 70\%$

Percentage of girls $= (100 - 70)\% = 30\%$

Then, $30\%\text{ of } x = 504$

$$\frac{30}{100} \times x = 504$$

$$x = \frac{504 \times 100}{30} = 1680$$

$$\text{Number of boys} = 70\%\text{ of } x = \frac{70}{100} \times 1680 = 1176$$

5. Let the total number of examinees be x.

Percentage of failures $= (100 - 72)\% = 28\%$

$$28\% \text{ of } x = 392$$

$$\frac{28}{100} \times x = 392$$

$$x = \frac{392 \times 100}{28} = 1400$$

Hence, the total number of examinees = 1400

6. Let the maximum marks be x.

Then, $36\% \text{ of } x - 39 = 123$

$$\frac{36}{100} \times x = 123 + 39 = 162$$

$$x = \frac{162 \times 100}{36} = 450$$

Hence, the maximum marks is 450.

7. Let the number of mangoes he had originally be x.

Percentage of mangoes sold = 40%

Percentage of mangoes left = $(100 - 40)\% = 60\%$

$$60\% \text{ of } x = 420$$

$$\frac{60}{100} \times x = 420$$

$$x = \frac{420 \times 100}{60} = 700$$

Hence, the number of mangoes he had originally = 700

8. Amount of carbon = 3% of 1 kg $= \left(\frac{3}{100} \times 1000\right) g = 30\,g$

Amount of calcium = 10% of 1 kg $= \left(\frac{10}{100} \times 1000\right) g = 100\,g$

Amount of oxygen = 12% of 1 kg $= \left(\frac{12}{100} \times 1000\right) g = 120\,g$

9. Let the total amount of the property be ` x.

Then, 3% of ` $x = 42660$

$$\frac{3}{100} \times x = 42660$$

$$x = \frac{42600 \times 100}{3} = 1422000$$

Hence, the total amount of the property is ` 1422000.

10. Let the school was open for x days.

Then, $75\% \text{ of } x = 219$

$$\frac{75}{100} \times x = 219$$

$$x = \frac{219 \times 100}{75} = 292$$

Hence, the school was open for 292 days.

11. Let the original price be ` x.

Then, $x + 8\%$ of $x = 1566$

$$x + \frac{8}{100} \times x = 1566$$

$$\frac{100x + 8x}{100} = 1566$$

$$108x = 1566 \times 100$$

$$x = \frac{1566 \times 100}{108} = 1450$$

Hence, the original price is ` 1450.

12. Let the original price be ` x.

Then, $x - 12\%$ of $x = 1188$

$$x - \frac{12x}{100} = 1188$$

$$\frac{100x - 12x}{100} = 1188$$

$$\frac{88x}{100} = 1188$$

$$x = \frac{1188 \times 100}{88} = 1350$$

Hence, the original price = ` 1350

13. Let the original salary be ` 100.

Increase in it = 20%

Salary after increase = ` $(100 + 20)$ = ` 120

To restore the original salary, reduction = ` $(120 - 100)$ = ` 20

Reduction on ` 120 = ` 20

$$\text{Reduction \%} = \left(\frac{20}{120} \times 100\right)\% = \frac{100}{6}\%$$

$$= \frac{50}{3}\% = 16\frac{2}{3}\%$$

Hence, the required reduction on new salary is $16\frac{2}{3}\%$.

14. Let the number be x.

Increased number $= 120\%$ of $x = \left(\frac{120}{100} \times x\right) = \frac{6x}{5}$

Decreased number $= 80\%$ of $\left(\frac{6x}{5}\right) = \left(\frac{80}{100} \times \frac{6x}{5}\right) = \frac{24x}{25}$

$$\text{Net decrease} = \left(x - \frac{24}{25}x\right) = \frac{25x - 24x}{25} = \frac{x}{25}$$

$$\text{Net decrease \%} = \left(\frac{x}{25} \times \frac{1}{x} \times 100\right)\% = 4\%$$

15. Let the income be ` x.

$$\text{Money spend} = ` \left(\frac{80}{100} \times x\right) = ` \frac{4x}{5}$$

$$\text{Money left} = ` \left(x - \frac{4}{5}x\right) = ` \frac{1}{5}x$$

$$\text{Amount of charity} = ` \left(\frac{10}{100} \times \frac{1}{5}x\right) = ` \frac{1}{50}x$$

$$\text{Total money spend} = ` \frac{4}{5}x + ` \frac{1}{50}x = ` \frac{(40+1)x}{50} = ` \frac{41x}{50}$$

$$\text{Money left} = ` \left(x - \frac{41}{50}x\right) = ` \frac{(50-41)x}{50} = ` \frac{9x}{50}$$

$$\frac{9}{50}x = 46260$$

$$x = \frac{46260 \times 50}{9} = 257000$$

Hence, the income is ` 257000.

16. Let Rajat's income be ` 100.

Then, Vipin's income = ` 120.

If Vipin's income is ` 120, then Rajat's income = ` 100

If Vipin's income is ` 100, then Rajat's income $= ` \left(\frac{100}{120} \times 100\right)$

$$= ` \frac{250}{3} = ` 83.33$$

Hence, Rajat's income is less than that of Vipin's $= (100 - 83.33)\%$

$$= 16.67\% = 16\frac{2}{3}\%$$

17. The present value of the car = ` 450000

The decrease in its value after 1 year = 20% of ` 450000

$$= ` \left(\frac{20}{100} \times 450000\right)$$

$$= ` 90000$$

The depreciated value after 1 year = ` (450000 − 90000)

$$= ` 360000$$

The decrease in its value after 2 years = 20% of ` 360000

$$= ` \left(\frac{20}{100} \times 360000\right)$$

$$= ` 72000$$

The depreciated value after 2 years = ` (360000 − 72000)

$$= ` 288000$$

Hence, the value of the car after 2 years will be ` 288000.

18. One year ago, let the value of the machine be ` x.

Annual decrease = 10%

$$\text{Present value} = \left(\frac{90}{100} \times x\right) = \frac{9}{10}x$$

$$\frac{9}{10}x = 387000$$

$$x = \frac{387000 \times 10}{9} = 430000$$

Hence, one year ago, the value of the machine was ` 430000.

19. Population after 2 years $= 60000\left(1 + \frac{10}{100}\right)^2$

$$= 60000 \times \frac{11}{10} \times \frac{11}{10} = 72600$$

Hence, the population after 2 years = 72600

20. Let the price of rice be ` 100.

$$\text{Increased price} = ` \left(\frac{125}{100} \times 100\right) = ` 125$$

$$\text{Decrease in price} = ` (125 - 100) = ` 25$$

$$\text{Decrease \%} = \left(\frac{25}{125} \times 100\right)\% = 20\%$$

Hence, the required decrease in consumption of rice = 20%

EXERCISE 10C

1. $x\%$ of $\frac{2}{7} = \frac{1}{35}$

$$\frac{x}{100} \times \frac{2}{7} = \frac{1}{35}$$

$$x = \frac{7 \times 100}{35 \times 2} = 10$$

(d) is correct.

2. $\frac{x}{100} \times 75 = 9$

$$x = \frac{9 \times 100}{75} = 12$$

(c) is correct.

3. $\frac{2}{5} = \left(\frac{2}{5} \times 100\right)\% = 40\%$

(c) is correct.

4. $\frac{3}{4} = \left(\frac{3}{4} \times 100\right)\% = 75\%$

(b) is correct.

5. Let the number of examinees be x.

Percentage of failures $= (100 - 95)\% = 5\%$

$$\frac{5}{100} \times x = 28$$

$$x = \frac{28 \times 100}{5} = 560$$

(c) is correct.

6. Let the original salary be ` x.

Then, $$x \times \frac{125}{100} = 20000$$

$$x = \frac{20000 \times 100}{125}$$

$$x = 16000$$

(b) is correct.

7. Let the gross value be ` x.

Then, $$x \times \frac{90}{100} = 18000$$

$$x = \frac{18000 \times 100}{90} = 20000$$

(b) is correct.

8. If copper is 5 g, quantity of ore $= 100\,\text{g}$

If copper is 1 g, quantity of ore $= \frac{100}{5}\,\text{g}$

If copper is 400 g, quantity of ore $= \frac{100}{5} \times 400\,\text{g} = 8000\,\text{g} = 8\,\text{kg}$

(d) is correct.

9. Let the number be x.

Then, $x \times \frac{9}{100} = 69$

$$x = \frac{69 \times 100}{92}$$

$$x = 75$$

(b) is correct.

10. Let the number be x.

Then, $x \times \frac{120}{100} = 42$

$$x = \frac{42 \times 100}{120} = 35$$

(a) is correct.

11. Value after 1 year $= ₹\ 25000\left(1 - \frac{10}{100}\right)$

$$= ₹\ 25000 \times \frac{9}{10} = ₹\ 22500$$

(b) is correct.

12. Let the total students be x.

Percentage of girls $= (100 - 70)\% = 30\%$

Then, $\frac{30}{100} \times x = 240$

$$x = \frac{240 \times 100}{30} = 800$$

$$\text{Number of boys} = \frac{70}{100} \times 800 = 560$$

(b) is correct.

HOTS

- Crate contains oranges = 400
  Spoiled oranges = 8 dozen = $8 \times 12 = 96$
  Good oranges = $400 - 96 = 304$

  Percentage of good oranges = $\frac{304}{400} \times 100 = 76\%$

VALUE BASED

- Vishal earning per month = ` 50,000

  He spends food, education, clothes, rent, etc. = 70%
  Remaining income = 30%
  He donate money = 40% of 30% of ` 50,000

  $= \frac{40}{100} \times \frac{30}{100} \times 50000 =$ ` 6,000

  Hence, vishal donate ` 6,000 to the school.

Chapter 11 Profit and Loss

EXERCISE 11A

1. (a) SP = $` \left[\frac{(100 - \text{Loss }\%)}{100} \times \text{CP}\right] = ` \left[\frac{\left(100 - 12\frac{1}{2}\right)}{100} \times 8640\right]$

$= ` \left[\frac{(200-25)}{200} \times 8640\right] = ` \left[\frac{175}{200} \times 8640\right] =$ ` 7560

(b) SP = $` \left[\frac{(100 + \text{Profit }\%)}{100} \times \text{CP}\right]$

$= ` \left[\frac{(100+6)}{100} \times 950\right] = ` \left[\frac{106}{100} \times 950\right] =$ ` 1007

2. (a) CP = ` 1800, SP = ` 1611

Since, CP > SP, so there is a loss.

Loss = CP − SP

$= ` (1800 - 1611) =$ ` 189

Loss % = $\left(\frac{\text{loss}}{\text{CP}} \times 100\right)\% = \left(\frac{189}{1800} \times 100\right)\%$

$= 10.5\%$

(b) CP = ` 12000, SP = ` 12800

Since, SP > CP, so there is a profit.

$$\text{Profit} = \text{SP} - \text{CP}$$

$$= ` (12800 - 12000) = ` 800$$

$$\text{Profit \%} = \left(\frac{\text{Profit}}{\text{CP}} \times 100\right)\% = \left(\frac{800}{12000} \times 100\right)\%$$

$$= 6.66\% = 6\frac{2}{3}\%$$

3. (a) $\text{CP} = ` \left(\frac{100}{(100 - \text{Loss \%})} \times \text{SP}\right) = ` \left(\frac{100}{100 - 6\frac{2}{3}\%} \times 5600\right)$

$$= ` \left(\frac{100 \times 5600 \times 3}{280}\right) = ` 6000$$

(b) $\text{CP} = ` \left(\frac{100}{(100 + \text{gain \%})} \times \text{SP}\right) = ` \left(\frac{100}{100 + 12\frac{1}{2}\%} \times 1755\right)$

$$= ` \left(\frac{100 \times 1755 \times 2}{225}\right) = ` 1560$$

4. CP of 12 bananas = ` 25

SP of 5 bananas = ` 12

SP of 1 banana = $` \frac{12}{5}$

SP of 12 bananas = $` \frac{12}{5} \times 12 = ` \frac{144}{5}$

Since, SP > CP, there is a profit.

$$\text{Profit} = \text{SP} - \text{CP}$$

$$= ` \left(\frac{144}{5} - 25\right) = ` \left(\frac{144 - 125}{5}\right) = ` \frac{19}{5}$$

$$\text{Profit\%} = \left(\frac{\text{Profit}}{\text{CP}} \times 100\right)\% = \left(\frac{19}{5 \times 25} \times 100\right)\% = 15.2\%$$

Hence, profit = 15.2%

5. Total investment on TV = ` (13600 + 400) = ` 14000

SP of the TV = ` 16800

$$\text{Profit} = \text{SP} - \text{CP}$$

$$= ` (16800 - 14000) = ` 2800$$

$$\text{Profit\%} = \left(\frac{\text{Profit}}{\text{CP}} \times 100\right)\%$$

$$= \left(\frac{2800}{14000} \times 100\right)\% = 20\%$$

Hence, the profit % of the TV is 20%.

6. Total investment on house = ` $(765000 + 115000) =$ ` 880000

$$\text{Selling price} = \text{`}\left(880000 \times \frac{105}{100}\right) = \text{`}\ 924000$$

Hence, Anil got ` 924000.

7. Let the CP of each spoon be ` 1.

CP of 16 spoons = ` 16

SP of 16 spoons = CP of 15 spoons = ` 15

Thus, CP = ` 16 and SP = ` 15

$$\text{Loss} = \text{CP} - \text{SP}$$

$$= \text{`}\ (16 - 15) = \text{`}\ 1$$

$$\text{Loss\%} = \left(\frac{\text{loss}}{\text{CP}} \times 100\right)\% = \left(\frac{1}{16} \times 100\right)\%$$

$$= \frac{25}{4}\% = 6\frac{1}{4}\%$$

Hence, loss $\% = 6\frac{1}{4}\%$

8. Let the CP of each pen be ` 1.

CP of 12 pens = ` 12

SP of 12 pens = CP of 15 pens = ` 15

Thus, CP = ` 12 and SP = ` 15

$$\text{Profit} = \text{SP} - \text{CP} = \text{`}\ 15 - \text{`}\ 12 = \text{`}\ 3$$

$$\text{Profit \%} = \left(\frac{\text{profit}}{\text{CP}} \times 100\right)\% = \left(\frac{3}{12} \times 100\right)\% = 25\%$$

Hence, gain per cent = 25%

9. CP for Dinesh = SP for Suresh

$$= \text{`}\ 12000 \times \frac{110}{100} = \text{`}\ 13200$$

CP for Harsh = SP for Dinesh

$$= \text{`}\ 13200 \times \frac{95}{100} = \text{`}\ 12540$$

Hence, Harsh paid ` 12540 for music system.

10. SP = ` 24480, loss = 4%

$$\text{CP} = ₹\left[\frac{100}{(100-\text{Loss }\%)} \times \text{SP}\right]$$

$$= ₹\left[\frac{100}{(100-4)} \times 24480\right]$$

$$= ₹\left[\frac{100 \times 24480}{96}\right] = ₹\ 25500$$

CP = ` 25500, gain = 4%

$$\text{SP} = ₹\left[\frac{(100+\text{Profit }\%)}{100} \times \text{CP}\right]$$

$$= ₹\left[\frac{(100+4)}{100} \times 25500\right]$$

$$= ₹\left[\frac{104}{100} \times 25500\right] = ₹\ 26520$$

Hence, the dealer should sell the watch for ` 26520.

11. SP = ` 1325, gain = 6%

$$\text{CP} = ₹\left[\frac{100}{(100+\text{gain }\%)} \times \text{SP}\right]$$

$$= ₹\left[\frac{100}{(100+6)} \times 1325\right] = ₹\left[\frac{100}{106} \times 1325\right]$$

$$= ₹\ 1250$$

CP = ` 1250, gain = 12%

$$\text{SP} = ₹\left[\frac{(100+\text{Profit }\%)}{100} \times \text{CP}\right]$$

$$= ₹\left[\frac{(100+12)}{100} \times 1250\right] = ₹\left[\frac{112}{100} \times 1250\right] = ₹\ 1400$$

Hence, SP of the watch = ` 1400

12. SP = ` 11400, loss = 5%

$$\text{CP} = ₹\left[\frac{100}{(100-\text{Loss }\%)} \times \text{SP}\right]$$

$$= ₹\left[\frac{100}{(100-5)} \times 11400\right] = ₹\left[\frac{100}{95} \times 11400\right]$$

$$= ₹\ 12000$$

Hence, the shopkeeper should purchase the TV for ` 12000.

13. SP = ` 21600, gain = 8%

$$\text{CP} = \text{`}\left\{\frac{100}{(100+\text{gain }\%)}\times \text{SP}\right\}$$

$$= \text{`}\left\{\frac{100}{(100+8)}\times 21600\right\}$$

$$= \text{`}\left\{\frac{100}{108}\times 21600\right\}$$

$$= \text{`}\ 20000$$

Hence, the CP of the TV is ` 20000.

14. CP for Pawan = $\text{`}\ 14300\times\frac{100}{104} = \text{`}\ 13750$

CP for Mohan = $\text{`}\ 13750\times\frac{100}{110} = \text{`}\ 12500$

15. Let the CP of the washing machine be ` x.

SP = ` 7350, gain = $\frac{1}{6}$ of C.P. = ` $\frac{x}{6}$

$$\text{CP} = \text{SP} - \text{gain}$$

$$x = 7350 - \frac{x}{6}$$

$$x + \frac{x}{6} = 7350$$

$$\frac{7x}{6} = 7350$$

$$x = 7350\times\frac{6}{7} = 6300$$

Hence, the CP of the washing machine = ` 6300.

16. Let the CP of the cycle be ` x.

$$\text{SP}_1 = \text{`}\ x\times\frac{115}{100} = \text{`}\ \frac{115x}{100}$$

$$\text{SP}_2 = \text{`}\ x\times\frac{120}{100} = \text{`}\ \frac{120x}{100}$$

According to question,

$$\text{SP}_2 - \text{SP}_1 = \text{`}\ 108$$

$$\frac{120x}{100} - \frac{115x}{100} = \text{`}\ 108$$

$$\frac{(120-115)x}{100} = \text{`}\ 108$$

$$\frac{5x}{100} = ₹\ 108$$

$$x = ₹\ \frac{108 \times 100}{5} = ₹\ 2160$$

Hence, the CP of the cycle = ₹ 2160

17. Let the CP of the cooler be ₹ x.

$$SP_1 = ₹\ x \times \frac{92}{100} = ₹\ \frac{92x}{100}$$

$$SP_2 = ₹\ x \times \frac{106}{100} = ₹\ \frac{106x}{100}$$

According to question,

$$SP_2 - SP_1 = ₹\ 3360$$

$$\frac{106x}{100} - \frac{92x}{100} = ₹\ 3360$$

$$\frac{(106-92)x}{100} = ₹\ 3360$$

$$\frac{14x}{100} = ₹\ 3360$$

$$x = ₹\ \frac{3360 \times 100}{14}$$

$$x = ₹\ 24000$$

Hence, the CP of the cooler = ₹ 24000

18. **First fan :** SP = ₹ 2376, gain = 10%

$$CP_1 = ₹\ \left[\frac{100}{(100 + \text{gain }\%)} \times SP\right]$$

$$= ₹\ \left[\frac{100}{(100+10)} \times 2376\right] = ₹\ \left[\frac{100}{110} \times 2376\right] = ₹\ 2160$$

Second fan : SP = ₹ 2376, loss = 10%

$$CP_2 = ₹\ \left[\frac{100}{(100 - \text{loss }\%)} \times SP\right]$$

$$= ₹\ \left[\frac{100}{(100-10)} \times 2376\right]$$

$$= ₹\ \left[\frac{100}{90} \times 2376\right]$$

$$= ₹\ 2640$$

Total SP = ` (2376 × 2) = ` 4752

Total CP = $CP_1 + CP_2$

= ` 2160 + ` 2640

= ` 4800

Since, SP < CP, so there is a loss.

$$\text{loss \%} = \left(\frac{CP - SP}{CP} \times 100\right)\%$$

$$= \left(\frac{(4800 - 4752)}{4800} \times 100\right)\%$$

$$= \frac{48}{4800} \times 100\%$$

$$= 1\%$$

Hence, loss = 1%

EXERCISE 11B

1. $CP = ₹\ 198 \times \frac{100}{110} = ₹\ 180$

(a) is correct.

2. CP = ` (100 − 20) = ` 80

Profit = ` 20

$$\text{Profit \%} = \left(\frac{\text{profit}}{CP} \times 100\right)\%$$

$$= \left(\frac{20}{80} \times 100\right)\% = 25\%$$

(b) is correct.

3. loss = ` (120 − 105) = ` 15

$$\text{loss \%} = \left(\frac{\text{loss}}{CP} \times 100\right)\%$$

$$= \left(\frac{15}{120} \times 100\right)\% = 12\frac{1}{2}\%$$

(a) is correct.

4. Profit = ` (100 − 80) = ` 20

$$\text{Profit} = ₹\left(\frac{20}{80} \times 100\right)\% = 25\%$$

(b) is correct.

5. CP = ` $144 \times \frac{100}{90}$ = ` 160

SP of gain 10% = ` $160 \times \frac{110}{100}$ = ` 176

(c) is correct.

6. Let the CP of 1 chocolate be ` 1.

CP of 3 chocolates be = ` 3

SP of 3 chocolates = CP of 4 chocolates

= ` 4

Profit = ` (4 − 3) = ` 1

$$\text{Profit \%} = \left(\frac{1}{3} \times 100\right)\% = 33\frac{1}{3}\%$$

(d) is correct.

7. CP = ` $48 \times \frac{100}{80}$ = ` 60

SP = ` $60 \times \frac{120}{100}$ = ` 72

(d) is correct.

8. Let the CP of 1 orange be ` 1.

CP of 15 oranges = ` 15

SP of 15 oranges = CP of 12 oranges = ` 12

loss = ` (15 − 12) = ` 3

$$\text{loss \%} = \left(\frac{\text{loss}}{\text{CP}} \times 100\right)\%$$

$$= \left(\frac{3}{15} \times 100\right)\% = 20\%$$

(a) is correct.

9. SP = ` 630, loss = 10%

$$\text{CP} = ₹\left[\frac{100}{(100 - \text{loss \%})} \times \text{SP}\right]$$

$$= ₹\left[\frac{100}{(100 - 10)} \times 630\right]$$

$$= ₹\left[\frac{100}{90} \times 630\right] = ₹\ 700$$

(c) is correct.

10. SP = ` 720, gain = 20%

$$\text{CP} = ₹\left[\frac{100}{(100+\text{profit }\%)} \times \text{SP}\right]$$

$$= ₹\left[\frac{100}{(100+20)} \times 720\right]$$

$$= ₹\left[\frac{100}{120} \times 720\right]$$

$$= ₹\ 600$$

(d) is correct.

HOTS

- 50 articles baught = ` 20,000

  1 article $= \frac{₹\ 20000}{50} = ₹\ 400$

  20 articles = ` 400 × 20 = ` 8000

  C.P. = ` 8000, Profit% = 15%

  S.P. $= \left(\frac{100+15}{100}\right) \times 8000 =$ ` 9200

  If profit is 30% then S.P. of 50 articles $= \left(\frac{100+30}{100}\right) \times 20000 = 26000$

  S.P. of rest 30 articles = 26000 − 9200 = 16800

  S.P. of 1 article $= \frac{16800}{30} =$ ` 560

Chapter 12 Simple Interest

EXERCISE 12A

1. $P =$ ` 5000, $R = 9\%$ p.a. and $T = 146$ days $= \frac{146}{365}$ year

$$SI = \frac{P \times R \times T}{100} = ₹\left[\frac{5000 \times 9 \times 146}{100 \times 365}\right] =$$ ` 180

Amount = Principal + SI

= ` (5000 + 180)

= ` 5180

$SI =$ ` 180 and amount = ` 5180

2. $P =$ ` 9600, $R = 7\frac{1}{2}\%$ p.a. $= \frac{15}{2}\%$ p.a. and $T = 5$ months $= \frac{5}{12}$ year

$$SI = \frac{P \times R \times T}{100} = ₹\left(\frac{9600 \times 15 \times 5}{100 \times 2 \times 12}\right) = ₹\ 300$$

$$\text{Amount} = \text{Principal} + SI$$
$$= ₹\ (9600 + 300)$$
$$= ₹\ 9900$$

$SI = ₹\ 300$ and amount $= ₹\ 9900$

3. $P = ₹\ 1500$, $R = 12\%$ p.a.

and $T = 3$ years 3 months $= \left(3 + \frac{3}{12}\right)$ years $= \frac{13}{4}$ years

$$SI = \frac{P \times R \times T}{100} = ₹\left(\frac{1500 \times 12 \times 13}{100 \times 4}\right) = ₹\ 585$$

$$\text{Amount} = \text{Principal} + SI$$
$$= ₹\ (1500 + 585) = ₹\ 2085$$

$SI = ₹\ 585$ and amount $= ₹\ 2085$

4. $P = ₹\ 2650$, $R = 8\%$ p.a. and $T = 2\frac{1}{2}$ years $= \frac{5}{2}$ years

$$SI = \frac{P \times R \times T}{100} = ₹\left(\frac{2650 \times 8 \times 5}{100 \times 2}\right) = ₹\ 530$$

$$\text{Amount} = \text{Principal} + SI$$
$$= ₹\ (2650 + 530) = ₹\ 3180$$

$SI = ₹\ 530$ and amount $= ₹\ 3180$

5. $P = ₹\ 6400$, $R = 6\%$ p.a. and $T = 2$ years

$$SI = \frac{P \times R \times T}{100} = ₹\left(\frac{6400 \times 6 \times 2}{100}\right) = ₹\ 768$$

$$\text{Amount} = \text{Principal} + SI$$
$$= ₹\ (6400 + 768)$$
$$= ₹\ 7168$$

$SI = ₹\ 768$ and amount $= ₹\ 7168$

6. $P = ₹\ 9640$, $SI = ₹\ 1908$, $R = 8\%$ p.a.

$$T = \left(\frac{100 \times SI}{P \times R}\right) \text{years} = \left(\frac{100 \times 1908}{9640 \times 8}\right) \text{years}$$
$$= 2.5 \text{ years}$$

7. $P = ₹\ 6400$, $SI = ₹\ 1152$, $R = 6\%$ p.a.

$$T = \left(\frac{100 \times SI}{P \times R}\right) \text{years} = \left(\frac{100 \times 1152}{6400 \times 6}\right) \text{years}$$
$$= 3 \text{ years}$$

8. $P = ₹\ 5000,\ A = ₹\ 6450$ and $R = 12\%$ p.a.

$$SI = A - P$$
$$= ₹\ 6450 - ₹\ 5000$$
$$= ₹\ 1450$$
$$T = \left(\frac{100 \times SI}{P \times R}\right) \text{years} = \left(\frac{100 \times 1450}{5000 \times 12}\right) \text{years}$$
$$= 2 \text{ years } 5 \text{ months}$$

9. $P = ₹\ 3560,\ A = ₹\ 4521.20$ and $T = 3$ years

$$SI = A - P$$
$$= ₹\ 4521.20 - ₹\ 3560$$
$$= ₹\ 961.20$$
$$R = \left(\frac{100 \times SI}{P \times T}\right) = \left(\frac{100 \times 961.20}{3560 \times 3}\right)\% \text{ p.a.} = 9\% \text{ p.a.}$$

10. $P = ₹\ 8250,\ SI = ₹\ 1100$ and $T = 2$ years

$$R = \left(\frac{100 \times SI}{P \times T}\right) = \left(\frac{100 \times 1100}{8250 \times 2}\right)\% \text{ p.a.} = 6\frac{2}{3}\% \text{ p.a.}$$

11. $P = ₹\ 5200,\ SI = ₹\ 975$ and $T = 2\frac{1}{2}$ years $= \frac{5}{2}$ years

$$R = \left(\frac{100 \times SI}{P \times T}\right) = \left(\frac{100 \times 975 \times 2}{5200 \times 5}\right)\% \text{ p.a.} = 7.5\% \text{ p.a.}$$

12. $SI = ₹\ 829.50,\ T = 3$ years and $R = 10\%$ per annum

$$P = \frac{SI \times 100}{R \times T}$$
$$= ₹\left(\frac{829.50 \times 100}{10 \times 3}\right) = ₹\ 2765$$

Hence, the sum is ₹ 2765.

13. $A = ₹\ 4491,\ R = 11\%$ p.a.

and $T = 2$ years 3 months $= \left(2 + \frac{3}{12}\right)$ years $= \frac{9}{4}$ years

Let P be the principle amount.

$$A = P + \frac{PRT}{100}$$
$$4491 = P\left(1 + \frac{11 \times 9}{4 \times 100}\right)$$
$$4491 = P(1.2475)$$

$$P = ₹\ 3600$$

$$SI = ₹\left(\frac{3600 \times 11 \times 3}{100}\right) = ₹\ 1188$$

$$A = P + SI = ₹\ 3600 + ₹\ 1188 = ₹\ 4788$$

Hence, the required amount is ₹ 4788.

14. $A = ₹\ 12122$, $R = 8\%$ p.a. and $T = 2$ years

Let P be the principle amount.

$$A = P + \frac{PRT}{100}$$

$$12122 = P\left(1 + \frac{8 \times 2}{100}\right)$$

$$12122 = P(1.16)$$

$$P = ₹\ 10450$$

$$2 \text{ years } 8 \text{ months} = \left(2 + \frac{8}{12}\right) \text{years} = \frac{8}{3} \text{ years}$$

$$SI = ₹\ \frac{10450 \times 9 \times 8}{100 \times 3} = ₹\ 2508$$

$$A = P + SI$$

$$= ₹\ 10450 + ₹\ 2508 = ₹\ 12958$$

Hence, the required amount is ₹ 12958.

15. $P = ₹\ 6000$, $T = 3$ years 8 months $= \left(3 + \frac{8}{12}\right)$ years $= \frac{11}{3}$ years,

$R = 12\%$ p.a.

$$SI = \frac{P \times R \times T}{100} = ₹\ \frac{6000 \times 12 \times 11}{100 \times 3} = ₹\ 2640$$

$$A = P + SI = ₹\ 6000 + ₹\ 2640 = ₹\ 8640$$

Hence, ₹ 8640 will clear Vikas's debt.

16. $P = ₹\ 12600$, $R = 15\%$ p.a., $T = 3$ years

$$SI = \frac{P \times R \times T}{100}$$

$$= ₹\left(\frac{12600 \times 15 \times 3}{100}\right) = ₹\ 5670$$

$$A = P + SI$$

$$= ₹\ (12600 + 5670) = ₹\ 18270$$

Dev returned ₹ 7070 to the moneylender.

So, remaining money = ₹ $(18270 - 7070)$ = ₹ 11200

Hence, the cost of the goat is ₹ 11200.

17. $P = ₹\ 5600,\ A = ₹\ 6720$ and $R = 8\%$ p.a.

$$SI = A - P$$
$$= ₹\ 6720 - ₹\ 5600 = ₹\ 1120$$
$$T = \frac{SI \times 100}{P \times R} = \frac{1120 \times 100}{5600 \times 8} \text{ years} = 2.5 \text{ years}$$

Hence, the required time is 2.5 years.

18. $P = ₹\ 640,\ A = ₹\ 768$ and $T = 2$ years 6 months $= \left(2 + \frac{6}{12}\right)$ years $= \frac{5}{2}$ years

$$SI = A - P$$
$$= ₹\ 768 - ₹\ 640 = ₹\ 128$$
$$R = \frac{100 \times SI}{P \times T}$$
$$= \left(\frac{100 \times 128 \times 2}{640 \times 5}\right)\% \text{ p.a.} = 8\% \text{ p.a.}$$

Now, $P = ₹\ 850,\ T = 3$ years, $R = 8\%$ p.a.

$$SI = \frac{P \times R \times T}{100} = ₹\left(\frac{850 \times 8 \times 3}{100}\right) = ₹\ 204$$

$$\text{Amount} = P + SI$$
$$= ₹\ 850 + ₹\ 204 = ₹\ 1054$$

Hence, the required amount is ₹ 1054.

19. $P = ₹\ 3600,\ A = ₹\ 4734,\ T = 3\frac{1}{2}$ years $= \frac{7}{2}$ years

$$SI = A - P$$
$$= ₹\ 4734 - ₹\ 3600 = ₹\ 1134$$
$$R = \frac{100 \times SI}{P \times T}\%$$
$$= \left(\frac{100 \times 1134 \times 2}{3600 \times 7}\right)\% \text{ p.a.} = 9\% \text{ p.a.}$$

20. Let the sum be ₹ 100.

After 5 years, amount $= ₹\left(\frac{8}{5} \times 100\right) = ₹\ 160$

$$SI = A - P$$
$$= ₹\ 160 - ₹\ 100 = ₹\ 60$$
$$R = \frac{100 \times SI}{P \times T} = \left(\frac{100 \times 60}{100 \times 5}\right)\% \text{ p.a}$$
$$= 12\% \text{ p.a.}$$

21. Amount in 3 years = Principal + *SI* for 3 years = ` 837

Amount in 2 years = Principal + *SI* for 2 years = ` 783

On subtracting, we get

SI for 1 year = ` (837 − 783) = ` 54

SI for 2 years = ` (54 × 2) = ` 108

Sum = Amount for 2 years − *SI* for 2 years

= ` 783 − ` 108 = ` 675

Now, P = ` 675, $SI$ = ` 108, T = 2 years

$$R = \frac{100 \times SI}{P \times T} = \left(\frac{100 \times 108}{675 \times 2}\right)\% \text{ p.a.} = 8\% \text{ p.a.}$$

22. Let the first part be ` x.

Then, the second part = ` $(3600 - x)$

SI on ` $x$ at 9% p.a. for 1 year = ` $\left(\frac{x \times 9 \times 1}{100}\right) =$ ` $\frac{9}{100}x$

SI on ` $(3600 - x)$ at 10% p.a. for 1 year = ` $\left\{\frac{(3600 - x) \times 10 \times 1}{100}\right\}$

$$= \text{`} \left(\frac{36000 - 10x}{100}\right) = \text{`} \left(\frac{3600 - x}{10}\right)$$

According to question,

$$\frac{9}{100}x + \left(\frac{3600 - x}{10}\right) = 333$$

$$\frac{9x + 36000 - 10x}{100} = 333$$

$$-x = 33300 - 36000 = -2700$$

$$x = 2700$$

Hence, the first part = ` 2700

and the second part = ` (3600 − 2700) = ` 900

EXERCISE 12B

1. Let the sum be ` 100.

Then, the amount = ` $\left(100 \times \frac{6}{5}\right) =$ ` 120

$$SI = A - P = \text{` } 120 - \text{` } 100 = \text{` } 20$$

$$T = 2\frac{1}{2} \text{ years} = \frac{5}{2} \text{ years}$$

$$R = \frac{100 \times SI}{P \times T} = \left(\frac{100 \times 20 \times 2}{100 \times 5}\right)\% \text{ p.a.} = 8\% \text{ p.a.}$$

(c) is correct.

2. $P = ₹\ 6250$, $R = 4\%$ p.a., $T = 6$ months $= \frac{6}{12}$ years $= \frac{1}{2}$ years

$$SI = \frac{P \times R \times T}{100} = ₹\ \frac{6250 \times 4 \times 1}{100 \times 2} = ₹\ 125$$

(a) is correct.

3. Let the required sum be ₹ x.

Then, $$SI = ₹\left(\frac{x \times 5 \times 219}{100 \times 365}\right) = ₹\left(\frac{219x}{20 \times 365}\right)$$

$$\text{Amount} = ₹\left(x + \frac{219x}{20 \times 365}\right) = ₹\left(\frac{7300x + 219x}{7300}\right) = ₹\ \frac{7519x}{7300}$$

But, Amount = ₹ 3605

$$\frac{7519x}{7300} = 3605$$

$$x = \frac{3605 \times 7300}{7519} = 3500$$

(b) is correct.

4. Let the sum be ₹ 100.

Then, $$SI = ₹\left(100 \times \frac{2}{5}\right) = ₹\ 40$$

$$R = \frac{100 \times SI}{P \times T} = \left(\frac{100 \times 40}{100 \times 5}\right)\% \text{ p.a.} = 8\% \text{ p.a.}$$

(b) is correct.

5. $P = \frac{100 \times SI}{R \times T} = ₹\left(\frac{100 \times x}{x \times x}\right) = ₹\ \frac{100}{x}$

(c) is correct.

6. Let the sum be ₹ 100.

$$\text{Amount} = ₹\ (100 \times 2) = ₹\ 200$$

Then, $SI = ₹\ 200 - ₹\ 100 = ₹\ 100$

$$R = \frac{100 \times SI}{P \times T} = \left(\frac{100 \times 100}{100 \times 10}\right)\% \text{ p.a.} = 10\% \text{ p.a.}$$

(b) is correct.

7. $SI = ₹\ 8360 - ₹\ 8000 = ₹\ 360$

$$T = \frac{100 \times SI}{P \times R} = \frac{100 \times 360}{8000 \times 6} = 0.75 \text{ years}$$

$$= \frac{3}{4} \text{ years} = 9 \text{ months}$$

(b) is correct.

8. Let the sum be ` 100.

$$SI = ` (100 \times 0.125) = ` 12.5$$

$$T = \frac{100 \times SI}{P \times R} = \frac{100 \times 12.5}{100 \times 10} \text{ years}$$

$$= 1.25 \text{ years} = 1\frac{1}{4} \text{ years}$$

(a) is correct.

9. $P = \frac{100 \times SI}{R \times T} = ` \left(\frac{100 \times 210}{\frac{15}{4} \times \frac{7}{3}}\right) = ` \left(\frac{100 \times 210 \times 4 \times 3}{15 \times 7}\right) = ` 2400$

(b) is correct.

10. $P = ` 600$, $A = ` 720$, $T = 4$ years

$$SI = A - P = ` 720 - ` 600 = ` 120$$

$$R = \frac{100 \times SI}{P \times T} = \left(\frac{100 \times 120}{600 \times 4}\right)\% \text{ p.a.} = 5\% \text{ p.a.}$$

New rate of interest = (5% + 2%) p.a. = 7% p.a.

Then, $SI = ` \frac{600 \times 7 \times 4}{100} = ` 168$

Amount = ` 600 + ` 168 = ` 768

(c) is correct.

HOTS

- Let us suppose, principal = P

  Then, as per given amount = $2P$

  $$T = 10 \text{ years}$$

  Now, $\text{Amount} = \text{Principal} + SI$

  $$2P = P + SI$$

  $$SI = 2P - P = P$$

  Now, $$R = \frac{SI \times 100}{P \times T} = \frac{P \times 100}{P \times 10} = 10\%$$

  Now, as per given new amount = $3P$

  $$R = 10\%$$

  $$SI = 3P - P = 2P$$

  $$T = \frac{SI \times 100}{P \times R} = \frac{2P \times 100}{P \times 10} = 20 \text{ years}$$

  Hence, in 20 years the same sum become three times at the same rate of interest.

EXERCISE 13

1. (a) The given angle is 25°.

Let the measure of its complement be $x°$. Then,

$$x° + 25° = 90°$$

$$x° = (90° - 25°) = 65°$$

Hence, the complement of the given angle measures 65°.

(b) The given angle is 57°.

Let the measure of its complement be $x°$. Then,

$$x° + 57° = 90°$$

$$x° = (90° - 57°) = 33°$$

Hence, the complement of the given angle measures 33°.

(c) The given angle is 70°.

Let the measure of its complement be $x°$. Then,

$$x° + 70° = 90°$$

$$x° = (90° - 70°) = 20°$$

Hence, the complement of the given angle measures 20°.

(d) The given angle is 86°.

Let the measure of its complement be $x°$. Then,

$$x° + 86° = 90°$$

$$x° = (90° - 86°) = 4°$$

Hence, the complement of the given angle measures 4°.

2. (a) The given angle measures 75°.

Let its supplement be $x°$. Then,

$$x° + 75° = 180°$$

$$x° = (180° - 75°) = 105°$$

Hence, the supplement of the given angle measures 105°.

(b) The given angle measures 44°.

Let its supplement be $x°$. Then,

$$x° + 44° = 180°$$

$$x° = (180° - 44°) = 136°$$

Hence, the supplement of the given angle measures 136°.

(c) The given angle measures 115°.

Let its supplement be $x°$. Then,

$$x° + 115° = 180°$$

$$x° = (180° - 115°) = 65°$$

Hence, the supplement of the given angle measures 65°.

(d) The given angle measures 132°.

Let its supplement be $x°$. Then,

$$x° + 132° = 180°$$

$$x° = (180° - 132°) = 48°$$

Hence, the supplement of the given angle measures 48°.

3. Let the measure of the required angle be $x°$. Then,

$$x° + x° = 180°$$

$$2x° = 180°$$

$$x° = 90°$$

Hence, the required angle measures 90°.

4. Let the angles be $x°$ and $(180° - x°)$.

$$(180° - x°) - x° = 36°$$

$$180° - 2x° = 36°$$

$$2x° = 180° - 36° = 144°$$

$$x° = \frac{144°}{2} = 72°$$

Hence, smaller angle $= 72°$

and larger angle $= 180° - 72° = 108°$

5. (a) No (b) Yes (c) No

6. $AOC + BOC = 180°$ (linear pair)

$$74° + x = 180°$$

$$x = 180° - 74° = 106°$$

Hence, the value of x is 106°.

7. $AOC + BOC = 180°$ (linear pair)

$$(2x - 10)° + (3x + 20)° = 180°$$

$$5x + 10 = 180$$

$$5x = 180 - 10 = 170$$

$$x = \frac{170}{5} = 34$$

Hence, $AOC = (2 \times 34 - 10)° = (68 - 10)° = 58°$

and $BOC = (3 \times 34 + 20)° = (102 + 20)° = 122°$

8. $63° + x + 72° = 180°$ (linear pair)

$$135° + x = 180°$$

$$x = 180° - 135° = 45°$$

Hence, $x = 45°$.

9. (a) $AOC + AOD = 180°$ (linear pair)

$32° + AOD = 180°$

$AOD = 180° - 32° = 148°$

(b) $BOD + AOC = 32°$ (vertically opposite angles)

(c) $AOC + COB = 180°$ (linear pair)

$32° + COB = 180°$

$COB = 180° - 32° = 148°$

10. (a) $POR + POS = 180°$ (linear pair)

$POR + 118° = 180°$

$POR = 180° - 118° = 62°$

(b) $ROQ = POS = 118°$ (vertically opposite angles)

(c) $QOS + POS = 180°$ (linear pair)

$QOS + 118° = 180°$

$QOS = 180° - 118° = 62°$

HOTS

- Let the measure of the larger angle be $x°$, then the measure of the smaller angle will be $(x - 30)°$.
  Since, the sum of complementary angle is 90°.
  So, $x° + (x - 30)° = 90°$

$$2x° = 90° + 30° = 120°$$

$$x° = \frac{120°}{2} = 60°$$

Hence, the larger angle = 60° and the smaller angle = 90° − 60° = 30°.

Chapter 14 Properties of Parallel Lines

EXERCISE 14

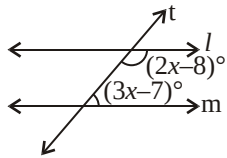
1. Sum of the consecutive interior angles is 180°

$(2x - 8)° + (3x - 7)° = 180°$

$5x - 15° = 180°$

$5x = 180° + 15° = 195°$

$$x = \frac{195°}{5} = 39°$$



$(2x - 8)° = (2 \times 39 - 8)° = (78 - 8)° = 70°$

$(3x - 7)° = (3 \times 39 - 7)° = (117 - 7)° = 110°$

2. $1 = 5 = 70°$ (Corresponding angles)

$3 = 1 = 70°$ (Vertically opposite angles)

$4 = 180° - 1$ (linear pair)

$4 = 180° - 70° = 110°$

$8 = 4 = 110°$ (corresponding angles)

3. Let $1 = 5x$ and $2 = 7x$

$1 + 2 = 5x + 7x = 180°$ (linear pair)

$12x = 180°$

$x = 15°$

$1 = 5 \times 15° = 75°, \quad 2 = 7 \times 15° = 105°,$

$3 = 1 = 75°, \quad 8 = 4 = 2 = 105°$

4. (a) $180° - 130° = 50° \neq 40°$; No

(b) $145° + 35° = 180°$; Yes

(c) $125° + 60° = 185° \neq 180°$; No

5. $1 = 50°$

(Vertically opposite angles)

$1 + x = 180°$

(Co-interior angles)

$50° + x = 180°$

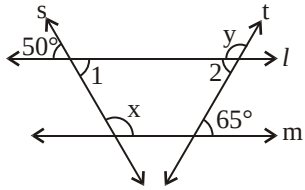
$x = 180° - 50° = 130°$

$2 = 65°$ (alternate interior angles)

$2 + y = 180°$ (linear pair)

$y = 180° - 2 = 180° - 65°$

$y = 115°$



Hence, $x = 130°$ and $y = 115°$

6. $x = B = 65°$ (alternate interior angles)

$y = C = 45°$ (alternate interior angles)

7. (a) $ACE = BAC = 80°$ (alternate interior angles)

(b) $ACB + ACE + ECD = 180°$

$ACB + 80° + 35° = 180°$

$ACB = 180° - (80° + 35°)$

$ACB = 180° - 115°$

$ACB = 65°$

(c) In ΔABC,

$BAC + ABC + ACB = 180°$

$80° + ABC + 65° = 180°$

$ABC + 145° = 180°$

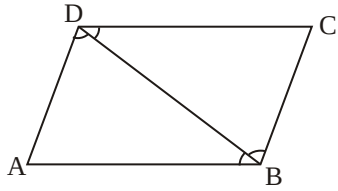
$ABC = 180° - 145° = 35°$

8. **Given:** A parallelogram *ABCD*.

To prove: $ADC = ABC$

Constuction: Join *B* and *D*.

Proof: Since $AB \| DC$ and *BD* is the transversal.



$$ABD = BDC$$

(alternate angles) ... (1)

Since $AD \| BC$ and *BD* is the transversal.

$$CBD = ADB$$ (alternate angles) ... (2)

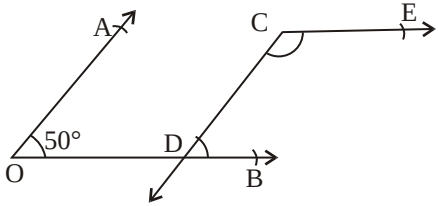
Adding (1) and (2)

$$ABD + CBD = BDC + ADB$$

$$ABC = ADC$$

Hence proved

9. Since $OA \| CD$ and *OB* is the transversal.



$$AOD = CDB = 50°$$

(corresponding angles)

$$ECD + CDB = 180°$$

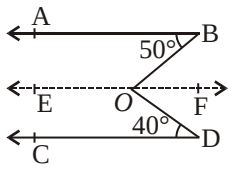
(consecutive interior angles)

$$ECD + 50° = 180°$$

$$ECD = 180° - 50° = 130°$$

10. Through *O*, draw $EF \| AB$.

Since, $EF \| BA$ and *OB* is a transversal.



$$OBA = BOF = 50°$$

(alternate angles) ... (1)

Since $EF \| DC$ and *OD* is a transversal.

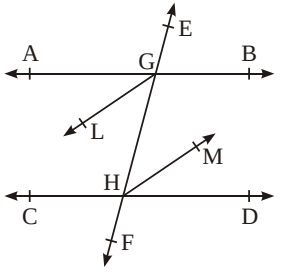
$$ODC = DOF = 40°$$ (alternate angles) ... (2)

Adding (1) and (2), we get

$$BOF + DOF = 50° + 40°$$

$$BOD = 90°$$

11. Since $AB \| CD$ and *EF* is a transversal.



$$AGH = GMD$$

(alternate angles)

$$\frac{AGH}{2} = \frac{GHD}{2}$$

$$LGH = GHM$$

(*GL* and *HM* are the bisectors)

Since, $LGH = GHM$ and these are alternate interior angles.

$GL \| HM$

12. $ABE = BEG = 120°$

(alternate angles)

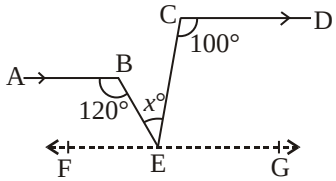
$ECD + CEG = 180°$

(consecutive interior angles)

$CEG = 180° - 100° = 80°$

$x° = BEG - CEG$

$= 120° - 80° = 40°$



13. $CAB + BAE = 180°$ (linear pair)

$x + 125° = 180°$

$x = 180° - 125° = 55°$

$x + z = 180°$

(consecutive interior angles)

$z = 180° - x = 180° - 55°$

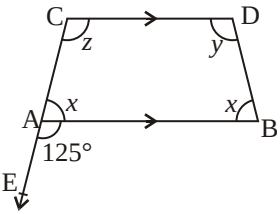
$z = 125°$

$x + y = 180°$

$55° + y = 180°$

$y = 180° - 55° = 125°$

Hence, $x = 55°$, $y = 125°$ and $z = 125°$



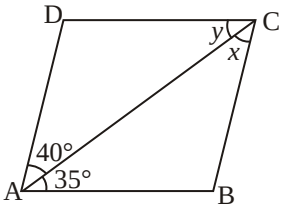
14. Since, $AB \| DC$ and AC is a transversal.

$y = 35°$ (alternate angles)

Since $AD \| BC$ and AC is a transversal.

$x = 40°$ (alternate angles)

Hence, $x = 40°$, $y = 35°$



15. $ABCD$ is a parallelogram.

($l \| m$ and $p \| q$)

$a = 65°$

(vertically opposite angles)

$a + b = 180°$

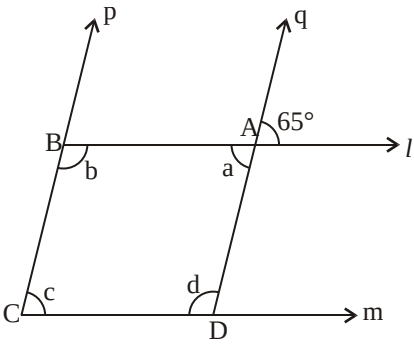
(consecutive interior angles)

$65° + b = 180°$

$b = 180° - 65° = 115°$

$d = b = 115°$

(opposite angles of a parallelogram)



$c = a = 65°$ (opposite angles of a parallelogram)

Hence, $a = 65°$, $b = 155°$, $c = 65°$ and $d = 115°$.

HOTS

- $6x = 108°$; $x = \frac{108°}{6} = 18°$

  $4z = 108°$; $z = \frac{108°}{4} = 27°$

  $3y = 4z = 108°$; $y = \frac{108°}{3} = 36°$

  $x = 18°$; $y = 36°$ and $z = 27°$.

Chapter 15 Triangle and Its Properties

EXERCISE 15 (A)

1. (a) QR (b) RPQ (c) Q

2. (a) Scalene triangle (b) Equilateral triangle
(c) Scalene triangle (d) Isosceles triangle

3. (a) Isosceles triangle (b) Scalene triangle
(c) Equilateral triangle

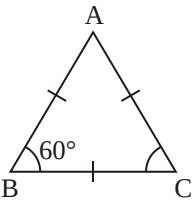
4. (a) Right-angled triangle (b) Obtuse-angled triangle
(c) Acute-angled triangle (b) Obtuse-angled triangle

5. (a) $C = B = 60°$ $(AB = AC)$

$A = C = 60°$ $(AB = BC)$

Since, each angle is less than 90°

ΔABC is an acute-angled triangle.

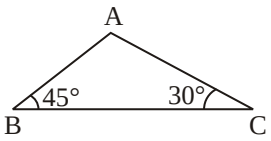


(b) $A = 180° - (45° + 30°)$

$= 180° - 75° = 105°$

Since, one angle is more than 90°.

ΔABC is an obtuse-angled triangle.

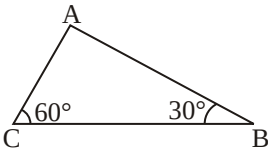


(c) $A = 180° - (60° + 30°)$

$= 180° - 90° = 90°$

Since, one angle is equal to 90°.

ΔABC is a right-angled triangle.

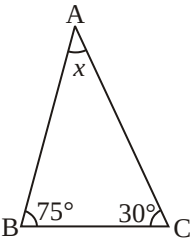


6. Altitude: AL ; Median; AL

EXERCISE 15 (B)

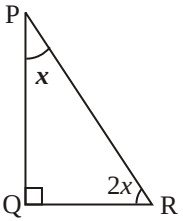
1. (a) In ΔABC,

$$A + B + C = 180°$$
$$x + 75° + 65° = 180°$$
$$x + 140° = 180°$$
$$x = 180° - 140°$$
$$x = 40°$$



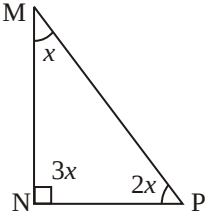
(b) In ΔPQR,

$$P + Q + R = 180°$$
$$x + 90° + 2x = 180°$$
$$3x = 180° - 90° = 90°$$
$$x = \frac{90°}{3} = 30°$$



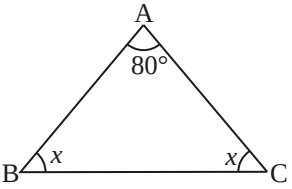
(c) In ΔMNP,

$$M + N + P = 180°$$
$$x + 3x + 2x = 180°$$
$$6x = 180°$$
$$x = \frac{180°}{6} = 30°$$



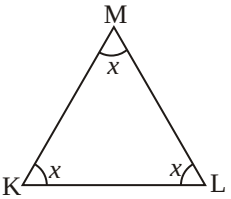
(d) In ΔABC,

$$A + B + C = 180°$$
$$80° + x + x = 180°$$
$$80° + 2x = 180°$$
$$2x = 180° - 80°$$
$$= 100°$$
$$x = \frac{100°}{2} = 50°$$

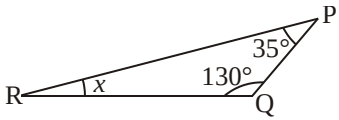


(e) In ΔMKL,

$$M + K + L = 180°$$
$$x + x + x = 180°$$
$$3x = 180°$$
$$x = \frac{180°}{3} = 60°$$

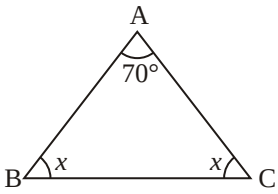


(f) In ΔPQR,



$$P + Q + R = 180°$$
$$35° + x + 130° = 180°$$
$$x + 165° = 180°$$
$$x = 180° - 165° = 15°$$

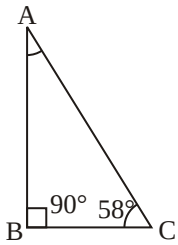
2. In ΔABC,



$$A + B + C = 180°$$
$$70° + x + x = 180°$$
$$2x + 70° = 180°$$
$$2x = 180° - 70°$$
$$= 110°$$
$$x = \frac{110°}{2} = 55°$$

Hence, $B = 55°$ and $C = 55°$.

3. In ΔABC,



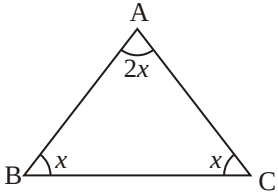
$$A + B + C = 180°$$
$$A + 90° + 58° = 180°$$
$$A + 148° = 180°$$
$$A = 180° - 148° = 32°$$

Hence, the measures of the other acute angle is 32°.

4. Let each base angle of ΔABC be $B = C = x$.

So, the vertical angle $A = 2x$

Since, the sum of three angles of a triangle is 180°.



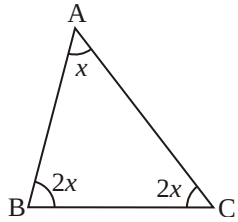
$$A + B + C = 180°$$
$$2x + x + x = 180°$$
$$4x = 180°$$
$$x = \frac{180°}{4} = 45°$$

Hence, $A = 2 \times 45° = 90°$, $B = 45°$ and $C = 45°$

5. Let $A = x$, $B = 2x$ and $C = 2x$

Since, the sum of three angles of a triangle is 180°.

$$A + B + C = 180°$$
$$x + 2x + 2x = 180°$$
$$5x = 180°$$
$$x = \frac{180°}{5} = 36°$$

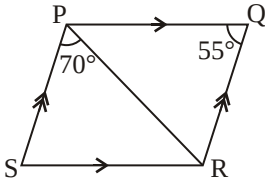


Hence, $A = 36°$, $B = C = 2 \times 36° = 72°$

6. Since $PS \parallel QR$ and PR is a transversal.

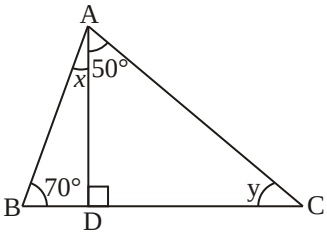
$$PRQ = SPR = 70°$$
$$PSR = PQR = 55°$$

(opposite angles of a parallelogram)



7. In ΔABD,

$$BAD + ABD + ADB = 180°$$
$$x + 70° + 90° = 180°$$
$$x + 160° = 180°$$
$$x = 180° - 160° = 20°$$

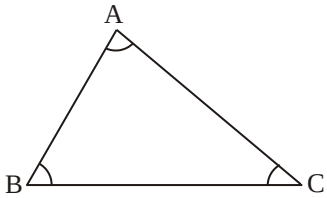


In ΔADC,

$$DAC + ADC + ACD = 180°$$
$$50° + 90° + y = 180°$$
$$y + 140° = 180°$$
$$y = 180° - 140° = 40°$$

8. Suppose $3 \quad A = 4 \quad B = 6 \quad C = K$

$$A = \frac{K}{3}, \quad B = \frac{K}{4} \text{ and } \quad C = \frac{K}{6}$$



Now, $A + B + C = 180°$

$$\frac{K}{3} + \frac{K}{4} + \frac{K}{6} = 180°$$
$$\frac{4K + 3K + 2K}{12} = 180°$$
$$9K = 180° \times 12$$
$$K = \frac{180° \times 12}{9} = 240°$$

So, $A = \frac{240°}{3} = 80°$, $B = \frac{240°}{4} = 60°$,

and $C = \frac{240°}{6} = 40°$

Hence, $A = 80°$, $B = 60°$ and $C = 80°$

EXERCISE 15 (C)

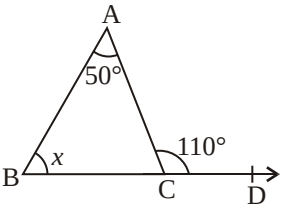
1. (a) $ACD = A + B$ (exterior angle property)

$110° = 50° + x$

$x = 110° - 50°$

$x = 60°$

Hence, $x = 60°$



(b) In ΔPKS, $PS = KS$ (given)

$P = K = x$

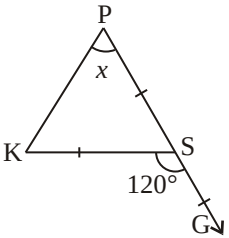
$KSG = P + K$ (exterior angle property)

$120° = x + x$

$2x = 120°$

$x = \frac{120°}{2} = 60°$

Hence, $x = 60°$



(c) $PQM + PQR = 180°$ (linear pair)

$120° + PQR = 180°$

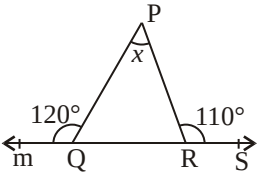
$PQR = 180° - 120°$

$= 60°$

$PRS + PRQ = 180°$ (linear pair)

$110° + PRQ = 180°$

$PRQ = 180° - 110° = 70°$



In ΔPQR,

$QPR + PQR + PRQ = 180°$

$x + 60° + 70° = 180°$

$x + 130° = 180°$

$x = 180° - 130° = 50°$

Hence, $x = 50°$

(d) $BAC = DAE$ (vertically opposite angles)

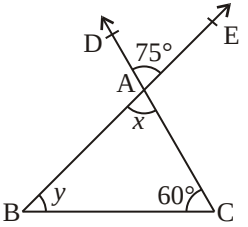
$x = 75°$

In ΔABC,

$A + B + C = 180°$

$x + y + 60° = 180°$

$75° + y + 60° = 180°$



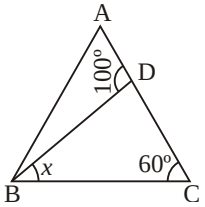
$$y + 135° = 180°$$
$$y = 180° - 135° = 45°$$

Hence, $x = 75°$ and $y = 45°$

(e) $ADB = DBC + BCD$

(exterior angle property)

$$100° = x + 60°$$
$$x = 100° - 60° = 40°$$



Hence, $x = 40°$

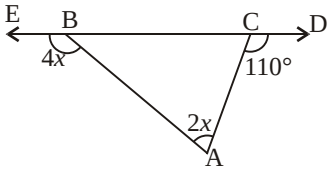
(f) $ABE + ABC = 180°$

(linear pair)

$$4x + ABC = 180°$$
$$ABC = 180° - 4x$$
$$ACD = ABC + BAC$$

(exterior angle property)

$$110° = (180° - 4x) + 2x$$
$$110° = 180° - 2x$$
$$2x = 180° - 110° = 70°$$
$$x = \frac{70°}{2} = 35°$$



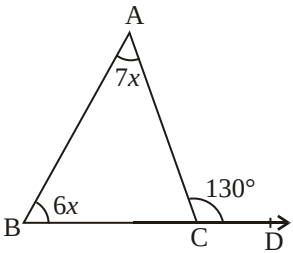
Hence, $BAC = 2 \times 30° = 70°$ and $ABE = 4 \times 35° = 140°$.

2. In ΔABC,

$$A = 7x \text{ and } B = 6x$$
$$ACD = A + B$$

(exterior angle property)

$$130° = 7x + 6x$$
$$13x = 130°$$
$$x = \frac{130°}{13} = 10°$$



Hence, $A = 7 \times 10° = 70°$, $B = 6 \times 10° = 60°$

and $ACB = 180° - 130° = 50°$

3. $ACB + ACD = 180°$

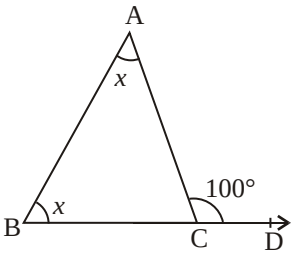
(linear pair)

$$ACB + 100° = 180°$$
$$ACB = 180° - 100° = 80°$$

In ΔABC,

$BAC + ABC + ACB = 180°$

(angle sum property of a triangle)



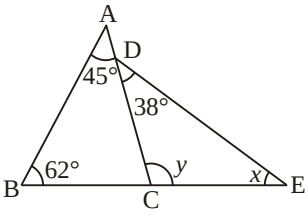
$$x + x + 80° = 180°$$

$$2x = 180° - 80° = 100°$$

$$x = \frac{100°}{2} = 50°$$

Hence, $BAC = 80°$, $ABC = 50°$ and $ACB = 80°$.

4. In ΔABC,



$BAC + ABC + ACB = 180°$

(angle sum property of a Δ)

$45° + 62° + ACB = 180°$

$107° + ACB = 180°$

$ACB = 180° - 107° = 73°$

$ACB + DCE = 180°$ (linear pair)

$73° + DCE = 180°$

$DCE = 180° - 73° = 107°$

$y = 107°$

In ΔCDE,

$CDE + DCE + CED = 180°$ (angle sum property of a triangle)

$38° + y + x = 180°$

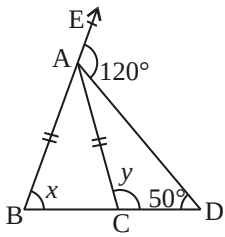
$38° + 107° + x = 180°$

$145° + x = 180°$

$x = 180° - 145° = 35°$

Hence, $x = 35°$ and $y = 107°$

5.



$DAE = ABD + ADB$

(exterior angle property)

$120° = x + 50°$

$x = 120° - 50° = 70°$

$\because$ $AB = AC$

$ACB = ABC = x$

$ACB = 70°$

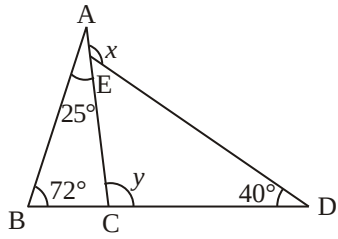
$ACB + ACD = 180°$ (linear pair)

$70° + y = 180°$

$y = 180° - 70° = 110°$

Hence, $x = 70°$ and $y = 110°$

6. In ΔABC,



$BAC + ABC + ACB = 180°$

(angle sum property of a Δ)

$25° + 72° + ACB = 180°$

$97° + ACB = 180°$

$ACB = 180° - 97° = 83°$

$ACB + ECD = 180°$

$83° + y = 180°$

$y = 180° - 83° = 97°$

$AED = EDC + ECD$ (exterior angle property)

$x = 40° + 97° = 137°$

Hence, $x = 137°$ and $y = 97°$

EXERCISE 15 (D)

1. (a) Clearly, $(2 + 3) > 4$,

$(3 + 4) > 2$,

$(2 + 4) > 3$,

Thus, the sum of any two of these numbers in greater than the third.

Hence, it is possible to draw a triangle whose sides are 2 cm, 3 cm and 4 cm.

(b) Clearly, $7 + 8 = 15$

Thus, the sum of two of these numbers is not greater than the third.

Hence, it is not possible to draw a triangle whose sides are 7 cm, 8 cm and 15 cm.

(c) Clearly, $(1 + 1) > 1$

$(1 + 1) > 1$

$(1 + 1) > 1$

Thus, the sum of any two of these numbers is greater than the third.

Hence, it is possible to draw a triangle whose sides are 1 cm, 1 cm and 1 cm.

(d) Clearly, $(6 + 7) > 14$

Thus, the sum of two of these numbers is not greater than the third.

Hence, it is not possible to draw a triangle whose sides are 6 cm, 7 cm and 14 cm.

(e) Clearly, $(3.4 + 2.1) > 5.3$

$(2.1 + 5.3) > 3.4$

$(3.4 + 5.3) > 8.7$

Thus, the sum of any two of these numbers is greater than the third.

Hence, it is possible to draw a triangle whose sides are 3.4 cm, 2.1 cm and 5.3 cm.

2. Let the length of the third side be x cm.

We know that the sum of any two sides of a triangle is greaer than the third.

$(5+9) > x \qquad x < 14$

Also, we know that the difference of any two sides of a triangle is less than the third side.

$(9-5) < x \qquad x > 4$

Thus, $4 < x < 14$

Hence, the length of the third side must be larger than 4 cm and smaller than 14 cm.

3. (a) $PB + PC \boxed{>} BC$ (b) $AC \boxed{<} PA + PC$ (c) $PA + PB \boxed{>} AB$

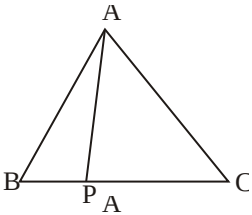
4. In ΔABP, $AB + BP > AP$ ... (1)

In ΔAPC, $PC + AC > AP$ ... (2)

Adding (1) and (2), we get

$AB + BP + PC + AC > 2AP$

$(AB + BC + AC) > 2AP$ **Hence proved**



5. In ΔABM,

$(AB + BM) > AM$ ... (1)

In ΔACM,

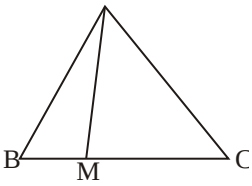
$(AC + MC) > AM$ ... (2)

Adding (1) and (2) , we get

$AB + BM + AC + MC > AM + AM$

$AB + (BM + MC) + AC > 2AM$

$(AB + BC + AC) > 2AM$ **Hence proved**



6. In ΔAOB,

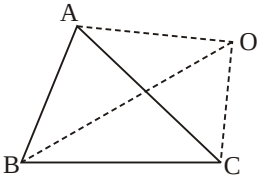
$(OA + OB) > AB$ ... (1)

In ΔBOC,

$(OB + OC) > BC$ ... (2)

In ΔAOC,

$(OA + OC) > CA$ ... (3)

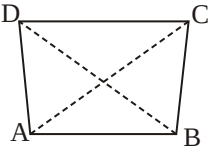


Adding (1), (2) and (3), we get

$(OA + OB) + (OB + OC) + (OA + OC) > (AB + BC + CA)$

$2(OA + OB + OC) > (AB + BC + CA)$ **Hence Proved**

7. In ΔABD,



$$(AB + DA) > BD \quad \text{... (1)}$$

In ΔBCD,

$$(BC + CD) > BD \quad \text{... (2)}$$

In ΔABC,

$$(AB + BC) > AC \quad \text{... (3)}$$

In ΔCAD,

$$(CD + AD) > AC \quad \text{... (4)}$$

Adding (1), (2), (3) and (4), we get

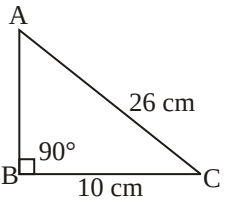
$$2(AB + BC + CD + AD) > 2(AC + BD)$$

$$(AB + BC + CD + DA) > (AC + BD)$$

Hence Proved

EXERCISE 15 (E)

1. By pythagoras' theorem,



$$AC^2 = AB^2 + BC^2$$

$$AB^2 = AC^2 - BC^2$$

$$= \{(26)^2 - (10)^2\}\,\text{cm}^2$$

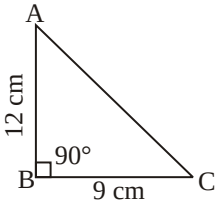
$$= (26-10)(26+10)\,\text{cm}^2$$

$$= (16 \times 36)\,\text{cm}^2$$

$$AB = \sqrt{(16 \times 36)}\,\text{cm} = 4 \times 6\,\text{cm} = 24\,\text{cm}$$

Hence, the length of the other side is 24 cm.

2. By pythagoras' theorem,



$$AC^2 = AB^2 + BC^2$$

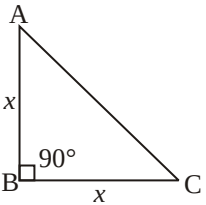
$$AC^2 = \{(12)^2 + (9)^2\}\,\text{cm}^2$$

$$= (144 + 81)\,\text{cm}^2 = 225\,\text{cm}^2$$

$$AC = \sqrt{225}\,\text{cm} = 15\,\text{cm}$$

Hence, the length of the hypotenuse is 15 cm.

3. Let ΔABC be right-angled at B.



Let $AB = BC = x$, and $AC^2 = 50$

Then, by pythagoras' theorem,

$$AC^2 = AB^2 + BC^2$$

$$50 = x^2 + x^2 \qquad 2x^2 = 50$$

$$x^2 = \frac{50}{2} = 25 \qquad x = \sqrt{25} = 5$$

Hence, the length of each leg is 5 units.

4. $(39)^2\ \text{cm}^2 = 1521\,\text{cm}^2$

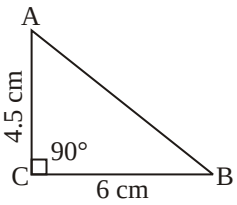
$\{(15)^2 + (36)^2\}\ \text{cm}^2$

$= (225 + 1296)\,\text{cm}^2 = 1521\,\text{cm}^2$

$\because \quad (39)^2 = (15)^2 + (36)^2$

Hence, it is a right-angled triangle.

5. By pythagoras' theorem,

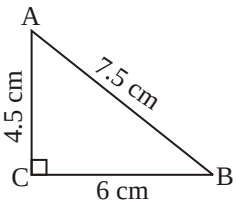


$$AB^2 = AC^2 + BC^2$$
$$= \{(4.5)^2 + (6)^2\}\,\text{cm}^2$$
$$= (20.25 + 36)\ \text{cm}^2$$
$$= 56.25\ \text{cm}^2$$
$$AB = \sqrt{56.25}\ \text{cm} = 7.5\ \text{cm}$$

Hence, the length of the hypotenuse is 7.5 cm.

6. Let the third side be x cm.

By Pythagoras' theorem,

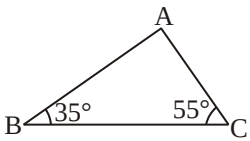


$$AC^2 = AB^2 + BC^2$$
$$(7.5)^2\ \text{cm}^2 = \{(4.5)^2 + x^2\}\,\text{cm}^2$$
$$x^2 = \{(7.5)^2 - (4.5)^2\}\,\text{cm}^2$$
$$= (7.5 + 4.5)(7.5 - 4.5)\ \text{cm}^2$$
$$x^2 = 12 \times 3\ \text{cm}^2 = 36\ \text{cm}^2 = (6)^2\ \text{cm}^2$$
$$x = \sqrt{(6)^2}\ \text{cm} = 6\,\text{cm}$$

Hence, the length of the third side is 6 cm.

7. $A = 180° - (35° + 55°)$

$= 180° - 90° = 90°$



By Pythagoras' theorem,

$$BC^2 = AB^2 + AC^2$$

Hence, (b) is correct.

8. (a) $a^2 + b^2 = \{(9)^2 + (12)^2\}\,\text{cm}^2$

$= (81 + 144)\,\text{cm}^2 = 225\ \text{cm}^2 = (15)^2\ \text{cm}^2$

$c^2 = (16)^2\ \text{cm}^2$

$a^2 + b^2 \neq c^2$

Given triangle is not right-angled.

(b) $a^2 + b^2 = \{(10)^2 + (24)^2\}\,\text{cm}^2$

$= (100 + 576)\ \text{cm}^2 = 676\ \text{cm}^2 = (26)^2\ \text{cm}^2$

$$c^2 = (26)^2 \text{ cm}^2$$

$$a^2 + b^2 = c^2$$

Given triangle is right-angled.

(c) $a^2 + b^2 = \{(15)^2 + (20)^2\}\text{cm}^2$

$$= (225 + 400)\text{ cm}^2 = 625\text{ cm}^2 = (25)^2\text{ cm}^2$$

$$c^2 = (25)^2\text{ cm}^2$$

$$a^2 + b^2 = c^2$$

Given triangle is right-angled.

9. By Pythagoras' theorem,

$$AC^2 = AB^2 + BC^2$$

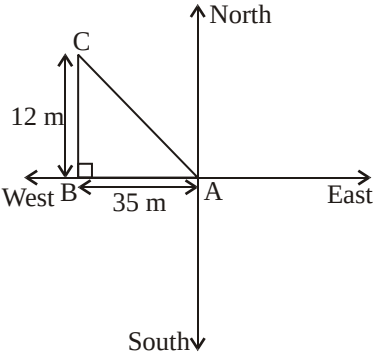
$$= \{(35)^2 + (12)^2\}\text{m}^2$$

$$= (1225 + 144)\text{m}^2$$

$$= 1369\,\text{m}^2$$

$$AC = \sqrt{1369}\,\text{m} = 37\,\text{m}$$

Hence, he is 37 m far away from his initial position.



10. By Pythagoras' theorem,

$$AC^2 = AB^2 + BC^2$$

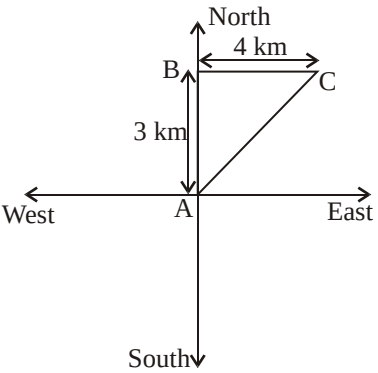
$$= \{(3)^2 + (4)^2\}\text{km}^2$$

$$= (9 + 16)\,\text{km}^2$$

$$= 25\,\text{km}^2$$

$$AC = \sqrt{25}\,\text{km} = 5\,\text{km}$$

Hence, he is 5 km far away from his initial position.



11. By pythagoras' theorem,

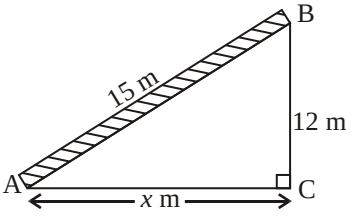
$$AB^2 = AC^2 + BC^2$$

$$(15)^2\text{m}^2 = \{(x)^2 + (12)^2\}\text{m}^2$$

$$x^2 = \{(15)^2 - (12)^2\}\text{m}^2$$

$$= (15 - 12)(15 + 12)\,\text{m}^2$$

$$= 3 \times 27\,\text{m}^2 = 81\,\text{m}^2$$

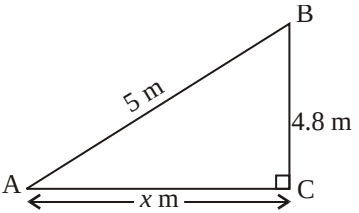


$$x^2 = (9)^2 \text{ m}^2$$

$$x = \sqrt{(9)^2} \text{ m} = 9 \text{ m}$$

Hence, the distance of the foot of the ladder from the wall is 9 m.

12. Let BC be the wall and AB be the ladder.



$$AC = x \text{ m}$$

Then, $AB = 5 \text{ m}$

and $BC = 4.8 \text{ m}$

By Pythagoras' theorem,

$$AB^2 = BC^2 + AC^2$$

$$(5)^2 \text{m}^2 = (4.8)^2 \text{ m}^2 + x^2$$

$$x^2 = \{(5)^2 - (4.8)^2\} \text{m}^2$$

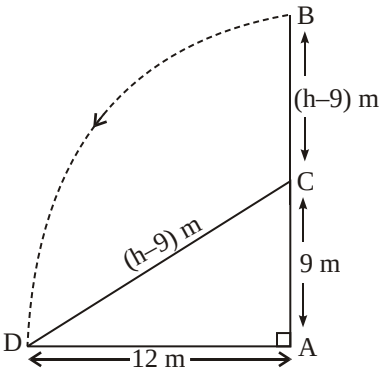
$$= (5 - 4.8)(5 + 4.8) \text{ m}^2$$

$$= (0.2 \times 9.8) \text{ m}^2 = 1.96 \text{ m}^2$$

$$x = \sqrt{1.96} \text{ m} = \sqrt{1.4} \text{ m}$$

Hence, the required distance is 1.4 m.

13. Let AB be the tree of height h metres broken at the point C and let CB take the position CD as shown in the figure.



Then, $AC = 9$ m, $AD = 12$ m and $CD = CB = (h - 9)$ m

From right ΔDAC by Pythagoras' theorem, we have

$$CD^2 = AC^2 + AD^2$$

$$(h - 9)^2 = 9^2 + 12^2$$

$$= 81 + 144 = 225 = (15)^2$$

$$h - 9 = 15$$

$$h = (15 + 9) = 24 \text{ m}$$

Hence, the original height of the tree was 24 m.

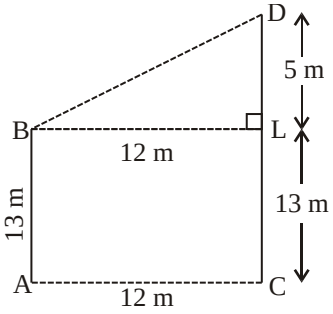
14. Let AB and CD be the given poles such that $AB = 13$ m, $CD = 18$ m and $AC = 12$ m.

Join BD.

From B, draw $BL \quad CD$

$\because AC \| BL$ then $CL = AB$

$$DL = (CD - CL)$$
$$= (CD - AB)$$
$$= (18 - 13)\,\text{m} = 5\,\text{m}$$
$$BL = AC = 12\,\text{m}$$



Now, in right ΔBLD, by Pythagoras' theorem, we have

$$BD^2 = BL^2 + DL^2$$
$$= \{(12)^2 + (5)^2\}\,\text{m}^2$$
$$= (144 + 25)\,\text{m}^2 = 169\,\text{m}^2$$
$$BD = \sqrt{169}\,\text{m} = \sqrt{13 \times 13}\,\text{m} = 13\,\text{m}$$

Hence, the distance between their tops is 13 m.

15. (a) right-angled (b) perpendicular (c) sum

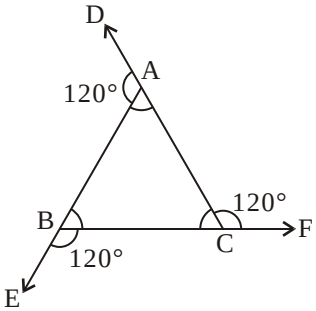
HOTS

- $\because$ Corresponting interior opposite angles are equal to each other.
  Exterior angles are equal to each other.

Sum of exterior angles = 360°

$$\text{One exterior angles} = \frac{360°}{3} = 120°$$

$$A + B = ACF$$
$$A + A = 120°$$
$$(\because A = B)$$
$$2A = 120°$$
$$A = \frac{120°}{2} = 60°$$



$\because$ Interior opposite angles are equal to each other.

$$A + B = C = 60°$$

Hence, the value of each of the interior angle is 60°.

Chapter 16 Congruence

EXERCISE 16

1. (a) $M \leftrightarrow S, P \leftrightarrow Q, N \leftrightarrow R$; $MP = SQ$, $PN = QR$, $MN = SR$; $M = S$, $P = Q$ and $N = R$

(b) $X \leftrightarrow Q, Z \leftrightarrow P, Y \leftrightarrow R$; $XZ = QP$, $ZY = PR$, $XY = QR$; $X = Q$, $Z = P$ and $Y = R$

(c) $C \leftrightarrow Q, A \leftrightarrow R, B \leftrightarrow P; CA = QR, AB = RP,$
$BC = PQ; \quad C = Q, \quad A = R$ and $B = P$

(d) $A \leftrightarrow E, B \leftrightarrow F, C \leftrightarrow D; AB = EF, BC = FD,$
$AC = ED; \quad A = E, \quad B = F$ and $C = D$

2. (a) ASA, $\Delta DEF \quad \Delta PNM$ (b) SSS, $\Delta YXZ \quad \Delta TRS$

(c) RHS, $\Delta RPQ \quad \Delta LNM$ (d) SAS, $\Delta ACB \quad \Delta DEF$

(e) ASA, $\Delta ACB \quad \Delta ACD$

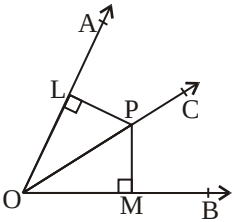
3. In ΔPLO and ΔPMO,

$PLO = PMO$ (90° each)

$PO = PO$ (common)

$PL = PM$ (given)

By *RHS* congruence property, $\Delta PLO \quad \Delta PMO$.



4. Given: AD is a bisector of A.

$DAB = DAC$ ... (1)

$AD \quad BC$

$BDA = CDA = 90°$

To prove: ΔABC is isosceles.

Proof: In ΔDAB and ΔDAC,

$BDA = CDA$ (90° each)

$DA = DA$ (common)

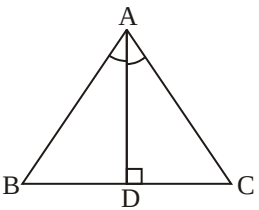
$DAB = DAC$ (from 1)

By *ASA* congruence property,

$\Delta DAB \quad \Delta DAC$

$AB = AC$ (corresponding parts of the congruent triangels)

Therefore, ΔABC is isosceles.



5. Given: $AB = AC, BD = DC$

To prove: $\Delta ADB \quad \Delta ADC$

Proof:

(a) In ΔADB and ΔADC,

$AB = AC$ (given)

$BD = DC$ (given)

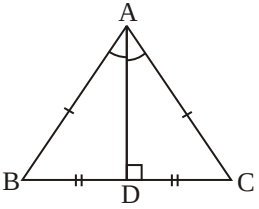
$DA = DA$ (common)

By *SSS* congruence property,

$\Delta ADB \quad \Delta ADC$

$ADB = ADC$ ... (1)

(corresponding parts of the congruent triangle)



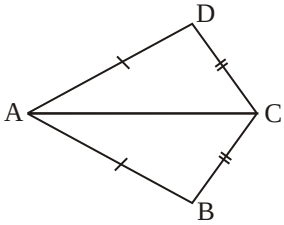
ADB and ADC are on the straight line.

$$ADB + ADC = 180°$$
$$ADB + ADB = 180°$$
$$2\,ADB = 180°$$
$$ADB = 90°$$

from (1), $ADB = ADC = 90°$

(b) $BAD = CAD$ (corresponding parts of the congruent triangles)

6. Given: $AB = AD$ and $CB = CD$



To prove: $\Delta ABC \quad \Delta ADC$

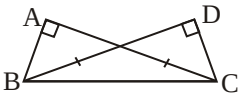
Proof: In ΔABC and ΔADC,

$AB = AD$	(given)
$CB = CD$	(given)
$AC = AC$	(common)

By SSS congruence property,

$\Delta ABC \quad \Delta ADC$

7. Given: $A = D = 90°$ and $AC = DB$



To prove: $\Delta ABC \quad \Delta DCB$

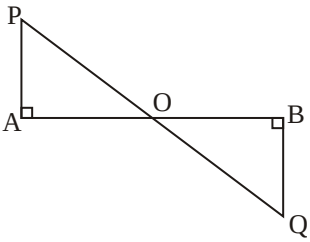
Proof: In ΔABC and ΔDCB,

$A = D$	(each 90°)
$BC = BC$	(common)
$AC = BD$	(given)

By RHS congruence property,

$\Delta ABC \quad \Delta DCB$

8. Given: $PA \quad AB, QB \quad AB$ and $PA = QB$



To prove: $\Delta OAP \quad OBQ$

Proof: In ΔOAP and ΔOBQ,

$APO = OQB$	(alternate angles)
$PAO = QBO$	(each 90°)
$PA = QB$	(given)

By ASA congruence property,

$\Delta OAP \quad \Delta OBQ$

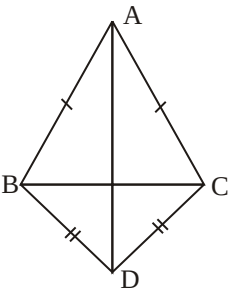
$OA = OB$ (corresponding parts of the congruent triangles)

9. Given: ΔABC is an isosceles triangle.

$AB = AC, BD = CD$

To prove: AD bisects A and D.

$\Delta BAD = CAD$ and $BDA = CDA$



Proof: In ΔABD and ΔACD,

$AB = AC$ (given)

$BD = CD$ (given)

$AD = AD$ (common)

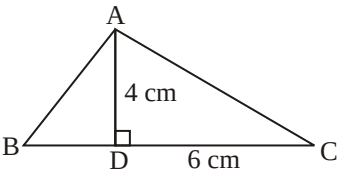
By *SSS* congruence property,

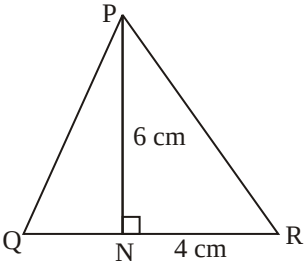
$\Delta ABD \quad \Delta ACD$

$BAD = CAD$ (by cpct)

$BDA = CDA$ (by cpct)

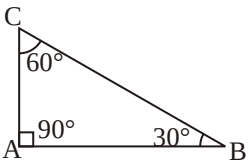
10.

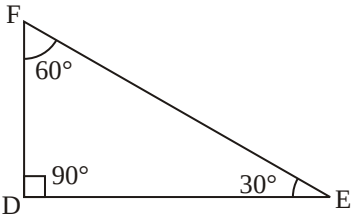




11. Two sides and the included angle of one must be equal to the corresponding two sides and the included angle of the other.

12. The triangles may be similar but not congruent.





13. (a) all part equal (b) the same length and same breadth (c) the same radius (d) the same side length (e) the same measure (f) the same length

14. (a) False (b) False (c) True (d) False (e) True (f) True (g) False (h) False (i) True (j) True

HOTS

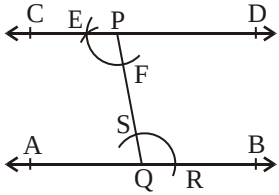
- $\Delta ABC \quad \Delta PQR$

VALUE BASED

- Do yourself

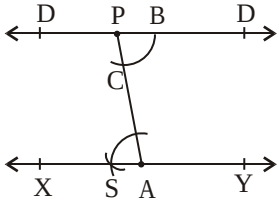
EXERCISE 17A

1. Steps of construction :



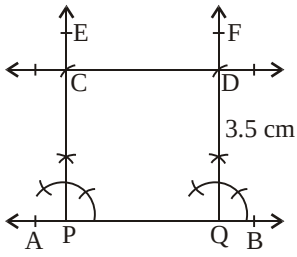
1. Take any point Q on AB. Join PQ.
2. With Q as centre and any radius draw an arc to cut AB at R and QP at S.
3. With P as centre and the same radius draw an arc, cutting QP at F.
4. With F as centre and radius equal to RS, draw an arc to cut the previous arc at E.
5. Join PE and produce it on both sides to get the required line CD parallel to AB.

2. Steps of construction :



1. Draw a line segment $DE = 6$ cm.
2. Take any point P on DE. Join PA.
3. With P as centre and any radius draw an arc to cut DE at B and AP at C.
4. With A as centre and the same radius draw on arc, cutting AP at R.
5. With R as centre and radius equal to BC, draw an arc to cut the previous arc at S.
6. Join SA and produce it on both sides to get the required line XY parallel to DE.

3. Steps of construction :

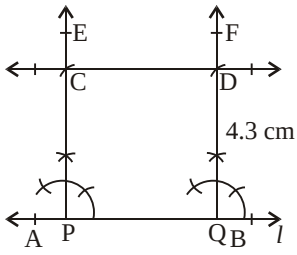


1. Let AB be the given line.
2. Take any two points P and Q on AB.
3. Construct $BPE = 90°$ and $BQF = 90°$.
4. With P as centre and radius equal to 3.5 cm, cut PE at C.
5. With Q as centre and radius equal to 3.5 cm, cut QF at D.
6. Join CD and produce it on either side to get the required line parallel to AB and at a distance of 3.5 cm from it.

4. Steps of construction :

1. Let l be the given line with A and B point as shown.
2. Take any two points P and Q on l.

3. Construct $QPE = 90°$ and $BQF = 90°$.
4. With P as centre and radius equal to 4.3 cm, cut PE at C.
5. With Q as centre and radius equal to 4.3 cm, cut QF at D.
6. Join CD and produce it on either side to get the required line parallel to AB and at a distance of 4.3 cm from it.



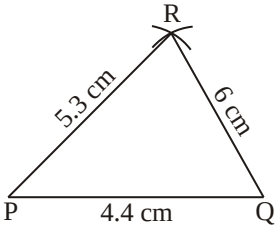
EXERCISE 17(B)

1. First we draw a rough sketch of ΔPQR, as shown.

Then, we draw ΔPQR in following steps.

Steps of construction :

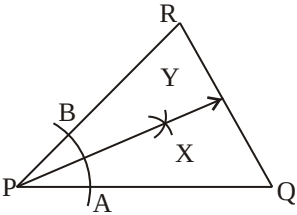
1. Draw a line segment $PQ = 4.4$ cm.
2. With P as centre and radius 5.3 cm, draw an arc.
3. With Q as centre and radius 6 cm, draw another arc, cutting the previous arc at R.
4. Join PR and QR.



(Rough sketch)

Thus, ΔPQR is the required triangle.

5. With P as centre and any convenient radius, draw an arc, cutting PQ and PR at A and B respectively.
6. With centre A and radius more than $\frac{1}{2}(AB)$, draw an arc.
7. With centre Q and the same radius as before, draw another arc, cutting the previously drawn arc at a point X.
8. Join PX and produce it to any point Y. Then, ray OY bisect P.



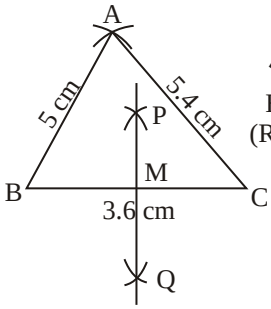
2. First we draw a rough sketch of ΔABC, as shown. Then, we draw ΔABC in following steps.

Steps of construction :

1. Draw a line segment $BC = 3.6$ cm.
2. With B as centre and radius 5 cm, draw an arc.

3. With C as centre and radius 5.4 cm, draw another arc, cutting the previous arc at A.
4. Join AB and AC.

Thus, ΔABC is the required triangle.



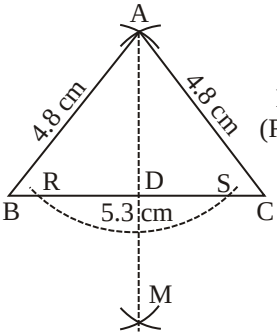
(Rough sketch)

5. With B as centre and radius measuring more than half of BC, draw arcs on both sides of BC.
6. With C as centre and the same radius as before, draw arcs on both sides of BC, cutting the previous arcs at P and Q, as shown. Join PQ.

Thus, PQ is the required perpendicular bisector of BC, meeting BC at M.

3. First we draw a rough sketch of ΔABC, as shown.

Then, we draw ΔABC in following steps.



(Rough sketch)

Steps of construction :

1. Draw a line segment BC = 5.3 cm.
2. With B as centre and radius 4.8 cm, draw an arc.
3. With C as centre and radius 4.8 cm, draw another arc, cutting the previous arc at A.
4. Join AB and AC.

Thus, ΔABC is the required triangle.

Now, you can measure B and C using protractor.

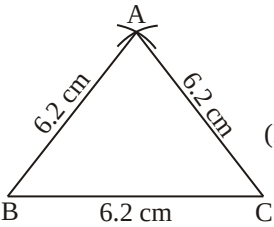
5. With A as centre and with a sufficient radius, draw an arc, cutting BC at R and S.
6. With R as centre and radius more than half of RS, draw an arc. Now with S as centre and with the same radius draw another arc, cutting the previous arc at M.
7. Join AM, meeting BC at D. Then AD BC.

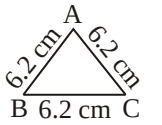
4. First we draw a rough sketch of ΔABC, as shown. Then, we draw ΔABC in following steps.

Steps of construction :

1. Draw a line segment BC = 6.2 cm.

2. With B as centre and radius 6.2 cm, draw an arc.
3. With C as centre and radius 6.2 cm, draw another arc, cutting the previous arc at A.
4. Join AB and AC.





(Rough sketch)

Thus, ΔABC is the required triangle.

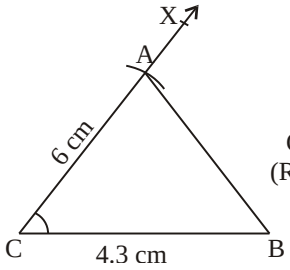
Now, $A = B = C = 60°$.

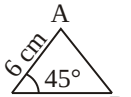
5. First we draw a rough sketch of ΔPQR, as shown.

Then, we construct ΔPQR in following steps.

Steps of construction :

1. Draw a line segment $BC = 4.3$ cm.
2. Construct $BCX = 45°$.
3. Along CX, set off $AC = 6$ cm.
4. Join AB.





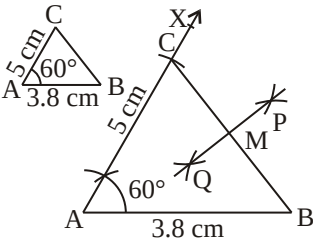
(Rough sketch)

Thus, ΔABC is the required triangle.

6. First we draw a rough sketch of ΔABC, as shown. Then, we construct ΔABC in following steps.

Steps of construction :

1. Draw a line segment $AB = 3.8$ cm.
2. Construct $A = 60°$.
3. Along AX, set off $AC = 5$ cm.
4. Join BC.



Thus, ΔABC is the required triangle.

7. First we draw a rough sketch of ΔABC, as shown.

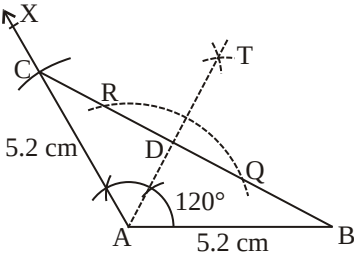
Then, we construct ΔABC in following steps.

Steps of construction:

1. Draw a line segment $AB = 5.2$ cm.
2. Construct $BAX = 120°$.
3. Along AX, set off $AC = 5.2$ cm.
4. Join BC.

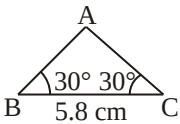
Thus, ΔABC is the required triangle.

5. With A as centre and with a sufficient radius, draw an arc, cutting BC at R and Q.



6. With R as centre and radius more than half of RQ, draw an arc. Now with Q as centre and with the same radius draw another arc, cutting the previous arc at T.
7. Join AT, meeting BC at D. Then AD BC.

8. First we draw a rough sketch of ΔABC, as shown.

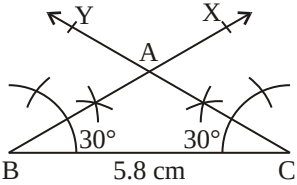


Steps of construction :

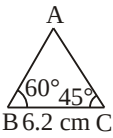
1. Draw a line segment $BC = 5.8$ cm.
2. Construct $CBX = 30°$ and $BCY = 30°$.
3. Let BX and CY intersect at A.

Thus, ΔABC is the required triangle.

We find $AB = AC$.



9. First we draw a rough sketch of ΔABC, as shown.

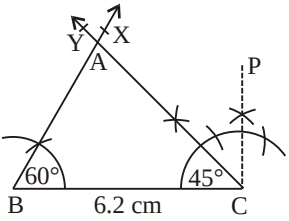


Then, we draw ΔABC in following steps.

Steps of construction:

1. Draw a line segment $BC = 6.2$ cm.
2. Construct $CBX = 60°$ and $BCY = 45°$.
3. Let BX and CY intersect at A.

Thus, ΔABC is the required triangle.



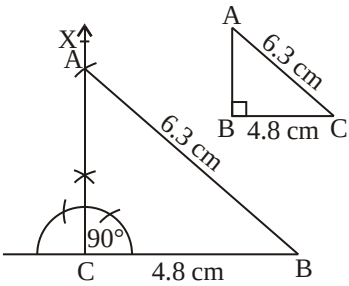
10. First we draw a rough sketch of ΔABC, as shown.

Then, we draw ΔABC in following steps.

Steps of construction:

1. Draw a line segment $BC = 4.8$ cm.
2. Construct $BCX = 90°$.
3. With B as centre and with radius 6.3 cm, draw an arc, cutting BX at A.
4. Join AB.

Thus, ΔABC is the required triangle.

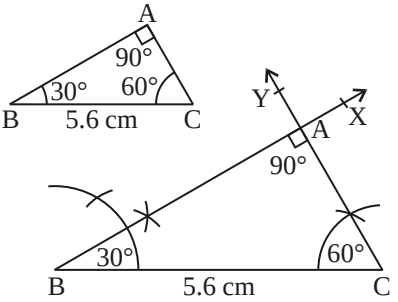


11. We know that the sum of the angles of a triangle is 180°.

Let us consider a right-angled ΔABC in which $A = 90°$, hypotenuse $BC = 5.6$ cm and $B = 30°$.

We know that the sum of the angles of a triangle is 180°.

$$A + B + C = 180°$$
$$90° + 30° + C = 180°$$
$$120° + C = 180°$$
$$C = 180° - 120° = 60°.$$

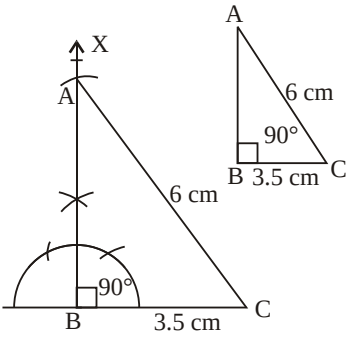


Steps of construction :

1. Draw a line segment AB = 6.3 cm.
2. Construct $CBX = 30°$ and $BCY = 60°$.
3. Let BX and CY intersect at the point A.

Thus, ΔABC is the required triangle.

12. First we draw a rough sketch of ΔABC, as shown.



Then, we draw ΔABC in following steps.

Steps of construction :

1. Draw a line segment $AB = 3.5$ cm.
2. Construct $CBX = 90°$.
3. With C as centre and with radius 6 cm, draw an arc, cutting BX at A.
4. Join AC.

Thus, ΔABC is the required triangle.

EXERCISE 17(C)

1. Let one angle be x.

Then, its supplement $= 180° - x$

A.T.Q.,

$$(180° - x) - x = 32°$$
$$180° - 2x = 32°$$
$$2x = 180° - 32° = 148°$$
$$x = \frac{148°}{2} = 74°$$

(b) is correct.

2. Let one angle be x.

Then, its complement $= 90° - x$

A.T.Q.,

$$x - (90° - x) = 24°$$

$$2x = 24° + 90° = 114°$$
$$x = \frac{114°}{2} = 57°$$

(b) is correct.

3. Let one angle be x.

Then, its supplement $= (180° - x)$

A.T.Q.,

$$x = \frac{1}{5}(180° - x)$$
$$5x = 180° - x$$
$$5x + x = 180°$$
$$6x = 180°$$
$$x = \frac{180°}{6} = 30°$$

(a) is correct.

4. Let the angle be x.

Then, its complement $= (90° - x)$

A.T.Q., $x = 90° - x$

$$2x = 90°$$
$$x = 45°$$

(b) is correct.

5. $90° - 80° = 10°$

(b) is correct.

6. $180° - 45° = 135°$

(c) is correct.

7. Let the angle be $3x$ and $2x$.

Then, $3x + 2x = 180°$

$$5x = 180°$$
$$x = \frac{180°}{5} = 36°$$

Smaller angle $= 2 \times 36° = 72°$

(c) is correct.

8. $x + 68° = 180°$ (linear pair)

$$x = 180° - 60 = 112°$$

(c) is correct.

9. $AOC + 132° = 180°$ (linear pair)

$$AOC = 180° - 132° = 48°$$

(b) is correct.

10. $AOC + COD + BOD = 180°$ (linear pair)

$$55° + x + 45° = 180°$$
$$x + 100° = 180°$$
$$x = 180° - 100° = 80°$$

(d) is correct.

11. $BOD = AOC = 50°$ (vertically opposite angles)

(b) is correct.

12. $ACD = ABC + BAC$ (exterior-angle property)

$$ACD = 55° + 45° = 100°$$

(c) is correct.

13. $CE \| BA$

$ACE = BAC = 50°$ (alternate angles)

$ACB + ACE + ECD = 180°$ (linear pair)

$$ACB + 50° + 60° = 180°$$
$$ACB + 110° = 180°$$
$$ACB = 180° - 110° = 70°$$

(c) is correct.

14. (d)

15. (c)

16. (d)

17. By pythagoras' theorem,

$$AC^2 = AB^2 + BC^2$$
$$(13)^2 = (5)^2 + BC^2$$
$$BC^2 = (13)^2 - (5)^2 = (13-5)(13+5)$$
$$BC^2 = 8 \times 18 = 144$$
$$BC = \sqrt{144} = 12$$

(c) is correct.

18. 2 $A = 3$ $B = 6$ $C = k$

$$A = \frac{k}{2}, \quad B = \frac{k}{3}, \quad C = \frac{k}{6}$$

In ΔABC, $A + B + C = 180°$

$$\frac{k}{2} + \frac{k}{3} + \frac{k}{6} = 180°$$
$$\frac{3k + 2k + k}{6} = 180°$$
$$\frac{6k}{6} = 180°$$

$$k = 180°$$

$$B = \frac{180°}{3} = 60°$$

(c) is correct.

19. Let the angles be $2x, 3x$ and $7x$.

Now, $2x + 3x + 7x = 180°$

$$12x = 180°$$

$$x = \frac{180°}{12} = 15°$$

Largest angle $= 7 \times 15° = 105°$

(c) is correct.

20. In ΔABC, $A + B + C = 180°$

$$A + 37° + 29° = 180°$$

$$A + 66° = 180°$$

$$A = 180° - 66° = 114°$$

(c) is correct.

HOTS

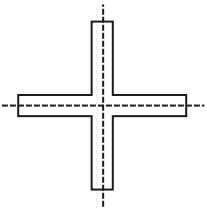
- Do yourself

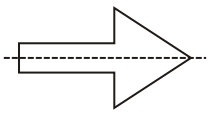
Chapter 18 Symmetry

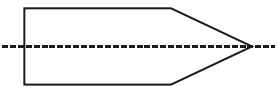
EXERCISE 18 (A)

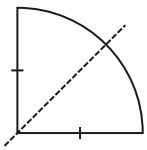
1. (c) **2.** (d) **3.** (a) **4.** (d) **5.** (b) **6.** (a)

7. (a) **8.** (a) **9.** (c)

10. (a) 

(b) 

(c) 

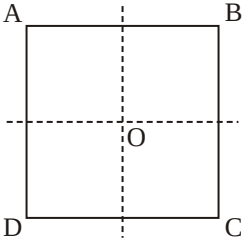
(d) 

11. (a) True (b) True (c) True (d) True (e) False (f) True (g) True

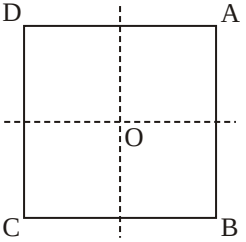
EXERCISE 18 (B)

1. (a) 3 (b) 3

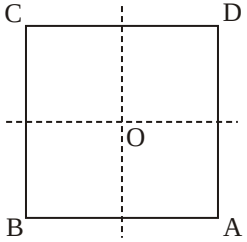
2.



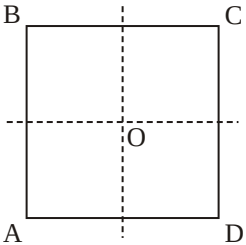
(i)
Original form



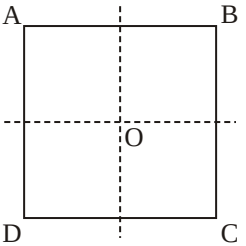
(ii)
Rotated through 90°



(iii)
Rotated through 180°



(iv)
Rotated through 270°

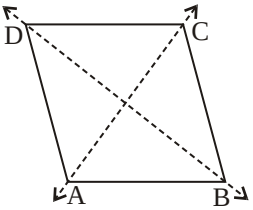


(v)
Rotated through 360°

Clearly, each of the four times, the figure fits onto itself. So, it has a rotational symmetry of order 4.

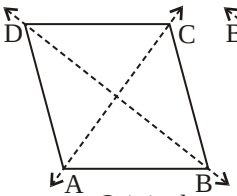
3. 180°, 360°

4. (a)

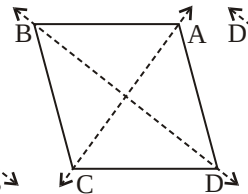


2 lines of symmetry

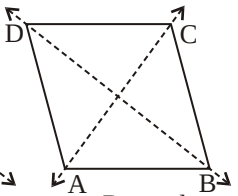
(b)



Original form

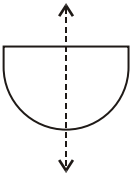


Rotated through 180°

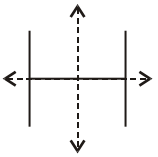
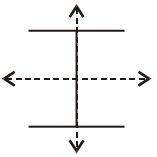
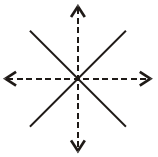


Rotated through 360°

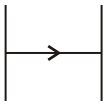
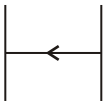
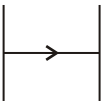
5. An isosceles triangle

6.  Perpendicular bisector of the diameter, No

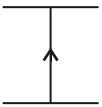
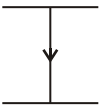
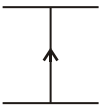
7. No

8.   

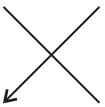
Lines of symmetry = 2

Original form | Rotated through 180° | Rotated through 360°

Original form | Rotated through 180° | Rotated through 360°

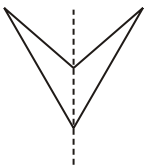
Original form | Rotated through 180° | Rotated through 360°

Clearly, each of the 2 times, the figures fit onto itself.

So, these figures have a ratational symmetry of order 2.

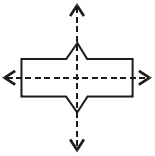
9. Scalene triangle

10. *Z*

11. (a)  (b) 0

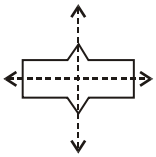
1 line of symmetry

12. (a)

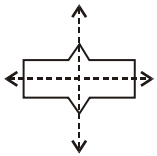


2 lines of symmetry

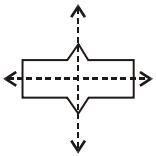
(b)



Original form



Rotated through 180°



Rotated through 360°

2 rotational symmetry

HOTS

• BED HOOD DIE

Chapter 19 Three-Dimensional Shapes

EXERCISE 19

1. (a) 6, 12, 8 (b) curved (c) 1, 2 (d) curved, flat

2. (a) T (b) F (c) T (d) T (e) T

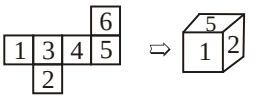
3. (a) matchbox, chalk box, brick, tile, book

(b) circular pillar, circular pipe, circular pencil, road roller, gas cylinder

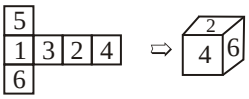
(c) ice-cream cone, conical tent, conical vessel, clown's cap, party hat

(d) Earth, Moon, basketball, soccerball, world globe.

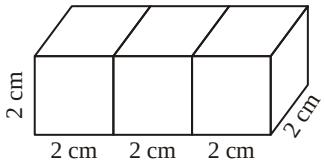
4. (a)



(b)



HOTS



Cuboid, 6 cm × 2 cm × 2 cm

EXERCISE 20(A)

1. (a) Area of the rectangle $= (l \times b)$ sq units
$= (12.5 \times 8)\,\text{m}^2 = 100\,\text{m}^2$

(b) Area of the rectangle $= (l \times b)$ sq units
$= (24.5 \times 18)\,\text{m}^2 = 441\,\text{m}^2$

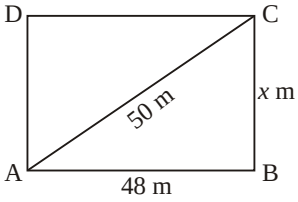
2. Ratio of length and beadth $= 4:3$

So, the length of the field $= (4x)$ units
and the breadth of the field $= (3x)$ units
Since, area of rectangular park $= 1728\,\text{m}^2$

$$\text{length} \times \text{breadth} = 1728$$
$$4x \times 3x = 1728$$
$$12x^2 = 1728$$
$$x^2 = \frac{1728}{12} = 144$$
$$x^2 = (12)^2 \qquad x = 12$$

So, the length of the park $= (4 \times 12)\,\text{m} = 48\,\text{m}$
and the breadth of the park $= (3 \times 12)\,\text{m} = 36\,\text{m}$
So, perimeter of the rectangular park $= 2 \times (l + b) = 2 \times (48 + 36)\,\text{m}$
$= 2 \times 84\,\text{m} = 168\,\text{m}$
So, the cost of fencing = ` $(168 \times 30)$ = ` 5040
Hence, the cost of fencing the rectangular park is ` 5040.

3. Let $ABCD$ be the rectangular plot.



Then, $AB = 48\,\text{m}$ and $AC = 50\,\text{m}$.
Let $BC = x\,\text{m}$
From right triangle ABC, we have

$$AC^2 = AB^2 + BC^2$$
$$(50)^2 = (48)^2 + x^2$$
$$x^2 = (50)^2 - (48)^2$$
$$= (50 - 48)(50 + 48) = 2 \times 98$$
$$x^2 = 196$$
$$x = \sqrt{196} = 14$$
$$BC = 14\,\text{m}$$

Hence, the area of the plot $= (48 \times 14)\,\text{m}^2 = 672\,\text{m}^2$

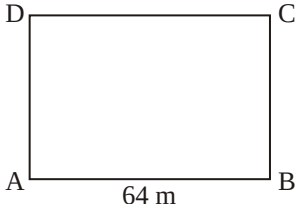
4. Area of the rectangular field $= 3584\ m^2$

$$\text{length} \times \text{breadth} = 3584\ m^2$$

$$64 \times \text{breadth} = 3584\ m^2$$

$$\text{breadth} = \frac{3584}{64}\ m$$

$$= 56\ m$$



Perimeter of the rectangular field $= 2 \times (l + b)$

$$= 2 \times (64 + 56)\ m$$

$$= 2 \times 120\ m = 240\ m$$

Total perimeter in 5 round $= (240 \times 5)\ m = 1200\ m$

$$\text{Speed of the boy} = 6\ km/h = \frac{6 \times 1000}{60}\ m/min = 100\ m/min$$

$$\text{Time taken by the boy} = \frac{1200}{100}\ \text{minutes} = 12\ \text{minutes}$$

Hence, the boy will table 12 minutes to go 5 times around the rectangular field.

5. $$\text{Width of the carpet} = 75\ cm = \frac{75}{100}\ m = \frac{3}{4}\ m$$

Let l be the length of the carpet.

Cost of the carpet per metre = ` 80

Cost of the carpet required for the room = ` $80 \times l$

Total cost for carpetting = ` 19200

$$80 \times l = 19200$$

$$l = \frac{19200}{80} = 240\ m$$

$$\text{Area of the carpet required for the room} = \frac{3}{4} \times 240\ m^2$$

$$= 180\ m^2 \qquad \ldots (1)$$

Length of the floor $= 15\ m$

Let b be the breadth of the room.

Area to be carpeted in the room $= 15 \times b\ m^2$

from eq. (1), we have

$$15 \times b = 180$$

$$b = \frac{180}{15} = 12\ m$$

Thus, width of the room is 12 m.

6. Length of the room $= 13\ m$

Breadth of the room $= 9\ m$

$$\text{Breadth of carpet} = 75\,\text{cm} = \frac{75}{100} = 0.75\,\text{m}$$

$$\text{Area of the room} = \text{length} \times \text{breadth}$$
$$= 13 \times 9\ \text{m}^2 = 117\,\text{m}^2$$

Let the length of required carpet be x m.

$$\text{Area of carpet} = x \times 0.75\,\text{m}^2 = 0.75x\,\text{m}^2$$

$$\text{Area of carpet} = \text{Area of room}$$
$$0.75x = 117$$
$$x = \frac{117}{0.75} = \frac{11700}{75} = 156$$

$$\text{Length of carpet} = 156\,\text{m}$$

Cost of carpeting 1 m = ` 105

Cost of carpeting 156 m = ` $156 \times 105$ = ` 16380

Hence, the cost of carpeting is ` 16380.

7. Total cost of fencing = ` 9600

Rate of fencing = ` 24 per metre

$$\text{Perimeter of the field} = \left(\frac{\text{Total cost of fencing}}{\text{rate per metre}}\right)\text{m}$$
$$= \left(\frac{9600}{24}\right)\text{m} = 400\,\text{m}$$

Let the length and breadth be $5x$ m and $3x$ m.

Then, $\text{perimeter} = 2 \times (5x + 3x)\,\text{m} = 16x\,\text{m}$

A.T.Q., $16x = 400$

$$x = \frac{400}{16} = 25\,\text{m}$$

$$\text{Length} = 5 \times 25 = 125\,\text{m}$$
$$\text{Breadth} = 3 + 25 = 75\,\text{m}$$

8. (a) $\text{Area of the square} = \left(\frac{1}{2} \times (\text{diagonal})^2\right)$ sq. units

$$= \frac{1}{2} \times (2.4)^2\ \text{m}^2 = \left(\frac{1}{2} \times 5.76\right)\text{m}^2 = 2.88\,\text{m}^2$$

(b) $\text{Area of the suqare} = \left(\frac{1}{2} \times (\text{diagonal})^2\right)$ sq. units

$$= \left(\frac{1}{2} \times (72)^2\right)\text{cm}^2$$

$$= \left(\frac{1}{2} \times 5184\right)\text{m}^2 = 2592\,\text{cm}^2$$

9. Area of the square $= (\text{side})^2$ sq. units

$= (8.5)^2 \text{ m}^2 = 72.25 \text{ m}^2$

10. Area of the square $= \left[\frac{1}{2} \times (\text{diagonal})^2\right]$ sq. units

$16200 = \left[\frac{1}{2} \times (\text{diagonal})^2\right] \text{m}^2$

$(\text{diagonal})^2 = 16200 \times 2 = 32400$

$\text{diagonal} = \sqrt{32400} = 180 \text{ m}$

Hence, the length of the diagonal is 180 m.

11. Let the length of the square plot is x m.

Area of the square plot $= x^2 \text{m}^2$

A.T.Q., $x^2 = 6084$

$x = \sqrt{6084} = 78 \text{ m}$

Perimeter $= (4 \times 78) \text{ m} = 312 \text{ m}$

Required length of the wire $= (312 \times 4) \text{ m} = 1248 \text{ m}$

12. Area of the four walls $= 2(l + b) \times h$ sq units

$168 = 2(l + 10) \times 4$

$168 = 8l + 80$

$8l = 168 - 80 = 88$

$l = \frac{88}{8} \text{ m} = 11 \text{m}$

Length of the room $= 11 \text{m}$.

13. Area of the four walls $= 2(l + b) \times h$ sq units

$= 2(50 + 40) \times 10 \text{ m}^2 = 1800 \text{ m}^2$

Area of the ceiling $= l \times b = (50 \times 40) \text{ m}^2 = 2000 \text{ m}^2$

Total area to be white washed $= (1800 + 2000) \text{ m}^2 = 3800 \text{ m}^2$

Rate of white washing = ` 20 / sq metre

Total cost of white washing = ` $(3800 \times 20)$ = ` 76000

14. Area of 4 walls of room $= 77 \text{ m}^2$

$2(l + b) \times h = 77$

$2(7.5 + 3.5) \times h = 77$

$2 \times 11 \times h = 77$

$h = \frac{77}{22} = 3.5 \text{ m}$

Hence, the height of the room $= 3.5 \text{ m}$

15. Area of the four walls $= 2(l + b) \times h$ sq. units

$= 2(8.5 + 6.5) \times 3.4\ m^2$

$= (30 \times 3.4)\ m^2 = 102\ m^2$

Area of one doors $= (1.5 \times 1)\ m^2 = 1.5\ m^2$

Area of two doors $= (2 \times 1.5)\ m^2 = 3\ m^2$

Area of one window $= (2 \times 1)\ m^2 = 2\ m^2$

Area of two windows $= (2 \times 2)\ m^2 = 4\ m^2$

Total area of two doors and two windows $= (3 + 4)\ m^2 = 7\ m^2$

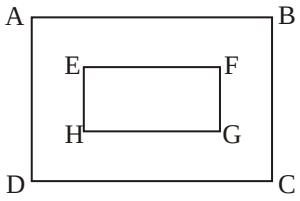
Area to be painted $= (102 - 7)\ m^2 = 95\ m^2$

Rate of painting = ` 160 per m^2

Total cost of painting = ` $(95 \times 160)$ = ` 15200

EXERCISE 20(B)

1. Let *ABCD* be the saree and *EFGH* be the part of saree without border.



Length $AB = 5$ m; Breadth, $BC = 1.3$ m

Width of the border of the saree = 25 cm

$= 0.25$ m

Area of $ABCD = 5\ m \times 1.3\ m = 6.5\ m^2$

Length, $GH = \{5 - (0.25 + 0.25)\}\ m = 4.5\ m^2$

Breadth, $FG = \{1.3 - (0.25 + 0.25)\}\ m = 0.8$ m

Area of $EFGH = 4.5\ m \times 0.8\ m = 3.6\ m^2$

Area of the border = Area of *ABCD* − Area of *EFGH*

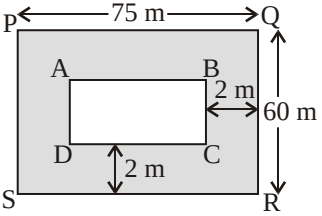
$= 6.5\ m^2 - 3.6\ m^2$

$= 2.9\ m^2 = 29000\ cm^2$

Rate of printing the border = ` 1 per 10 cm^2

Total cost of printing the border = ` $\left(\frac{1 \times 29000}{10}\right)$ = ` 2900

2. Let *PQRS* be a rectangular field and shaded part represents the path inside the plot.



$PQ = 75$ m

So, $AB = PQ - 2 \times 2 = 75 - 4 = 71$ m

$PS = QR = 60$ m

So, $AD = PS - 2 \times 2 = 60 - 4 = 56$ m

Area of the path = Area of rect. $PQRS$ − Area of rect $ABCD$

$= (75 \times 60) - (71 \times 56)$

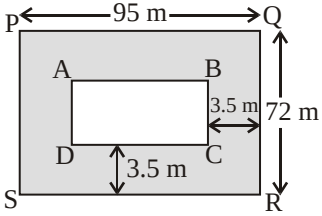
$= (4500 - 3976)\,m^2$

$= 524\,m^2$

Cost of constructing the path = ` (524×125)

= ` 65500

3. Let $PQRS$ be a rectangular plot and shaded part represents the path inside the plot.



$PQ = 95\,m$,

$AB = PQ - 2 \times 3.5 = 95 - 7 = 88\,m$

$CB = QR - 2 \times 3.5 = 72 - 7 = 65\,m$

Area of the path = Area of rectangle $PQRS$ − Area of rectangle $ABCD$

$= (95 \times 72) - (88 \times 65)$

$= (6840 - 5720)\,m^2 = 1120\,m^2$

Cost of constructing the path = `$(1120 \times 80)$ = ` 89600

Area of the rectangle $ABCD = (88 \times 65)\,m^2$

$= 5720\,m^2$

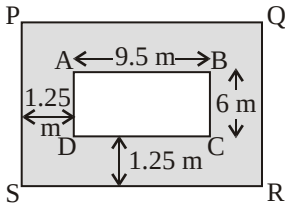
Cost of laying the grass = ` (5720×40)

= ` 228800

Total cost = cost of constructing the path + cost of laying the grass

= ` 89600 + ` 228800 = ` 318400

4. Let $ABCD$ be a rectangular room and shaded part represents the verandah outside the room.



$AB = 9.5\,m$,

$PQ = AB + 2 \times 1.25$

$= 9.5 + 2.5 = 12\,m$

$BC = 6\,m$,

$QR = BC + 2 \times 1.25$

$= 6 + 2.5 = 8.5m$

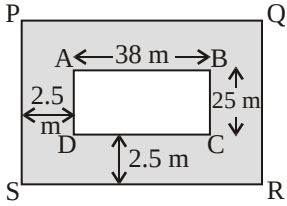
Area of the verandah = Area of rectangle $PQRS$ − Area of rectangle $ABCD$

$= (12 \times 8.5) - (9.5 \times 6)$

$= (102 - 57)\,m^2 = 45\,m^2$

Cost of cementing the verandah = ` $(45 \times 80)$ = ` 3600

5. Let *ABCD* be a rectangular grassy lawn and shaded part represents the path outside the lawn.



$AB = 38\,\text{m}$,

$PQ = AB + 2 \times 2.5$

$= 38 + 5 = 43\,\text{m}$

$BC = 25\,\text{m}$,

$QR = BC + 2 \times 2.5 = 25 + 5 = 30\,\text{m}$

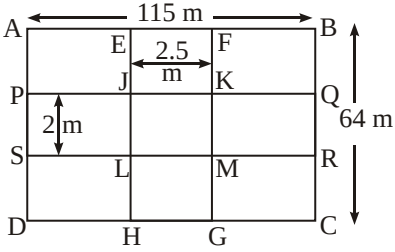
Area of the path = Area of rectangle *PQRS* − Area of rectangle *ABCD*

$= (43 \times 30) - (38 \times 25)$

$= (1290 - 950)\,\text{m}^2 = 340\,\text{m}^2$

Cost of gravelling the path = ` $(340 \times 120) =$ ` 40800

6. Let *ABCD* be a rectangular lawn and *EFGH* and *PQRS* two roads.



Area of road *EFGH* = *EH* × *EF*

$= (64 \times 2.5)\ \text{m}^2$

$= 160\ \text{m}^2$

Area of road *PQRS* = *PQ* × *QR*

$= (115 \times 2)\ \text{m}^2$

$= 230\,\text{m}^2$

Part *JKML* of the road is common in both roads so we will subtract the area of part *JKML* one time because it has been considered twice.

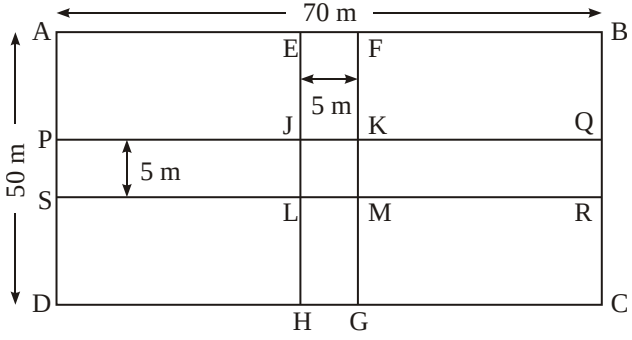
Area of part *JKML* = *JK* × *KM*

$= (2.5 \times 2)\ \text{m}^2 = 5\,\text{m}^2$

So, total area of both roads $= (160 + 230 - 5)\ \text{m}^2 = 385\ \text{m}^2$

Cost of gravelling the roads = ` $(385 \times 60) =$ ` 23100

7. Let *ABCD* be a rectangular garden and *EFGH* and *PQRS* two roads.



Area of road $EFGH = EH \times EF$

$= 50 \times 5\,m^2 = 250\,m^2$

Area of road $PQRS = PQ \times PS$

$= 70 \times 5\,m^2 = 350\,m^2$

Part $JKML$ of the road is common in both roads so we will subtract the area of part $JKML$ one time because it has been considered twice.

Area of part $JKML = JK \times KM$

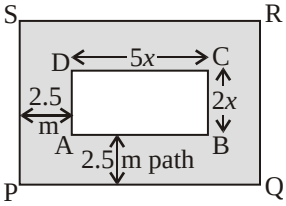
$= 5 \times 5\,m^2 = 25\,m^2$

So, total area of both roads $= (250 + 350 - 25)\,m^2 = 575\,m^2$

Therefore, the cost of constructing the rod is $= ` (575 \times 120) = ` 69000$

8. Let the length of the park $= 5x$

breadth $= 2x$



Therefore,

Area of the rectangular park $= 5x \times 2x$

$= 10x^2$

Width of the path $= 2.5\,m$

Outer length $PQ = 5x + 2.5 + 2.5 = 5x + 5$

Outer length $QR = 2x + 2.5 + 2.5 = 2x + 5$

Area of $PQRS = (5x + 5)(2x + 5) = 10x^2 + 35x + 25$

Area of the path $= (10x^2 + 35x + 25) - 10a^2$

$305 = 35x + 25$

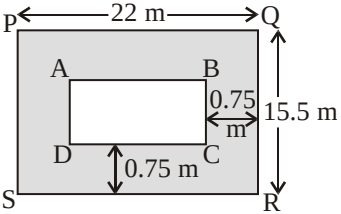
$x = \frac{280}{35} = 8$

Length of the park $= 5x = 5 \times 8 = 40\,m$

Breadth of the park $= 2x = 2 \times 8 = 16\,m$

9. Length of the hall, $PQ = 22\,m$

Breadth of the hall, $QR = 15.5\,m$



Area of the school hall $PQRS = 22\,m \times 15.5\,m = 341\,m^2$

Length of the carpet, $AB = \{22 - (0.75 + 0.75)\}\,m = 20.5\,m$

Breadth of the carpet, $BC = \{15.5 - (0.75 + 0.75)\}\,\text{m} = 14\,\text{m}$

Area of the carpet $ABCD = (20.5 \times 14)\,\text{m}^2 = 287\,\text{m}^2$

Area of the strip = Area of the school hall ($PQRS$)
− Area of the carpet ($ABCD$)

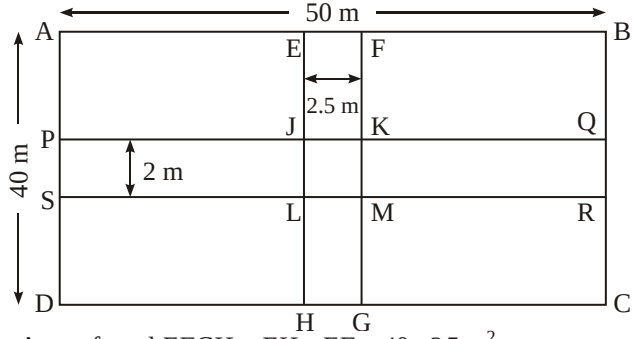
$= 341\ \text{m}^2 - 287\ \text{m}^2 = 54\ \text{m}^2$

Length of the carpet whose area is $287\ \text{m}^2$

$$= \frac{287}{0.82} = 350\ \text{m}$$

Cost of the 350 m long carpet = ` (60 × 350) = ` 21000

10. Let $ABCD$ be a rectangular garden and $EFGH$ and $PQRS$ two roads.



Area of road $EFGH = EH \times EF = 40 \times 2.5\,\text{m}^2$

$= 100\,\text{m}^2$

Area of road $PQRS = PQ \times PS = 50 \times 2\,\text{m}^2 = 100\,\text{m}^2$

Part $JKML$ of the road is common in both roads so we will subtract the area of part $JKML$ one time because it has been considered twice.

Area of part $JKML = JK \times KM$

$= 2 \times 2.5\,\text{m}^2 = 5\,\text{m}^2$

So, total area of both roads $= (100 + 100 - 5)\,\text{m}^2 = 195\,\text{m}^2$

Area of the rectangular field $ABCD = (50 \times 40)\,\text{m}^2 = 2000\,\text{m}^2$

Area of the remaining portion of the field $= (2000 - 195)\,\text{m}^2 = 1805\,\text{m}^2$

11. Let $ABCD$ be the lawn and shaded area represents the path.

Area of the path $= 165\,\text{m}^2$

Width of the path $= 2.5\,\text{m}$

Let side of square lawn be x m.

Outer side $= x + 2.5 + 2.5$

$= (x + 5)\,\text{m}$

Area of the path $= (x+5)^2 - x^2$

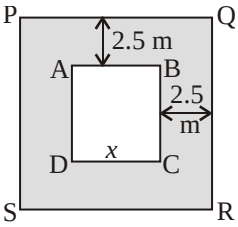
$x^2 + 10x + 25 - x^2 = 165$

$10x = 165 - 25 = 140$

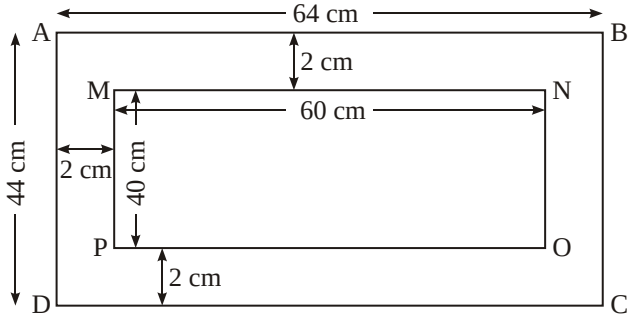
$x = \frac{140}{10} = 14$ m

Side of lawn $= 14$ m

Area of the lawn $= (14)^2$ m^2 $= 196$ m^2



12. Let *MNOP* be a poster and *ABCD* a cardboard.



$MN = 60$ cm

So, $AB = (60 + 2\times 2)$ cm $= 64$ cm

So, $AD = (40 + 2\times 2)$ cm $= 44$ cm

Area of margin = Area of rect. *ABCD* − Area of rect. *MNOP*

$= AB \times BC - MN \times MP$

$= 64 \times 44 - 60 \times 40$

$= 2816 - 2400$ cm^2 $= 416$ cm^2

Area of cardboard used = Area of rect. *ABCD*

$= 64 \times 44 = 2816$ cm^2

So, the cost of cardboard = ` $(2816 \times 1.85) =$ ` 5209.6

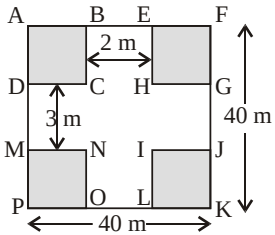
13. (a) $AD = \frac{(40-3)}{2}$ m $= \frac{37}{2}$ m

$AB = \frac{(40-2)}{2}$ m $= 19$ m

Area of rectangle $ABCD = \left(\frac{37}{2} \times 19\right)$ m^2

Area of 4 shaded region $= \left(4 \times \frac{37}{2} \times 19\right)$ m^2

$= 1406$ m^2



(b) Area of rectangle $ABCD = (43 \times 27)\,m^2$

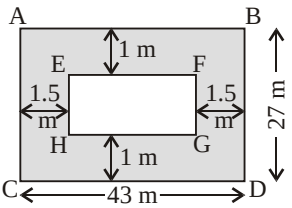
$= 1161\,m^2$

$FG = (27 - 2 \times 1)$

$= 25\,m$

$EF = (43 - 2 \times 1.5)$

$= 40\,m$



Area of rectangle $EFGH = (25 \times 40)\,m^2 = 1000\,m^2$

Area of shaded region $= 1161\,m^2 - 1000\,m^2 = 161\,m^2$

14. (a) $AH = (24 - 4)\,m = 20\,m$

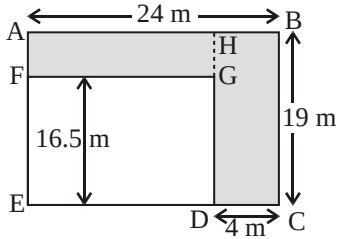
$HG = (19 - 16.5)\,m = 2.5\,m$

Area of $AHGF = (20 \times 2.5)\,m^2$

$= 50\,m^2$

Area of $HBCD = (19 \times 4)\,m^2$

$= 76\,m^2$



Total area of shaded region $= 50\,m^2 + 76\,m^2 = 126\,m^2$

(b) Area of rect. AMOD $= (15 \times 3)\,cm^2$

$= 45\,cm^2$

Area of rect. $OCLK = (12 - 3) \times 3\,cm^2$

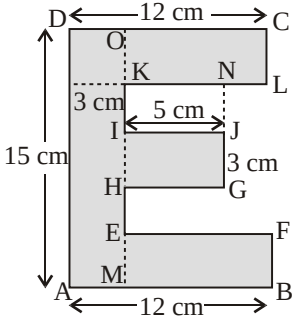
$= 27\,cm^2$

Area of rect. $IJGH = (5 \times 3)\,cm^2$

$= 15\,cm^2$

Area of rect. $EFPM = (12 - 3) \times 3\,cm^2$

$= 27\,cm^2$



Total shaded area $= (45 + 27 + 15 + 27)\,cm^2$

$= 114\,cm^2$

EXERCISE 20(C)

1. Area of parallelogram = base × height

$= (32 \times 16.5)\,cm^2 = 528\,cm^2$

2. Area of parallelogram $= 54\,cm^2$

base × height $= 54\,cm^2$

$15 \times$ height $= 54\,cm^2$

$$\text{height} = \frac{54}{15}\,cm = 3.6\,cm$$

3. base = 1 m 60 cm

$$= 1\text{ m} + \frac{60}{100}\text{ m}$$

$$= 1\text{ m} + 0.6\text{ m} = 1.6\text{ m}$$

$$\text{height} = 75\text{ cm} = \frac{75}{100}\text{ m} = 0.75\text{ m}$$

Area of parallelogram = base × height

$$= (1.6 \times 0.75)\text{ m}^2$$

$$= 1.2\text{ m}^2$$

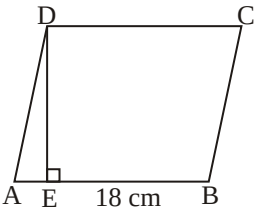
4. Area of parallelogram = 153 cm^2

base × height = 153 cm^2

$18 \times DE = 153\text{ cm}^2$

$$DE = \frac{153}{18}\text{ cm} = 8.5\text{ cm}$$

Hence, the required distance is 8.5 cm.



5. $AB = DC = 15$ cm

Area of parallelogram $ABCD$ on base DC

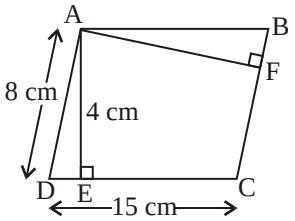
= Area of parallelogram $ABCD$ on base BC

$DC \times AE = BC \times AF$

$15 \times 4 = 8 \times AF$

$$AF = \frac{15 \times 4}{8}\text{ cm} = 7.5\text{ cm}$$

Hence, the distance between the shorter sides is 7.5 cm.



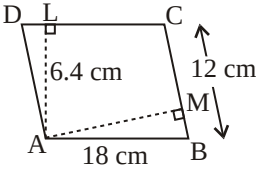
6. Area of parallelogram $ABCD$ on base AB

= Area of parallelogram $ABCD$ on base BC

$= AB \times LA = BC \times AM$

$18 \times 6.4 = 12 \times AM$

$$AM = \frac{18 \times 6.4}{12}\text{ cm} = 9.6\text{ cm}$$



7. (a) Area of the rhombus = base × height

$$= \left(\frac{2}{10} \times 12.6\right)\text{cm}^2 = 2.52\text{ cm}^2$$

(b) Area of the rhombus = base × height

$$= (12 \times 7.5)\text{ cm}^2 = 90\text{ cm}^2$$

8. (a) $AC = 8\,\text{dm}\ 5\,\text{cm}$

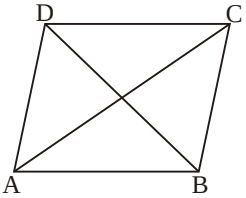
$= 8 \times 10\,\text{cm} + 5\,\text{cm}$

$= 85\,\text{cm}$

$BD = 5\,\text{dm}\ 6\,\text{cm}$

$= 5 \times 10\,\text{cm} + 6\,\text{cm}$

$= 56\,\text{cm}$



Area of the rhombus $= \frac{1}{2} \times$ (product of diagonals)

$= \frac{1}{2} \times AC \times BD$

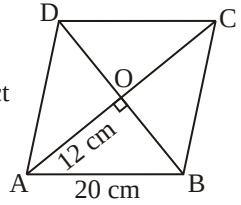
$= \frac{1}{2} \times 85 \times 56\ \text{cm}^2 = 2380\,\text{cm}^2$

(b) Area of the rhombus $= \frac{1}{2} \times$ (product of diagonals)

$= \left(\frac{1}{2} \times 16 \times 28\right)\text{cm}^2 = 224\,\text{cm}^2$

9. Let $ABCD$ be the rhombus is which $AB = 20\,\text{cm}$ and $AC = 24\,\text{cm}$.

We know that the diagonals of a rhombus bisect each other at right angles.



$OA = \frac{1}{2} \times AC = \left(\frac{1}{2} \times 24\right)\text{cm}$

$= 12\,\text{cm}$ and $AOB = 90°$

$OB = \sqrt{AB^2 - OA^2} = \sqrt{(20)^2 - (12)^2}\ \text{cm}$

$= \sqrt{400 - 144}\ \text{cm} = \sqrt{256}\ \text{cm} = 16\,\text{cm}$

$BD = (2 \times OB) = (2 \times 16)\,\text{cm} = 32\,\text{cm}$

Area of rhombus $ABCD = \left(\frac{1}{2} \times AC \times BD\right)$ sq. units

$= \left(\frac{1}{2} \times 24 \times 32\right)\text{cm}^2 = 384\,\text{cm}^2$

10. Area of the rhombus $= 148.8\,\text{cm}^2$

$\frac{1}{2} \times d_1 \times d_2 = 148.8\,\text{cm}^2$

$\frac{1}{2} \times 19.2 \times d_2 = 148.8\ \text{cm}^2$

$d_2 = \frac{148.8 \times 2}{19.2}\,\text{cm} = 15.5\,\text{cm}$

Hence, the length of the other diagonal is 15.5 cm.

11. Lets s be the side of rhombus. Then

$$\text{Area of rhombus} = \text{side} \times \text{height}$$

$$441 = 5 \times 17.5$$

$$s = \frac{441}{17.5} = 25.2 \text{ cm}$$

Hence, side of rhombus = 25.2 cm.

12. Let each side of the rhombus be S. Then,

$$4S = 56 \text{ cm}$$

$$S = \frac{56}{4} = 14 \text{ cm}$$

Now, Area of rhombus $= 119 \text{ cm}^2$

$$\text{base} \times \text{height} = 119$$

$$14 \times \text{height} = 119$$

$$\text{height} = \frac{119}{14} = 8.5 \text{ cm}$$

Hence, the height of the rhombus is 8.5 cm.

EXERCISE 20(D)

1. (a) Here, base = 8 dm = 80 cm and height = 35 cm

$$\text{Area of the triangle} = \left(\frac{1}{2} \times \text{base} \times \text{height}\right) \text{sq. units}$$

$$= \left(\frac{1}{2} \times 80 \times 35\right) \text{cm}^2 = 1400 \text{ cm}^2$$

(b) Here, base = 42 cm and height = 25 cm

$$\text{Area of the triangle} = \left(\frac{1}{2} \times \text{base} \times \text{height}\right) \text{sq. units}$$

$$= \left(\frac{1}{2} \times 42 \times 25\right) \text{cm}^2 = 525 \text{ cm}^2$$

(c) Here, base = 16.8 m and height $= 75 \text{ cm} = \frac{75}{100} \text{ m}$

$$\text{Area of the triangle} = \left(\frac{1}{2} \times \text{base} \times \text{height}\right) \text{sq. units}$$

$$= \left(\frac{1}{2} \times 16.8 \times \frac{75}{100}\right) \text{m}^2 = 6.3 \text{ m}^2$$

2. Area of the triangle $= 90 \text{ cm}^2$

$$\frac{1}{2} \times \text{base} \times \text{height} = 90 \text{ cm}^2$$

$$\frac{1}{2} \times \text{base} \times 12 = 90\,\text{cm}^2$$

$$\text{base} = \frac{90 \times 2}{12}\,\text{cm} = 15\,\text{cm}$$

3. Area of the triangle $= 72\,\text{cm}^2$

$$\frac{1}{2} \times \text{base} \times \text{height} = 72\,\text{cm}^2$$

$$\frac{1}{2} \times 16 \times \text{height} = 72\,\text{cm}^2$$

$$\text{height} = \frac{72 \times 2}{16}\,\text{cm} = 9\,\text{cm}$$

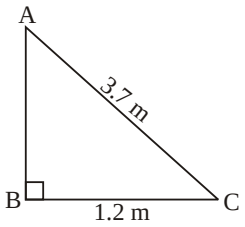
4. Area of the triangular region $= 224\,\text{m}^2$

$$\frac{1}{2} \times \text{base} \times \text{height} = 224\,\text{m}^2$$

$$\frac{1}{2} \times 28 \times \text{height} = 224\,\text{m}^2$$

$$\text{height} = \frac{224 \times 2}{28}\,\text{m} = 16\,\text{m}$$

5. By Pythagoras' theorem, we have



$$AB^2 = AC^2 - BC^2$$

$$AB^2 = \{(3.7)^2 - (1.2)^2\}\,\text{m}^2$$

$$= (13.69 - 1.44)\,\text{m}^2$$

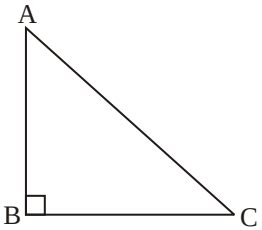
$$= 12.25\,\text{m}^2$$

$$AB = \sqrt{12.25}\,\text{m} = 3.5\ \text{m}$$

$$\text{Area of } \Delta ABC = \left(\frac{1}{2} \times BC \times AB\right) \text{sq units}$$

$$= \left(\frac{1}{2} \times 1.2 \times 3.5\right)\text{m}^2 = 2.1\ \text{m}^2$$

6. Let $AB = 3x$ and $BC = 4x$



Area of $\Delta ABC = 1014\,\text{cm}^2$

$$\frac{1}{2} \times BC \times AB = 1014\,\text{cm}^2$$

$$\frac{1}{2} \times 4x \times 3x = 1014\,\text{cm}^2$$

$$x^2 = \frac{1014}{6}\,\text{cm}^2 = 169\,\text{cm}^2$$

$$x = \sqrt{169}\ \text{cm} = 13\ \text{cm}$$
$$AB = (3 \times 13)\ \text{cm} = 39\ \text{cm}$$
$$BC = (4 \times 13)\text{cm} = 52\text{cm}$$

7. Area of the triangular field $= \frac{14580}{1080} = 13.5$ hectare

$$= 13.5 \times 10000\ \text{m}^2 = 13.5000\ \text{m}^2$$
$$= 13.5000\ \text{m}^2$$

Let the height of the triangle be x.

$$135000 = \frac{1}{2} \times x \times 3x$$
$$x^2 = \frac{135000 \times 2}{3} = 90000$$
$$x = \sqrt{90000} = 300$$
$$\text{base} = 3x = 3 \times 300 = 900\ \text{m}$$
$$\text{height} = x = 300\ \text{m}$$

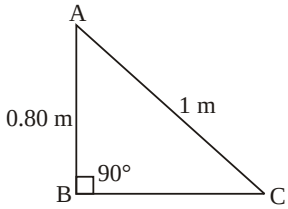
8. Let the length of other side be x cm.

Then, Area of the triangle $= 129.5\ \text{cm}^2$

$$\frac{1}{2} \times 14.8 \times x = 129.5\ \text{cm}^2$$
$$x = \frac{129.5 \times 2}{14.8}\ \text{cm} = 17.5\ \text{cm}$$

Hence, the length of other side is 17.5 cm.

9. Let there is a right-angled triangle with sides AC, AB and BC. AC be the longest side of this triangle.



So, in ΔABC, $AC = 1\text{m}$,

$$AB = 80\text{cm} = \frac{80}{100}\text{m}$$
$$= 0.80\ \text{m}$$
$$AC^2 = AB^2 + BC^2$$
$$(1)^2 = (0.8)^2 + BC^2$$
$$BC^2 = 1 - 0.64 = 0.36$$
$$BC = 0.6\ \text{m}$$
$$\text{Area of the triangle} = \frac{1}{2} \times 0.6 \times 0.8 = 0.24\ \text{m}^2$$
$$\text{Cost of scarf} = \text{`}\ (250 \times 0.24) = \text{`}\ 60$$

10. Area of the equilateral triangle $= (16\times\sqrt{3})\,\text{cm}^2$

$$\left(\frac{\sqrt{3}}{4}\times a^2\right) = 16\times\sqrt{3}$$

$$a^2 = \frac{16\times\sqrt{3}\times 4}{\sqrt{3}} = 64$$

$$a = \sqrt{64} = 8\,\text{cm}$$

Hence, the length of the equilateral triangle $= 8\,\text{cm}$

11. (a) Area of the equilateral triangle $= \left(\frac{\sqrt{3}}{4}\times a^2\right)$ sq. units

$$= \left(\frac{\sqrt{3}}{4}\times 18\times 18\right)\text{cm}^2$$

$$= 140.13\,\text{cm}^2$$

(b) Area of the qeuilateral triangle $= \left(\frac{\sqrt{3}}{4}\times a^2\right)$ sq. units

$$= \left(\frac{\sqrt{3}}{4}\times 20\times 20\right)\text{cm}^2 \quad = 173\,\text{cm}^2$$

12. Area of the equilateral triangle $= \left(\frac{\sqrt{3}}{4}\times a^2\right)$ sq. units

$$\frac{1}{2}\times 24\times h = \frac{\sqrt{3}}{4}\times 24\times 24$$

$$h = \frac{\sqrt{3}\times 24\times 24\times 2}{4\times 24} = 20.76\,\text{cm}$$

Hence, the required height is 20.76 cm.

13. Let the equal sides of the isosceles triangle be a and the base b.

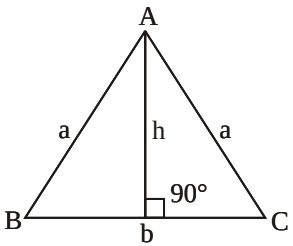
Perimeter of the triangle $= a + a + b$

$$32 = 2a + b$$

$$2a + 12 = 32$$

$$a = 10\,\text{cm}$$

Let the height of the ΔABC be h.



$$a^2 = h^2 + \left(\frac{b}{2}\right)^2$$

$$10^2 = h^2 + b^2$$

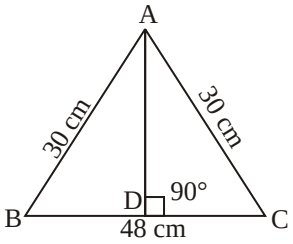
$$h^2 = 100 - 36 = 64$$

$$h = \sqrt{64} = 8\,\text{cm}$$

Area of the triangle $= \frac{1}{2} \times \text{base} \times \text{height}$

$$= \frac{1}{2} \times 12 \times 8 = 48\,\text{cm}^2$$

14. Let AD be the height of the ΔABC.



Then, $AC = 30\,\text{cm}$,

$$DC = \frac{48}{2}\,\text{cm} = 24\,\text{cm}$$

In ΔADC, $AC^2 = AD^2 + DC^2$

$$(30)^2 = AD^2 + (24)^2$$

$$AD^2 = 900 - 576 = 324$$

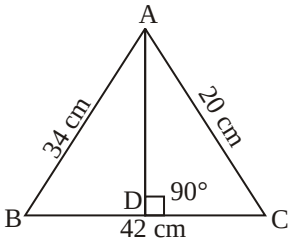
$$AD = \sqrt{324} = 18\,\text{cm}$$

Area of the triangle $= \frac{1}{2} \times \text{base} \times \text{height}$

$$= \frac{1}{2} \times BC \times AD$$

$$= \frac{1}{2} \times 48 \times 18\,\text{cm}^2 = 432\,\text{cm}^2$$

15. Here, $a = 42\,\text{cm}$, $b = 20\,\text{cm}$ and $c = 34\,\text{cm}$



$$s = \frac{1}{2}(42 + 20 + 34)\,\text{cm} = 48\,\text{cm}$$

$(s - a) = (48 - 42)\,\text{cm} = 6\,\text{cm}$,

$(s - b) = (48 - 20)\,\text{cm} = 28\,\text{cm}$,

$(s - c) = (48 - 34)\,\text{cm} = 14\,\text{cm}$

Area of ΔABC

$$= \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{48 \times 6 \times 28 \times 14}\,\text{cm}^2 = 336\,\text{cm}^2$$

Draw $AD \perp BC$. Then,

$$\frac{1}{2} \times BC \times AD = 336$$

$$\frac{1}{2} \times 42 \times AD = 336$$

$$AD = \frac{336 \times 2}{42} = 16\,\text{cm}$$

Hence, area of the triangle $= 16\,\text{cm}$

and length of the height on the longest side $= 16\,\text{cm}$.

16. Let the sides of the triangle be $13x, 14x$ and $15x$.

Perimeter of the triangle $= 13x + 14x + 15x = 42x$

Given, perimeter of the triangle $= 84$ cm

$$42x = 84 \text{ cm}$$

$$x = 2 \text{ cm}$$

So the sides of the triangle are $13a = 13 \times 2 = 26$ cm,

$14x = 14 \times 2 = 28$ cm and $15x = 15 \times 2 = 30$ cm.

$$s = \frac{26 + 28 + 30}{2} = 42 \text{ cm}$$

$$\text{Area of the triangle} = \sqrt{9(s-a)(s-b)(s-c)}$$

$$= \sqrt{42(42-26)(42-28)(42-30)}$$

$$= \sqrt{42 \times 16 \times 14 \times 12}$$

$$= \sqrt{6 \times 7 \times 4 \times 4 \times 7 \times 2 \times 6 \times 2}$$

$$= 6 \times 7 \times 4 \times 2 = 336 \text{ cm}^2$$

17. Here, $a = 33$ cm, $b = 44$ cm and $c = 55$ cm

$$s = \frac{33 + 44 + 55}{2} = 66 \text{ cm}$$

$$\text{Therefore, area} = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{66(66-33)(66-44)(66-55)}$$

$$= \sqrt{66 \times 33 \times 22 \times 11} = 726 \text{ cm}^2$$

Now, area of the triangle $= 726 \text{ cm}^2$

$$\frac{1}{2} \times \text{base} \times \text{height} = 726$$

$$\frac{1}{2} \times 44 \times \text{height} = 726$$

$$\text{height} = \frac{726 \times 2}{44} = 33 \text{ cm}$$

Hence, the area of the triangle $= 726 \text{ cm}^2$

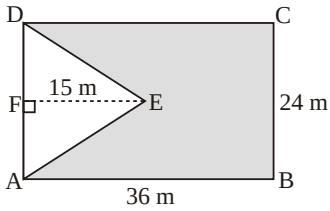
and the height of the triangle $= 33$ cm

18. Area of the shaded region

$$= \text{Area of rect } ABCD - \text{Area of } \Delta ADE$$

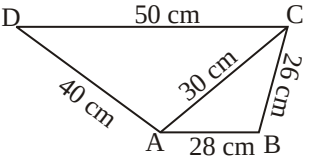
$$= (36 \times 24)\text{ m}^2 - \left(\frac{1}{2} \times 24 \times 15\right)\text{m}^2$$

$$= 864 \text{ m}^2 - 180 \text{ m}^2 = 684 \text{ m}^2$$



19. $s_1 = \frac{50+40+30}{2} = 60\,\text{cm}$

$s_2 = \frac{30+28+26}{2} = 42\,\text{cm}$



Area of the quadrilateral

$= \text{ar.}(\Delta ABC) + \text{ar.}(\Delta ABC)$

$= \sqrt{s_1(s_1 - DC)(s_1 - AC)(s_1 - AD)}$

$+ \sqrt{s_2(s_2 - AC)(s_2 - AB)(s_2 - BC)}$

$= \sqrt{60(60-50)(60-30)(60-40)}\,\text{cm}^2$

$+ \sqrt{42(42-30)(42-28)(42-26)}\,\text{cm}^2$

$= \sqrt{60\times 10\times 30\times 20}\,\text{cm}^2 + \sqrt{42\times 12\times 14\times 16}\,\text{cm}^2$

$= (600 + 336)\,\text{cm}^2 = 936\,\text{cm}^2$

20. Area of quadrilateral $ABCD$

$= \text{ar.}(\Delta ABD) + \text{ar.}(\Delta BCD)$

$= \left(\frac{1}{2}\times BD\times AL + \frac{1}{2}\times BD\times MC\right)$ sq. units

$= \left(\frac{1}{2}\times 24\times 5 + \frac{1}{2}\times 24\times 8\right)\text{cm}^2$

$= (60 + 96)\,\text{cm}^2 = 156\,\text{cm}^2$

EXERCISE 20 (E)

1. (a) Circumference $= (2\pi r)\text{units}$

$= \left(2\times \frac{22}{7}\times 1.4\right)\text{m} = 8.8\,\text{m}$

(b) Circumference $= (2\pi r)\text{units}$

$= \left(2\times \frac{22}{7}\times 28\right)\text{cm} = 176\,\text{cm}$

2. (a) Circumference $= (2\pi r)\text{units}$

$= (2r\times \pi)\,\text{units}$

$= \left(4.9\times \frac{22}{7}\right)\text{m}^2 = 15.4\,\text{m}^2$

(b) Circumference $= (2\pi r)\text{units} = (2r\times \pi)\,\text{units}$

$= \left(35\times \frac{22}{7}\right)\text{cm}^2 = 110\,\text{cm}^2$

3. Circumference of the given circle = 57.2 cm

$$C = 57.2 \text{ cm}$$
$$2\pi r = 57.2 \text{ cm}$$
$$r = \left(\frac{57.2 \times 7}{2 \times 22}\right) \text{cm} = 9.1 \text{ cm}$$

Hence, the radius of the circle is 9.1 cm.

4. Circumference of the given circle = 63.8 m

$$C = 63.8 \text{ cm}$$
$$2\pi r = 63.8 \text{ cm}$$
$$r = \left(\frac{63.8 \times 7}{2 \times 22}\right) \text{cm} = 10.15 \text{ cm}$$

Diameter of the circle = $2r = (2 \times 10.15)$ m = 20.3 m

5. Circumference = $(2\pi r)$ units

$$= (2 \times 3.14 \times 15) \text{ cm}$$
$$= 94.2 \text{cm}$$

6. Let the radii of the given circles be $5x$ and $3x$ respectively and let their circumferences be C_1 and C_2 respectively.

Then, $C_1 = 2 \times \pi \times 5x = 10\pi x$

and $C_2 = 2 \times \pi \times 3x = 6\pi x$

$$\frac{C_1}{C_2} = \frac{10\pi x}{6\pi x} = \frac{5}{3}$$

$$C_1 : C_2 = 5 : 3$$

7. Let the radius of the circle be r cm.

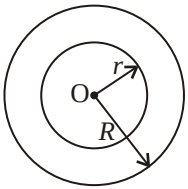
Then, its circumference = $2\pi r$ cm.

Now, (circumference) − (diameter) = 30 cm

$$(2\pi r - 2r) = 30$$
$$2r(\pi - 1) = 30$$
$$2r \times \left(\frac{22}{7} - 1\right) = 30$$
$$2r \times \frac{15}{7} = 30$$
$$r = \left(\frac{30 \times 7}{2 \times 15}\right) = 7$$

Hence, the radius of the circle is 7 cm.

8. Let the inner and outer radii of the track be r metres and R metres respectively.



Then, $2\pi r = 528$ and $2\pi R = 616$

$$2 \times \frac{22}{7} \times r = 528 \text{ and } 2 \times \frac{22}{7} \times R = 616$$

$$r = \left(\frac{528 \times 7}{2 \times 22}\right) = 84$$

and $$R = \left(\frac{616 \times 7}{2 \times 22}\right) = 98$$

$$(R - r) = (98 - 84)\text{ m} = 14\text{ m}$$

Hence, the width of the track is 14 m.

9. Circumference of circular field $= 2\pi r$

$$= \left(2 \times \frac{22}{7} \times 21\right)\text{m} = 132\text{ m}$$

Speed of cycling $= 8$ km/h $= \dfrac{8 \times 1000\text{m}}{60 \times 60\text{s}} = \dfrac{20}{9}$ m/s

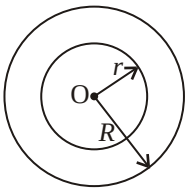
Time taken to cover a distance of $\dfrac{20}{9}$ m $= 1$ s

Time taken to cover a distance of 1 m $= \dfrac{1}{20/9}$ s

Time taken to cover a distance of 132 m $= \dfrac{132 \times 9}{20}$ s $= 59.4$ s

Hence, the time taken is 59.4 seconds.

10. Let the radius of the inner and outer circle be r metres and R metres respectively.



$$r = 98\text{ cm}$$

and $$R = 1\text{m } 26\text{ cm} = 100\text{ cm} + 26\text{ cm}$$
$$= 126\text{ cm}$$

Then, circumference of the first circle $= 2\pi r$

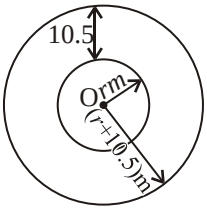
$$= \left(2 \times \frac{22}{7} \times 98\right)\text{cm} = 616\text{ cm}$$

Circumference of the second circle $= 2\pi r$

$$= \left(2 \times \frac{22}{7} \times 126\right)\text{cm} = 792\text{ cm}$$

Difference of the circumferences $= 792\text{ cm} - 616\text{ cm} = 176\text{ cm}$

11. Let the inner and outer radii of the track be r metres and $(r+7)$ metres respectively.



Inner circumference = 330 m

$$2\pi r = 330$$

$$2 \times \frac{22}{7} \times r = 330$$

$$r = \left(330 \times \frac{7}{44}\right) = 52.5$$

$\because$ Inner radius of the track = 52.5 m

Outer radius of the track = $(52.5 + 10.5)$ m = 63 m

Circumference of the outer circle = $\left(2 \times \frac{22}{7} \times 63\right)$ m = 396 m

Rate of fencing is ` 20 per metre.

Total cost of fencing the outer circle = ` $(396 \times 20)$ = ` 7920

12. Diameter of the wheel = 70 cm

Radius of the wheel = $\left(\frac{70}{2}\right)$ cm = 35 cm

Circumference of the wheel = $2\pi r$

$$= \left(2 \times \frac{22}{7} \times 35\right) \text{cm} = 220 \text{ cm} = 2.2 \text{ m}$$

Distance covered by the wheel in 1 revolution = 2.2 m

Distance covered by the wheel in 250 revolutions = (250×2.2) m

= 550 m

Hence, the distance covered by the wheel is 550 m.

13. Diameter of the wheel = 77 cm

$$\text{Radius of the wheel} = \frac{77}{2} \text{ cm}$$

Circumference of the wheel = $2\pi r$

$$= \left(2 \times \frac{22}{7} \times \frac{77}{2}\right) \text{cm} = 242 \text{ cm}$$

$$= \left(\frac{242}{100}\right) \text{m} = 2.42 \text{ m}$$

Distance covered by the wheel in 1 revolution

= its circumference = 2.42 m

Now, 2.42 m is covered by the car in 1 revolution.

(121×1000) m will be covered by

the car in $\left(1 \times \frac{1}{2.42} \times 121 \times 1000\right)$ revolutions = 50000 revolutions

Hence, the required number of revolutions = 50000

14. Let r be the radius of the wheel.

$$\text{Circumference of wheel} = 2\pi r = 2 \times \frac{22}{7} \times r$$

$$\text{Total distance covered in 5000 revolutions} = 2 \times \frac{22}{7} \times r \times 5000$$

A.T.Q., $2 \times \frac{22}{7} \times r \times 5000 = 11\,\text{km} = 11000\,\text{m}$

$$r = \frac{11000 \times 7}{5000 \times 2 \times 22} = \frac{7}{20}$$

$$r = 0.35\,\text{m}$$

$$\text{Circumference} = 2 \times \frac{22}{7} \times 0.35 = 2.2\,\text{m} = 220\,\text{cm}$$

$$\text{Diameter} = 2 \times 0.35\,\text{m} = 0.7\,\text{m} = 70\,\text{cm}$$

15. Diameter of the wheel = 98 cm

$$\text{Circumference of the wheel} = \pi d = \frac{22}{7} \times 98\,\text{cm}$$

$$= 308\,\text{cm}$$

Thus, the bus travels 308 cm in one rotation.

Distance covered by the bus in 2000 rotations

$$= (308 \times 2000)\,\text{cm}$$

$$= 616000\,\text{cm} = 6160\,\text{m}$$

16. Diameter of the well (d) = 140 cm

$$\text{Radius of the well } (r) = \frac{140}{2}\,\text{cm} = 70\,\text{cm}$$

Let the radius of the outer circle be R cm.

Length of the outer edge of the parapet = 616 cm

$$2\pi R = 616$$

$$2 \times \frac{22}{7} \times R = 616$$

$$R = \left(\frac{616 \times 7}{2 \times 22}\right)\text{cm} = 98\,\text{cm}$$

Now, width of the parapet = Radius of the outer circle

$$- \text{Radius of the well}$$

$$= (98 - 70)\,\text{cm} = 28\,\text{cm}$$

Hence, the width of the parapet is 28 cm.

EXERCISE 20 (F)

1. (a) Area of the circle $= \pi r^2$

$$= \frac{22}{7} \times 3.5 \times 3.5 = 38.5 \text{ m}^2$$

(b) Area of the circle $= \pi r^2$

$$= \frac{22}{7} \times 21 \times 21 = 1386 \text{ cm}^2$$

2. (a) Diameter (d) $= 1.4$ m

Radius (r) $= \frac{1.4}{2}$ m $= 0.7$ m

Area of circle $= \pi r^2$

$$= \left(\frac{22}{7} \times 0.7 \times 0.7\right) \text{m}^2 = 1.54 \text{ m}^2$$

(b) Diameter (d) $= 28$ cm

Radius (r) $= \frac{28}{2}$ cm $= 14$ cm

Area of circle $= \pi r^2$

$$= \left(\frac{22}{7} \times 14 \times 14\right) \text{cm}^2 = 616 \text{ cm}^2$$

3. Circumference $= 35.2$ m

$$2\pi r = 35.2$$

$$2 \times \frac{22}{7} \times r = 35.2$$

$$r = \frac{35.2 \times 7}{2 \times 22} = 5.6 \text{ m}$$

Area of the circle $= \pi r^2$

$$= \left(\frac{22}{7} \times 5.6 \times 5.6\right) \text{m}^2$$

$$= 98.56 \text{ m}^2$$

4. Circumference $= 264$ cm

$$2\pi r = 264$$

$$2 \times \frac{22}{7} \times r = 264$$

$$r = \frac{264 \times 7}{2 \times 22} = 42 \text{ cm}$$

Area of the circle $= \pi r^2$

$$= \left(\frac{22}{7} \times 42 \times 42\right) \text{cm}^2$$

$$= 5544 \text{ cm}^2$$

5. Area of the circle $= 1386 \text{ m}^2$

$$\pi r^2 = 1386$$

$$\frac{22}{7} \times r^2 = 1386$$

$$r^2 = \frac{1386 \times 7}{22} = 441 \qquad r = 21 \text{m}$$

Circumference $= 2\pi r$

$$= \left(2 \times \frac{22}{7} \times 21\right) \text{m} = 132 \text{ m}$$

6. Area of the circle $= 616 \text{ cm}^2$

$$\pi r^2 = 616$$

$$\frac{22}{7} \times r^2 = 616$$

$$r^2 = \frac{616 \times 7}{22} = 196$$

$$r = 14 \text{ cm}$$

Circumference $= 2\pi r$

$$= \left(2 \times \frac{22}{7} \times 14\right) \text{cm} = 88 \text{ cm}$$

7. Let r_1 and r_2 be the radii of two given circles.

Then,
$$\frac{r_1}{r_2} = \frac{4}{5}$$

$$\frac{r_1^2}{r_2^2} = \left(\frac{4}{5}\right)^2 = \frac{16}{25}$$

$$\frac{\pi r_1^2}{\pi r_2^2} = \frac{16}{25}$$

Let their areas be A_1 and A_2 respectively. Then,

$$\frac{A_1}{A_2} = \frac{\pi r_1^2}{\pi r^2} = \frac{16}{25}$$

$$A_1 : A_2 = 16 : 25$$

Hence, the ratio of the areas of the given circles is 16 : 25.

8. Radius of circular wire (r) = 28 cm

$$\text{Circumference} = 2\pi r = 2 \times \frac{22}{7} \times 28 = 176 \text{ cm}$$

Let x be the side of the square.

Circumference of circle = perimeter of the square

$$176 = 4x$$

$$x = \frac{176}{4} = 44 \text{ cm}$$

$$\text{Area of the square} = x^2 = 44^2 \text{ cm}^2 = 1936 \text{ cm}^2$$

9. Area of the acrylic sheet = 34 cm × 24 cm = 816 cm^2

Given that the diameter of a circular button is 3.5 cm.

$$\text{Radius of the circular button } (r) = \frac{3.5}{2} \text{ cm} = 1.75 \text{ cm}$$

Area of 1 circular button = πr^2

$$= \left(\frac{22}{7} \times 1.75 \times 1.75\right) \text{cm}^2 = 9.625 \text{ cm}^2$$

Area of 64 such buttons = $(64 \times 9.625) \text{ cm}^2 = 616 \text{ cm}^2$

Area of the remaining acrylic sheet

= Area of the acrylic sheet − Area of 64 circular buttons

$$= (816 - 616) \text{ cm}^2 = 200 \text{ cm}^2$$

10. Area of square enclosed by wire = 121 cm^2

$$(\text{side})^2 = (11)^2 \text{ cm}^2$$

$$\text{side} = 11 \text{ cm}$$

Length of wire = Perimeter of square

$$= 4 \times 11 \text{ cm} = 44 \text{ cm}.$$

Circumference of the circle = Length of wire

$$2\pi r = 44 \text{ cm}$$

$$r = \frac{44}{2 \times \frac{22}{7}} = \frac{44 \times 7}{2 \times 22} = 7 \text{ cm}$$

Now, Area of circle = πr^2

$$= \frac{22}{7} \times 7 \times 7 \text{ cm}^2$$

$$= 154 \text{ cm}^2$$

Hence, the area of circle enclosed by wire is 154 cm^2.

11. Area where the horse can graze = Area of a circle

$$= \pi r^2 = \left(\frac{22}{7} \times 21 \times 21\right) m^2 = 1386\, m^2$$

12. Required area of the field $= \frac{1}{4} \times \pi r^2$

$$= \left(\frac{1}{4} \times \frac{22}{7} \times 14 \times 14\right) m^2$$

$$= 154\, m^2$$

Hence, horse can graze $154\, m^2$ area of the rectangular field.

13. Diameter of inner big circle $= \left(\frac{2}{3} \times 21\right) cm = 14\, cm$

Radius of inner big circle $= \frac{14}{2}\, cm = 7\, cm$

Diameter of inner small circle $= \left(\frac{1}{3} \times 21\right) cm = 7\, cm$

Radius of inner small circle $= \frac{7}{2}\, cm$

Required area $= \left[\left(\frac{22}{7} \times \frac{21}{2} \times \frac{21}{2}\right) - \left\{\left(\frac{22}{7} \times 7 \times 7\right) + \left(\frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}\right)\right\}\right] cm^2$

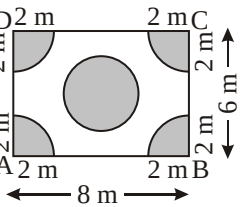
$= [346.5 - \{154 + 38.5\}]\ cm^2$

$= [346.5 - 192.5]\ cm^2 = 154\ cm^2$

14. Required area $= \left[(8 \times 6) - \left\{4 \times \frac{1}{4} \times \frac{22}{7} \times 2 \times 2\right\} + \left\{\frac{22}{7} \times 2 \times 2\right\}\right] m^2$

$= [48 - \{12.57 + 12.57\}]\, m^2$

$= [48 - 25.14]\, m^2 = 22.86\ m^2$



15. Area of the square $= (14 \times 14)\ cm^2 = 196\ cm^2$

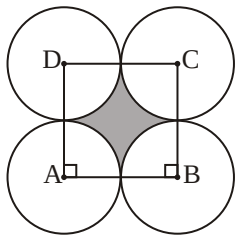
Sum of the areas of 4 quadrants

$$= \left(4 \times \frac{1}{4} \times \frac{22}{7} \times 7 \times 7\right) cm^2$$

$$= 154\, cm^2$$

Area of the shaded region $= (196 - 154)\, cm^2$

$$= 42\, cm^2$$



EXERCISE 20 (G)

1. $BC^2 = AC^2 - AB^2$

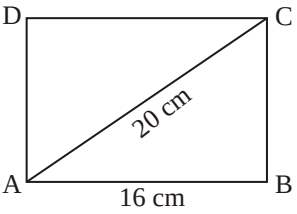
$= \{(20)^2 - (16)^2\}\,\text{cm}^2$

$= (400 - 256)\,\text{cm}^2 = 144\,\text{cm}^2$

$BC = 12\,\text{cm}$

Area $= (16 \times 12)\,\text{cm}^2 = 192\,\text{cm}^2$

(c) is correct.



2. Area of the square $= 200\,\text{cm}^2$

$(\text{side})^2 = 200\,\text{cm}^2$

$\text{side} = \sqrt{200}\,\text{cm} = 10\sqrt{2}\,\text{cm}$

Length of the diagonal $= \sqrt{2}$ side

$= (\sqrt{2}) \times (10\sqrt{2})\,\text{cm} = (10 \times 2)\,\text{cm} = 20\,\text{cm}$

(b) is correct.

3. Let the length and breadth be $5x$ metre and $3x$ metre respectively.

A.T.Q., $2 \times (5x + 3x) = 480$

$16x = 480 \qquad x = \dfrac{480}{16} = 30\,\text{m}$

Length $= 5 \times 30\,\text{m} = 150\,\text{m}$, breadth $= 3 \times 30\,\text{m} = 90\,\text{cm}$

Area $= (150 \times 90)\,\text{m}^2 = 13500\,\text{m}^2$

(b) is correct.

4. Area $= \dfrac{1}{2} \times d_1 \times d_2 = \left(\dfrac{1}{2} \times 24 \times 18\right)\text{cm}^2 = 216\,\text{cm}^2$

(b) is correct.

5. $s = \left(\dfrac{13 + 14 + 15}{2}\right)\text{cm} = 21\,\text{cm}$

Area $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{21(21-13)(21-14)(21-15)}$

$= \sqrt{21 \times 8 \times 7 \times 6} = 84\,\text{cm}$

(a) is correct.

6. Area $= \dfrac{1}{2} \times \text{base} \times \text{height} = \left(\dfrac{1}{2} \times 12 \times 8\right)\text{m}^2 = 48\,\text{m}^2$

(b) is correct.

7. Let a be the side.

Then, $\dfrac{\sqrt{3}}{2}a = \sqrt{6} \qquad a = \dfrac{2\sqrt{6}}{\sqrt{3}}\,\text{cm} = 2\sqrt{2}\,\text{cm}$

$$\text{Area} = \frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} (2\sqrt{2})^2 \text{ cm}^2$$
$$= \frac{\sqrt{3}}{4} \times 4 \times 2 \text{ cm}^2$$
$$= 2\sqrt{3} \text{ cm}^2$$

(b) is correct.

8. $$\text{Area} = \frac{\sqrt{3}}{4} \times (\text{side})^2$$
$$= \left(\frac{\sqrt{3}}{4} \times 8 \times 8\right) \text{cm}^2 = 16\sqrt{3} \text{ cm}^2$$

(c) is correct.

9. Perimeter of rectangle $= 2(l + b)$

$$18 = 2(l + b)$$

Area of four walls $= 2(l + b) \times h$

Area of four walls $= (18 \times 3) \text{ m}^2 = 54 \text{ m}^2$

(c) is correct.

10. $$\frac{1}{2} \times d_1 \times d_2 = 36$$
$$\frac{1}{2} \times 6 \times d_2 = 36$$
$$d_2 = \frac{36 \times 2}{6} = 12 \text{ cm}$$

(c) is correct.

11. $$\text{Area} = 24.64 \text{ m}^2$$
$$\pi r^2 = 24.64$$
$$r^2 = \frac{24.64 \times 7}{22} = 7.84$$
$$r = \sqrt{7.84} = 2.8 \text{ m}$$
$$\text{Circumference} = 2\pi r = 2 \times \frac{22}{7} \times 2.8$$
$$= 17.60 \text{ m}$$

(c) is correct.

12. Circumference $= 2\pi r$

$$= \left(2 \times \frac{22}{7} \times 1.75\right) \text{m} = 11 \text{m}$$

Distance $= 11$ km $= 11 \times 1000$ m $= 11000$ m

Number of revolutions $= \frac{11000}{11} = 1000$

(c) is correct.

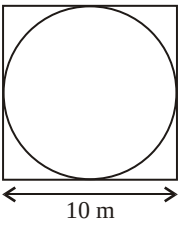
HOTS

- Perimeter of square $= 4 \times 10\,\text{m} = 40\,\text{m}$
  Perimeter of circle = Circumference of circle $= 2\pi r$
  Diameter $= 2r = 10\,\text{m}$

  Circumference of circle $= \frac{22}{7} \times 10$

  $= 31.43$ m (approx)

  Hence, perimeter of circle is less.



VALUE BASED

- Perimeter of circular park = Circumference of circle

  $= 2\pi r$

  $= \frac{22}{7} \times 84\,\text{m} = 264\,\text{m}$ $(\because 2r = 84\,\text{m})$

  Gap between two trees $= 2\,\text{m}$

  Number of trees planted along the circular park boundary $= \frac{264}{2}$

  $= 132$

  Hence, 132 trees planted along the boundary.

Chapter 21 Collection and Organisation of Data (Mean, Median and Mode)

EXERCISE 21A

1. Arranging the given data in ascending order, we get

260, 260, 300, 300, 300, 300, 360, 360, 360, 360, 360, 360, 400, 400, 400

We may now prepare the frequency table as shown below :

Daily wages (in `)	Tally marks	Number of workers (Frequency)
260	||	2
300	||||	4
360	𝍸 |	6
400	|||	3

2. Arranging the given data in ascending order, we get

5, 5, 6, 6, 6, 6, 7, 7, 7, 7, 7, 7, 7, 8, 8, 8, 8, 8, 8, 9, 9, 10, 10

Observation	Tally marks	Frequency
5	||	2
6	||||	4
7	𝍸 ||	7
8	𝍸	5
9	||	2
10	||	2

3. Sum of the first five natural numbers

$$= 1 + 2 + 3 + 4 + 5 = 15$$

$$\text{Mean} = \frac{\text{Sum of the observations}}{\text{Number of observations}} = \frac{15}{5} = 3$$

4. Sum of the first six odd natural numbers

$$= 1 + 3 + 5 + 7 + 9 + 11 = 36$$

$$\text{Mean} = \frac{\text{Sum of the observations}}{\text{Number of observations}} = \frac{36}{6} = 6$$

5. Sum of the first seven even natural numbers

$$= 2 + 4 + 6 + 8 + 10 + 12 + 14 = 56$$

$$\text{Mean} = \frac{\text{Sum of the observations}}{\text{Number of observations}} = \frac{56}{7} = 8$$

6. Sum of the first five prime numbers

$$= 2 + 3 + 5 + 7 + 11 = 28$$

$$\text{Mean} = \frac{\text{Sum of the observations}}{\text{Number of observations}} = \frac{28}{5} = 5.6$$

7. For calculating the mean, we prepare the table given below:

Height (in cm) (x_i)	Number of boys (f_i)	Product ($f_i \times x_i$)
165	9	1485
170	8	1360
175	11	1925
180	12	2160
	$\Sigma f_i = 40$	$\Sigma(f_i \times x_i) = 6930$

$$\text{Mean} = \frac{\Sigma(f_i \times x_i)}{\Sigma f_i} = \frac{6930}{40} = 173.25$$

Hence, the mean height is 173.25 cm.

8. For calculating the mean, we prepare the table given below:

Weight (in kg) (x_i)	Number of workers (f_i)	Product ($f_i \times x_i$)
60	4	240
63	5	315
66	3	198
72	1	72
75	2	150
	$\Sigma f_i = 15$	$\Sigma(f_i \times x_i) = 975$

$$\text{Mean} = \frac{\Sigma(f_i \times x_i)}{\Sigma f_i} = \frac{975}{15} = 65$$

Hence, the mean weight is 65 kg.

9. For calculating the mean, we prepare the table given below:

Age (in years) (x_i)	Number of players (f_i)	Product ($f_i \times x_i$)
14	15	210
15	14	210
16	10	160
17	8	136
18	3	54
	$\Sigma f_i = 50$	$\Sigma(f_i \times x_i) = 770$

$$\text{Mean} = \frac{\Sigma(f_i \times x_i)}{\Sigma f_i} = \frac{770}{50} = 15.4$$

Hence, the mean age is 15.4 years.

10. (a) tabulation (b) frequency (c) array (d) original (e) numerical

EXERCISE 21B

1. (a) Arranging the given data in ascending order, we get

6, 8, 9, 15, 16, 18, 21, 22, 25

Here, n is 9.

So, median $= \left(\frac{n+1}{2}\right)^{th}$ observation $= \left(\frac{9+1}{2}\right)^{th}$ observation

$= 5^{th}$ Observation $= 16$

Hence, the median is 16.

(b) Arranging the given data in ascending order, we get

6, 8, 9, 13, 15, 16, 18, 20, 21, 22, 25

Here, n is 11.

So, median $= \left(\frac{n+1}{2}\right)^{th}$ observation

$= \left(\frac{11+1}{2}\right)^{th}$ observation

$= 6^{th}$ observation $= 16$

Hence, the median is 16.

2. (a) Arranging the given data in ascending order, we get

9, 10, 17, 19, 21, 22, 32, 35

Here, n is 8.

So, median $= \frac{1}{2}\left[\left(\frac{n}{2}\right)^{th} \text{ observation} + \left(\frac{n}{2}+1\right)^{th} \text{ observation}\right]$

$= \frac{1}{2}\left[\left(\frac{8}{2}\right)^{th} \text{ observation} + \left(\frac{8}{2}+1\right)^{th} \text{ observation}\right]$

$= \frac{1}{2}\{4^{th} \text{ observation} + 5^{th} \text{ observation}\}$

$= \frac{1}{2}(19+21) = \frac{1}{2} \times 40 = 20$

Hence, the median is 20.

(b) Arranging the given data in ascending order, we get

29, 35, 51, 55, 60, 63, 72, 82, 85, 91

Here, n is 10.

So, median $= \frac{1}{2}\left[\left(\frac{n}{2}\right)^{th} \text{ observation} + \left(\frac{n}{2}+1\right)^{th} \text{ observation}\right]$

$= \frac{1}{2}\left[\left(\frac{10}{2}\right)^{th} \text{ observation} + \left(\frac{10}{2}+1\right)^{th} \text{ observation}\right]$

$= \frac{1}{2}\{5^{th} \text{ observation} + 6^{th} \text{ observation}\}$

$= \frac{1}{2}(60+63) = \frac{1}{2} \times 123 = 61.5$

3. First 50 whole numbers are

0, 1, 2, 3, 4, …., 49

Here, $n = 50$, which is even.

median $= \frac{1}{2}\left[\left(\frac{n}{2}\right)^{th} \text{ observation} + \left(\frac{n}{2}+1\right)^{th} \text{ observation}\right]$

$$= \frac{1}{2}\left[\left(\frac{50}{2}\right)^{th} \text{ observation} + \left(\frac{50}{2}+1\right)^{th} \text{ observation}\right]$$

$$= \frac{1}{2}\{(25)^{th} \text{ observation} + (26)^{th} \text{ observation}\}$$

$$= \frac{1}{2}(24+25) = \frac{1}{2} \times 49 = 24.5$$

Hence, the median of first 50 whole numbers is 24.5.

4. The first 15 odd numbers are :

1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29

Here, $n = 15$ (odd)

So, $\text{median} = \frac{1}{2}(n+1)^{th}$ observation

$$= \frac{1}{2}(15+1)^{th} \text{ observation}$$

$$= \frac{16}{2}^{th} \text{ observation}$$

$$= 8^{th} \text{ observation} = 15$$

Hence, the median is 15.

5. The first 10 even numbers are

2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Here, $n = 10$, which is even.

$$\text{median} = \frac{1}{2}\left[\left(\frac{n}{2}\right)^{th} \text{ observation} + \left(\frac{n}{2}+1\right)^{th} \text{ observation}\right]$$

$$= \frac{1}{2}\left[\left(\frac{10}{2}\right)^{th} \text{ observation} + \left(\frac{10}{2}+1\right)^{th} \text{ observation}\right]$$

$$= \frac{1}{2}\{(5)^{th} \text{ observation} + 6^{th} \text{ observation}\}$$

$$= \frac{1}{2}(10+12) = \frac{1}{2} \times 22 = 11$$

Hence, the median of first 10 even numbers is 11.

6. The ages in years of 10 teachers in a school are

34, 37, 53, 46, 52, 43, 31, 36, 40, 50

Arranging them in ascending order, we get

31, 34, 36, 37, 40, 43, 46, 50, 52, 53

Here, $n = 10$ (even)

$$\text{median} = \frac{1}{2}\left[\left(\frac{n}{2}\right)^{th} \text{ observation} + \left(\frac{n}{2}+1\right)^{th} \text{ observation}\right]$$

$$= \frac{1}{2}\left[\left(\frac{40}{2}\right)^{th} \text{ observation} + \left(\frac{40}{2}+1\right)^{th} \text{ observation}\right]$$

$$= \frac{1}{2}\{(5)^{th} \text{ observation} + 6^{th} \text{ observation}\}$$

$$= \frac{1}{2}(40+43) = \frac{83}{2} = 41.5$$

Hence, the median age is 41.5 years.

7. Marks of 15 students are

20, 22, 26, 31, 40, 19, 17, 19, 25, 29, 23, 17, 24, 21, 35

Arranging the marks in ascending order :

17, 17, 19, 19, 20, 21, 22, 23, 24, 25, 26, 29, 31, 35, 40

Here, $n = 15$ (odd)

$$\text{median} = \frac{1}{2}(n+1)^{th} \text{ observation}$$

$$= \frac{1}{2}(15+1)^{th} \text{observation}$$

$$= \frac{16^{th}}{2} \text{ observation } = 8^{th} \text{ observation} = 23$$

Hence, the median marks is 23.

8. Arranging the terms in ascending order, we have :

Marks	15	17	20	22	25	30
Number of students	3	5	9	4	6	10

Now, preparing the cumulative frequency table, we have

Marks obtained (x_i)	**Number of students (f_i)**	**Cumulative frequency**
15	3	3
17	5	8
20	9	17
22	4	21
26	6	27
30	10	37

Total number of terms = 37, which is odd.

$$\text{Median of marks} = \text{marks obtained by } \left(\frac{37+1}{2}\right)^{th} \text{ student}$$

$$= \text{marks obtained by } 19^{th} \text{ student}$$

$$= 22$$

Hence, median of marks = 22

9. The given terms are in ascending order :

Weight (in kg)	45	46	48	50	52	54	55
Number of boys	8	5	6	9	7	4	2

Now, preparing the cumulative frequency table, we have

Weight (in kg) (x_i)	**Number of boys (f_i)**	**Cumulative frequency**
45	8	8
46	5	13
48	6	19
50	9	28
52	7	35
54	4	39
55	2	41

Here, $n = 41$, which is odd.

$$\text{Median weight} = \text{value of } \frac{1}{2}(n+1)^{th} \text{ observtion}$$

$$= \text{weight of } \frac{1}{2}(41+1)^{th} \text{ student}$$

$$= \text{weight of } 21^{st} \text{ student} = 50$$

Hence, the median weight is 50 kg.

10. Arranging the terms in ascending order, we have :

Height (in cm)	151	152	153	154	155	156	157
Number of students	6	3	12	4	10	8	7

Now, preparing the cumulative frequency table, we have

Weight (in cm) (x_i)	**Number of students (f_i)**	**Cumulative frequency**
151	6	6
152	3	9
153	12	21
154	4	25
155	10	35
156	8	43
157	7	50

Total number of terms = 50, which is even.

$$\text{median of height} = \frac{1}{2}\left\{\left(\frac{n}{2}\right)^{th} \text{ observation} + \left(\frac{n}{2}+1\right)^{th} \text{ observation}\right\}$$

$$= \frac{1}{2}\left\{\left(\frac{50}{2}\right)^{th} \text{ observation} + \left(\frac{50}{2}+1\right)^{th} \text{ observation}\right\}$$

$$= \frac{1}{2}\{(25)^{th} \text{ observation} + 26^{th} \text{ observation}\}$$

$$= \frac{1}{2}(154+155) = \frac{309}{2} = 154.5$$

Hence, the median height is 154.5 cm.

EXERCISE 21C

1. (a) Arranging the given data in ascending order, we get

4, 6, 7, 8, 8, 8, 8, 10, 11, 15

Clearly, 8 occurs maximum number of times.

Hence, mode is 8.

(b) Arranging the given data in ascending order, we get

28, 21, 23, 27, 27, 27, 27, 27, 36, 39, 40

Clearly, 27 occurs maximum number of times.

Hence, mode is 27.

2. Arranging the given data in ascending order, we get

28, 31, 32, 32, 32, 32, 34, 36, 38, 40, 41

Clearly, 32 occurs maximum number of times.

Hence, mode is 32.

3. We may prepare the table given below :

Marks (x_i)	**Number of students (f_i)**	**Cumulative frequency**	**($f_i \times x_i$)**
15	2	2	30
17	5	7	85
20	10	17	200
22	12	29	264
25	8	37	200
30	4	41	120
	$N = \Sigma f_i = 41$		$\Sigma(f_i \times x_i) = 899$

Here, $N = \Sigma f_i = 41$, which is odd.

$$\text{median} = \text{size of } \frac{1}{2}(N+1)^{\text{th}} \text{ item}$$

$$= \text{size of } \frac{1}{2}(41+1)^{\text{th}} \text{ item}$$

$$= \text{size of } 21^{\text{st}} \text{ item} = 22$$

Thus, median = 22

Also, $$\text{mean} = \frac{\Sigma(f_i \times x_i)}{\Sigma f_i} = \frac{899}{41} = 21.92$$

$$\text{mode} = 3(\text{median}) - 2(\text{mean})$$

$$= (3 \times 22) - (2 \times 21.92)$$

$$= 66 - 43.84 = 22.16$$

Thus, median = 22, mean = 21.92 and mode = 22.16

4. We may prepare the table given below :

Daily wages (in `) (x_i)	**Number of workers (f_i)**	**Cumulative frequency**	**($f_i \times x_i$)**
300	6	6	1800
375	8	14	3000
450	9	23	4050
525	12	35	6300
600	10	45	6000
	$N = \Sigma f_i = 45$		$\Sigma(f_i \times x_i) = 21150$

Here, $N = \Sigma f_i = 45$, which is odd.

$$\text{median} = \text{size of } \frac{1}{2}(N+1)^{\text{th}} \text{ item}$$

$$= \text{size of } \frac{1}{2}(45+1)^{\text{th}} \text{ item}$$

$$= \text{size of } 23^{\text{rd}} \text{ item}$$

$$= 450$$

Thus, median = 450

Also, $$\text{mean} = \frac{\Sigma(f_i \times x_i)}{\Sigma f_i} = \frac{21150}{45} = 470$$

$$\text{mode} = 3(\text{median}) - 2(\text{mean})$$

$$= (3 \times 450) - (2 \times 470)$$

$$= 1350 - 940 = 410$$

Hence, median = ` 450, mean = ` 470 and mode = ` 410

5. We may prepare the table given below :

Weight (in kg) (x_i)	Number of players (f_i)	Cumulative frequency	($f_i \times x_i$)
48	4	4	192
50	3	7	150
52	2	9	104
54	2	11	108
58	1	12	58
	$N = \Sigma f_i = 12$		$\Sigma(f_i \times x_i) = 612$

Here, $N = \Sigma f_i = 12$, which is even.

$$\text{median} = \frac{1}{2}\left[\text{size of } \left(\frac{N}{2}\right)^{th} \text{ item} + \text{size of } \left(\frac{N}{2}+1\right)^{th} \text{ item}\right]$$

$$= \frac{1}{2}\{(\text{size of } 6^{th} \text{ item}) + (\text{size of } 7^{th} \text{ item})\}$$

$$= \frac{1}{2}(50+50) = \frac{100}{2} = 50\,\text{kg}$$

Also, $$\text{mean} = \frac{\Sigma(f_i \times x_i)}{\Sigma f_i} = \frac{612}{12}\,kg = 51\text{kg}$$

$$\text{mode} = 3(\text{median}) - 2(\text{mean})$$
$$= \{(3\times 50) - (2\times 51)\}\,\text{kg}$$
$$= (150 - 102) = 48\,\text{kg}$$

Hence, median = 50 kg, mean = 51 kg and mode = 48 kg

HOTS

- Data arrange in ascending order :
  130, 130, 135, 142, 142, 142, 142, 142, 142, 150, 150, 158, 158, 160, 160, 160, 160, 174, 174, 190.

$$\text{Mean} = \frac{\text{Sum of blood pressures}}{\text{No. of patients}} = \frac{3041}{20} = 152.05$$

$$\text{Median} = \frac{1}{2}\left[\left(\frac{n}{2}\right)^{th} \text{observation} + \left(\frac{n}{2}+1\right)^{th} \text{observation}\right]$$

$$= \frac{1}{2}\left[\left(\frac{20}{2}\right)^{th} \text{observation} + \left(\frac{20}{2}+1\right)^{th} \text{observation}\right]$$

$$= \frac{1}{2}\{10^{th} \text{ observation} + 11^{th} \text{ observation}\}$$

$$= \frac{1}{2}(150+150) = \frac{1}{2}\times 300 = 150$$

Mode = Value of the observation which occurs most frequently.
Clearly, 142 occurs maximum number of times.
Hence, mode = 142.

VALUE BASED

- Do yourself

Chapter 22 Bar Graphs

EXERCISE 22

1. We can draw the bar graph by following steps :

Step 1. On a graph paper, draw a horizontal line OX and a vertical line OY, representing the x-axis and the y-axis respectively.

Step 2. Along OX, mark the sports at points taken at equal gaps.

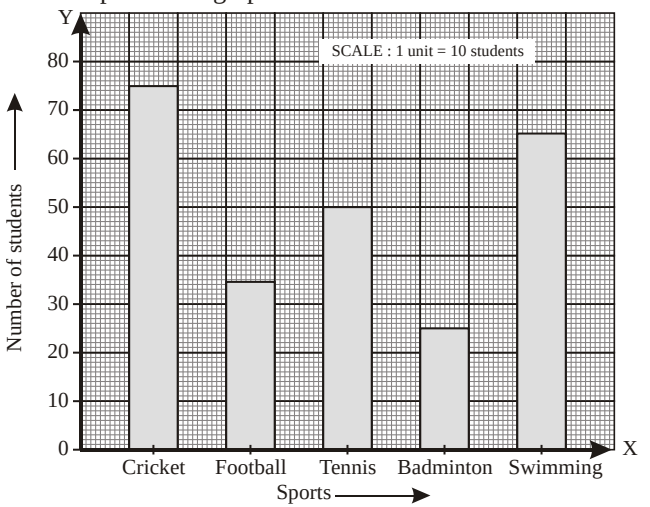
Step 3. Choose the scale : 1 small division = 1 student

Step 4. The heights of the bars are :

Number of students who play cricket = 75 small divisions
Number of students who play football = 35 small divisions
Number of students who play Tennis = 50 small divisions
Number of students who play Badminton = 25 small divisions
Number of students who play Swimming = 65 small divisions

Step 5. Draw bars of equal width and of heights calculated in step 4 at the points marked in step 2.

The completed bar graph is shown below.



Bar graph showing the favourite sports of 250 students of a school

2. We can draw the bar graph by following steps :

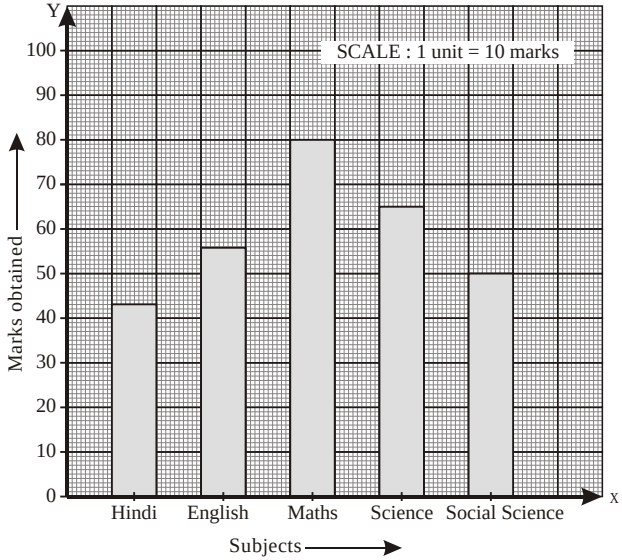
Step 1. On a graph paper, draw a horizontal line OX and a vertical line OY. These two lines represent the x-axis and the y-axis respectively.

Step 2. Along OX, write the names of the subjects at points taken at uniform gaps.

Step 3. Choose the scale : 1 small division ≡ 1 mark.

Step 4. Then, the heights of the various bars are :
Hindi = 43 small divisions, English = 56 small divisions, Mathematics = 80 small divisions, Science = 65 small divisions, and Social Science = 50 small divisions.

Step 5. On the x-axis, draw bars of equal width and of heights obtained in Step 4 at the points maked in Step 2.
The completed bar graph is shown below :



Bar graph showing marks obtained by Students in five subjects

3. We can draw the bar graph by following these steps :

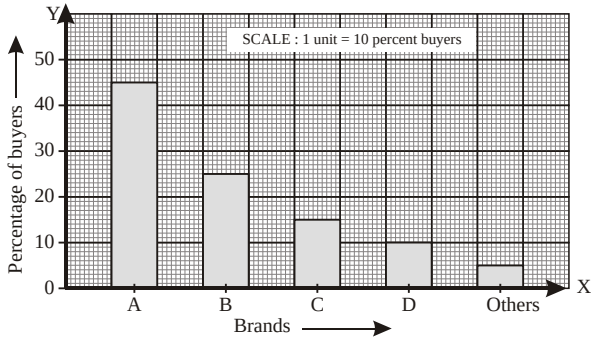
Step 1. On a graph paper, draw a horizontal line OX and a vertical line OY. These two lines represent the x-axis and the y-axis respectively.

Step 2. Along OX, write the names of the subjects at points taken at uniform gaps.

Step 3. Choose the scale : 1 small division ≡ 1 percent of buyers

Step 4. Then, the heights of the various bars are :
A = 45 small divisions, B = 25 small divisions, C = 15 small divisions, D = 10 small divisions, and others = 5 small divisiors

Step 5. On the *x*-axis, draw bars of equal width and of heights obtained in Step 4 at the points marked in Step 2.
The completed bar graph is shown below :



Bar graph showing percentage of buyers of the given brands

4. We can draw the bar graph by following these steps :

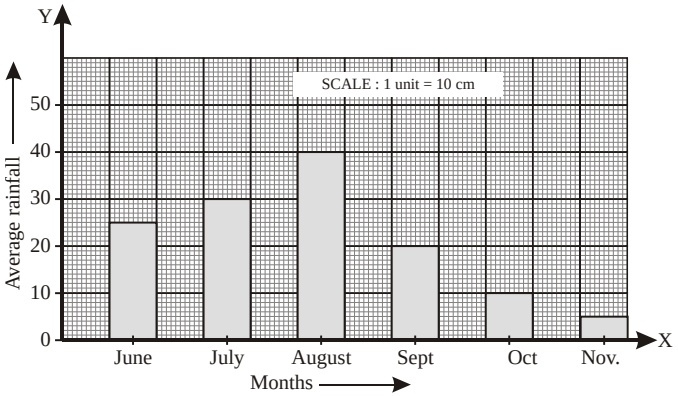
Step 1. On a graph paper, draw a horizontal line OX and a vertical line OY. These two lines represent the *x*-axis and the *y*-axis respectively.

Step 2. Along OX, write the names of the subjects at points taken at uniform gaps.

Step 3. Choose the scale : 1 small division ≡ 1 cm

Step 4. Then, the heights of the various bars are :
June = 25 small divisions, July = 30 small divisions,
Aug = 40 small divisions, Sept = 20 small divisions,
Oct = 10 small divisions and Nov = 5 small divisions.

Step 5. On the *x*-axis, draw bars of equal width and of heights obtained in Step 4 at the points marked in Step 2.
The completed bar graph is shown below :



Bar graph showing average rainfall during the given months

5. We can draw the bar graph by following these steps :

Step 1. On a graph paper, draw a horizontal line OX and a vertical line OY. These two lines represent the x-axis and the y-axis respectively.

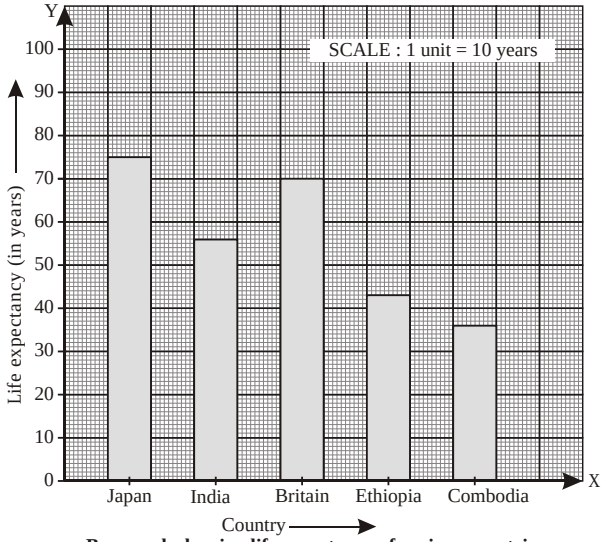
Step 2. Along OX, write the names of the subjects at points taken at uniform gaps.

Step 3. Choose the scale : 1 small division ≡ 1 year

Step 4. Then, the heights of the various bars are :
Japan = 76 small divisions, India = 57 small divisions,
Britain = 70 small divisions, Ethiopia = 43 small divisions
and Combodia = 36 small divisions.

Step 5. On the x-axis, draw bars of equal width and of heights obtained in Step 4 at the points marked in Step 2.

The completed bar graph is shown below :



Bar graph showing life expectancy of various countries

6. We can draw the bar graph by following these steps :

Step 1. On a graph paper, draw a horizontal line OX and a vertical line OY. These two lines represent the x-axis and the y-axis respectively.

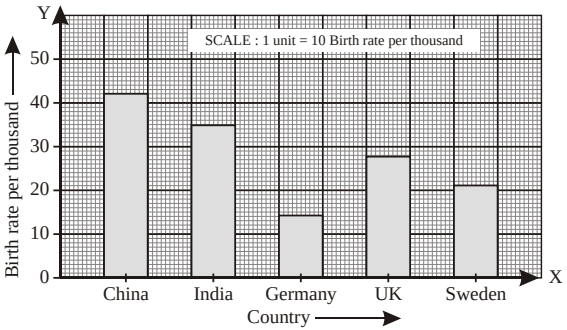
Step 2. Along OX, write the names of the subjects at points taken at uniform gaps.

Step 3. Choose the scale : 1 small division ≡ 1 Birth rate per thousand

Step 4. Then, the heights of the various bars are :
China = 42 small divisions, India = 35 small divisions,
Germany = 14 small divisions, UK = 28 small divisions
and Sweden = 21 small divisions.

Step 5. Draw bars of equal width and of heights calculated in Step 4 at the points maked in Step 2.

The completed bar graph is shown below :



Bar graph showing the birth rate per thousand in five different countries

7. We can draw the bar graph by following these steps :

Step 1. On a graph paper, draw a horizontal line OX and a vertical line OY representing x-axis and the y-axis respectively.

Step 2. Along OX, mark the vehicles at points taken at equal gaps.

Step 3. Choose the scale : 1 small division $\equiv$ 10 students

Step 4. Number of students using school bus

$$= \left(\frac{1}{10} \times 640\right) = 64 \text{ small divisions}$$

Number of students using private bus

$$= \left(\frac{1}{10} \times 360\right) = 36 \text{ small divisions}$$

Number of students using bicycle

$$= \left(\frac{1}{10} \times 490\right) = 49 \text{ small divisions}$$

Number of students using rickshaw

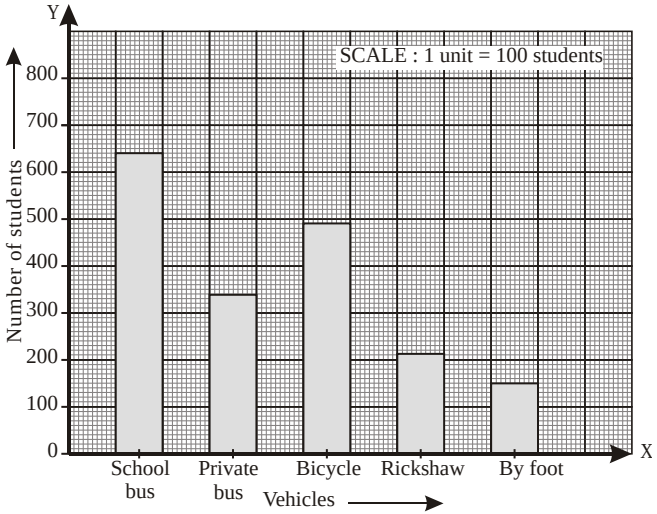
$$= \left(\frac{1}{10} \times 210\right) = 21 \text{ small divisions}$$

Number of students using foot

$$= \left(\frac{1}{10} \times 150\right) = 15 \text{ small divisions}$$

Step 5. Draw bars of equal width and of heights calculated in Step 4 at the points marked in Step 2.

The completed bar graph is shown below :



Bar graph showing the various modes of transport used by students

8. (a) The bar graph shows the marks obtained by a student in various subjects in an examination.

(b) The student is very good in Mathematics.

(c) The student is poor in Hindi.

(d) Average marks $= \frac{(60+35+75+50+60)}{5}$

$$= \frac{280}{5} = 56$$

9. We can draw the double bar graph in the following steps :

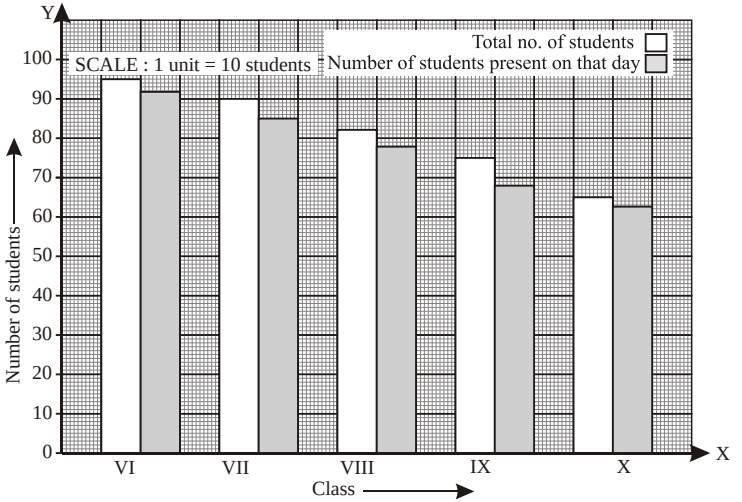
Step 1. On a graph paper, draw a horizontal line OX and a vertical line OY, representing the x-axis and the y-axis respectively.

Step 2. Along OX, write the names of the class taken at appropriate uniform gaps.

Step 3. Choose the scale: 1 small division = 1 student.

Step 4. The heights of various pairs of bars in terms of the number of small divisions are: VI = 95 and 92; VII = 90 and 85; VIII = 82 and 78; IX = 75 and 69 ; X = 68 and 62.

Step 5. On the x-axis, draw pairs of bars of equal width and of heights shown in Step 4 at the points marked in Step 2.



Double Bar graph showing class and students

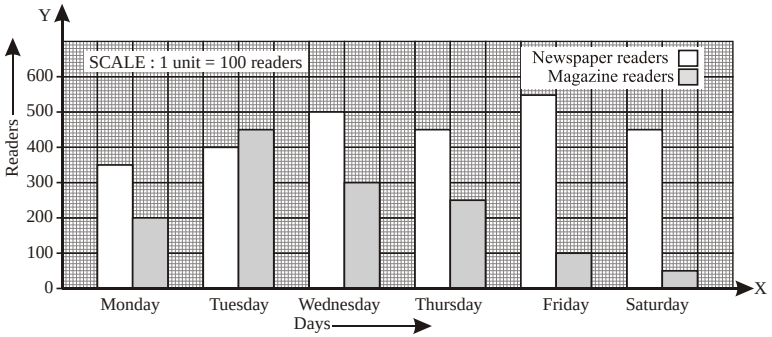
The completed double bar graphs are shown on the previous page.

(a) Class VI (b) 85 : 90 = 17 : 18

(c) $\frac{(75-69)}{75} \times 100 = \frac{6}{15} \times 100 = 8\%$

10. (a) We can draw the double bar graph in the following steps :

Step 1. On a graph paper, draw a horizontal line OX and a vertical line OY, representing the x-axis and the y-axis respectively.



Double Bar graph depicting marks scored by a student in various subjects in two different terms

Step 2. Along OX, write the names of the subjects taken at appropriate uniform gaps.

Step 3. Choose the scale: 1 small division = 10 readers

Step 4. The heights of various pairs of bars in terms of the number of small divisions are:

Monday = 350 and 200; Tuesday = 400 and 450;
Wednesday = 500 and 300 ; Thursday = 450 and 250;
Friday = 550 and 100 ; Sat = 450 and 50

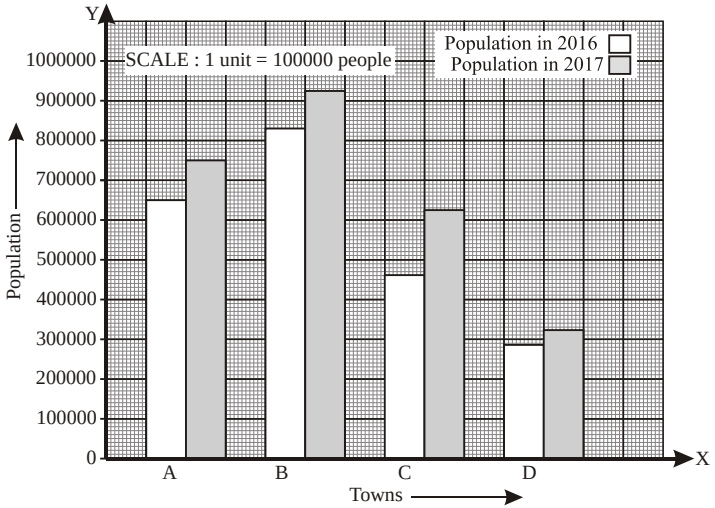
Step 5. On the *x*-axis, draw pairs of bars of equal width and of heights shown in Step 4 at the points marked in Step 2. The completed double bar graphs are shown above.

(b) Number of readers on Monday = 350 + 200 = 550
Number of readers on Tuesday = 400 + 450 = 850
Number of readers on Wednesday = 500 + 300 = 800
Number of readers on Thursday = 450 + 250 = 700
Number of readers on Friday = 550 + 100 = 650
Number of readers on Saturday = 450 + 50 = 500
Hence, the number of readers in the library was maximum on Tuesday.

(c) $\frac{200+450+300+250+100+50}{6} = \frac{1350}{6} = 225$

11. (a) We can draw the double bar graph in the following steps :

Step 1. On a graph paper, draw a horizontal line OX and a vertical line OY, representing the *x*-axis and the *y*-axis respectively.



Double Bar graph showing population of different towns

Step 2. Along OX, write the names of the subjects taken at appropriate uniform gaps.

Step 3. Choose the scale: 1 small division = 10000 people.

Step 4. The heights of the bars are :

For town A : $2016 = \left(\frac{1}{10000}\right) \times 640000 = 64$ small divisions

$2017 = \left(\frac{1}{10000}\right) \times 750000 = 75$ small divisions

For town B : $2016 = \left(\frac{1}{10000}\right) \times 830000 = 83$ small divisions

$2017 = \left(\frac{1}{10000}\right) \times 920000 = 92$ small divisions

For town C : $2016 = \left(\frac{1}{10000}\right) \times 460000 = 46$ small divisions

$2017 = \left(\frac{1}{10000}\right) \times 630000 = 63$ small divisions

For town D : $2016 = \left(\frac{1}{10000}\right) \times 290000 = 29$ small divisions

$2017 = \left(\frac{1}{10000}\right) \times 320000 = 32$ small divisions

Step 5. On the *x*-axis, draw pairs of bars of equal width and of heights shown in Step 4 at the points marked in Step 2.

The completed double bar graphs are shownon the previous page.

(b) Population growth in town A $= \left(\frac{750000 - 640000}{640000}\right) \times 100\%$

$= \left(\frac{110000}{640000} \times 100\right)\% = 17.19\%$

Population growth in town B $= \left(\frac{920000 - 830000}{830000}\right) \times 100\%$

$= \left(\frac{90000}{830000} \times 100\right)\% = 10.84\%$

Population growth in town C $= \left(\frac{630000 - 460000}{460000}\right) \times 100\%$

$= \left(\frac{170000}{460000} \times 100\right)\% = 36.96\%$

Population growth in town D $= \left(\frac{320000 - 290000}{290000}\right) \times 100\%$

$= \left(\frac{30000}{290000} \times 100\right)\% = 10.34\%$

Hence, the population growth is maximum is town C (36.96%).

(c) D (10.34 %)

12. (a) Minimum temperature for Nov, Dec, Jan and Feb of 2015 and 2016 have been compared.

(b) 18: 14 = 9 : 7 (c) November and February

(d) $\frac{14+13+8+9}{4} = \frac{44}{4} = 11°\,C$

(e) Nov = 18 − 14 = 4, Dec = 13 − 11 = 2, Jan = 8 − 5 = 3, Feb = 11 − 9 = 2
Hence, the variation of temperature is maximum in the month of November.

HOTS

- Do yourself

Chapter 23 Probability

EXERCISE 23

1. Total number of trials = 240
Number of heads = 150
Number of tails = 90

(a) P (getting a head) $= \frac{\text{Number of heads}}{\text{Total number of trials}} = \frac{150}{240} = \frac{5}{8}$

(b) P (getting a tail) $= \frac{\text{Number of tails}}{\text{Total number of trials}} = \frac{90}{240} = \frac{3}{8}$

2. Total number of trials = 200
Number of 2 heads = 58
Number of 1 head = 83
Number of 0 head = 59

(a) P (getting 2 heads) $= \frac{\text{Number of 2 heads}}{\text{Total number of trials}}$

$= \frac{58}{200} = \frac{29}{100}$

(b) P (getting 1 head) $= \frac{\text{Number of 1 head}}{\text{Total number of trials}} = \frac{83}{200}$

(c) P (getting 0 head) $= \frac{\text{Number of 0 head}}{\text{Total number of trials}} = \frac{59}{200}$

3. Total number of trials = 100

(a) P (getting a 3) $= \frac{18}{100} = \frac{9}{50}$

(b) P (getting a 6) $= \frac{9}{100}$

(c) P(getting a 4) $= \frac{15}{100} = \frac{3}{20}$

(d) P(getting a 1) $= \frac{21}{100}$

4. Total number of ladies = 100

Number of ladies who like coffee = 36

Number of ladies who dislike coffee = 64

(a) P(chosen lady likes coffee) $= \frac{36}{100} = \frac{9}{25}$

(b) P(chosen lady dislikes coffee) $= \frac{64}{100} = \frac{16}{25}$

5. Total number of students = 25 + 35 = 60

(a) P (selected student is a boy) $= \frac{25}{60} = \frac{5}{12}$

(b) P (selected student is a girl) $= \frac{35}{60} = \frac{7}{12}$

6. Total number of balls = 15 + 25 + 10 = 50

Number of red balls = 15

Number of blue balls = 25

Number of green balls = 10

(a) P (ball picked is red) $= \frac{15}{50} = \frac{3}{10}$

(b) P (ball picked is blue) $= \frac{25}{50} = \frac{1}{2}$

(c) P (ball picked is green) $= \frac{10}{50} = \frac{1}{5}$

HOTS

- P(Probability of an event) $= \frac{\text{Number of favourable events}}{\text{Total number of possible events}}$

(i) P(Hit a bundary) $= \frac{6}{90} = \frac{1}{15}$

(ii) Did not hit a boundary $= 1 - \frac{1}{15} = \frac{14}{15}$

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