PENGUIN SERIES

Accurate Mathematics

A Coursebook in Mathematics with Activities

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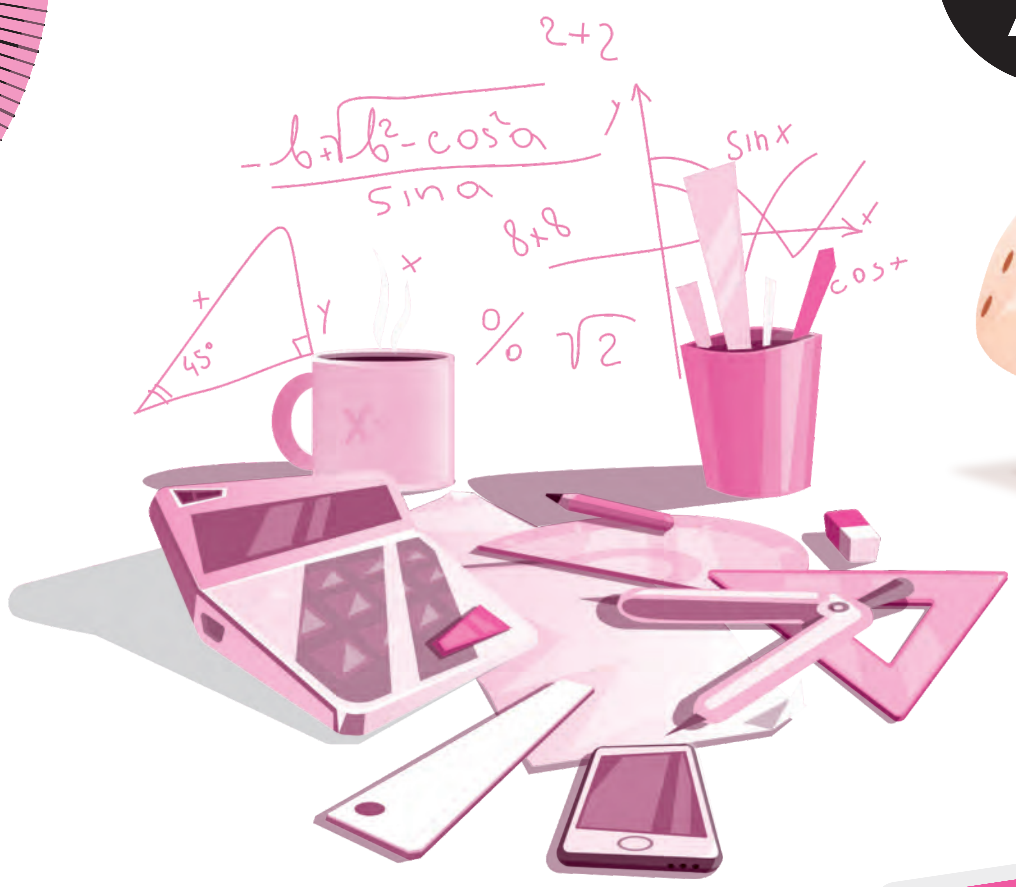

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Accurate Mathematics

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Preface

Accurate Mathematics is an innovative series for classes 1 to 8 which is specially designed for the children of new generation. Children should enjoy learning Mathematics rather than be afraid of it. They should pose and solve meaningful problems with ease. The contents of the books are complete and carefully graded as per the novel approach to the teaching of 'Mathematics hands on experience', in perfect co-ordination with resources available in the learner's immediate environment. The series follows the 'explain, comprehend and practise essential drill application' approach. The chapters provide a clear understanding, emphasize an investigative and exploratory approach to teaching. Wherever necessary, theory is presented precisely in a style tailored to act as a tool for teachers and students.

The theory is presented in a very simple language and supported with examples from everyday life.

A large number of objective questions have been included, which will help students quickly test their knowledge and skill.

A separate chapter titled as 'Activities' has been included to connect maths with real-life situations.

Test papers will help learners practise and apply the concepts learnt.

Every effort has been made to keep the series error-free. However, constructive suggestions for the improvement of the next edition will be highly appreciated.

– Publisher

Contents

1 Integers

In previous class, we have read about integers and operations on integers. In this chapter, we will revise previous topics in brief and read more on integers.

VARIOUS TYPES OF NUMBERS

Natural Numbers : *Counting numbers are called natural numbers.*

Thus, 1, 2, 3, 4, 5, 6, ... etc., are all natural numbers.

Whole Numbers : *All natural numbers together with* 0 (*zero*) *are called whole numbers.*

Thus, 0, 1, 2, 3, 4, ..., etc. are whole numbers.

Clearly, every natural number is a whole number but 0 is a whole number which is not a natural number.

Integers : *All natural numbers*, 0 *and negatives of counting numbers are called integers.*

Thus, ..., $-4, -3, -2, -1, 0, 1, 2, 3, 4, \ldots$, etc., are all integers.

(i) **Positive integers :** 1, 2, 3, 4, 5, ..., etc., are all positive integers.

(ii) **Negative integers :** $-1, -2, -3, -4, \ldots$, etc., are all negative integers.

(iii) **Zero** is an integer which is neither positive nor negative.

MODULUS OR ABSOLUTE VALUE

Modulus or absolute value of an integer is always positive. The absolute value of an integer a is denoted by $|a|$ and is given by

$$|a| = \begin{cases} a & \text{if } a \geq 0 \\ -a & \text{if } a < 0 \end{cases}$$

Example. *Evaluate the following* :

(a) $|28| - |-37|$ (b) $|63 - 24| - |16 - 17|$

Solution: (a) $|28| - |-37| = 28 - (37)$
$= 28 - 37$
$= -9$

(b) $|63 - 24| - |16 - 17| = 39 - (+1)$
$= 39 - 1$
$= 38$

ADDITION OF INTEGERS

There are some rules for adding positive and negative integers.

1. **Addition of two or more positive integers :** When we add two or more positive integers, then we simply add their values and assign the positive (+) sign to the sum.

   For example : Add 27, 37 aned 47.
   $27 + 37 + 47 = +111$

2. **Addition of two or more negative integers :** When we add two or more negative integers, then we simply add their values regardless of their signs and assign the negative (–) sign to the difference.

For example : Add (–38), (–79) and (–103).

$(-38)+(-79)+(-103) = -(38+79+103) = -220$

3. Addition of one positive and one negative integer : When one integer is positive and other integer is negative, then we subtract their numerical values regardless of their signs and assign the sign of that integer which has greater numerical value to the result.

For example : Add (–87) and 64.

Absolute value of –87 is 87.

Absolute value of 64 is 64.

Their difference $= 87 - 64 = 23$

Since, 87 has greater numerical value, so assign the negative sign to the difference.

Hence, $(-87)+64 = -23$

* The sum of two positive integers is always positive.
* The sum of two negative integers is always negative.

PROPERTIES OF ADDITION OF INTEGERS

I. Closure Property of Addition : *The sum of two integers is always an integer.*

Examples. (a) $3+4=7$, which is an integer.

(b) $5+(-7) = -2$, which is an integer.

(c) $(-2)+(-9) = -11$, which is an integer.

(d) $17+(-8) = 9$, which is an integer.

Hence, the sum of two integers is always an integer.

II. Commutative Law of Addition : *If a and b are any two integers, then*

$$a+b=b+a$$

Examples. (a) $(-3)+7=4$ and $7+(-3)=4$

$\therefore\ (-3)+7=7+(-3)$

(b) $(-4)+(-7)=-11$ and $(-7)+(-4)=-11$

$\therefore\ (-4)+(-7)=(-7)+(-4)$

III. Associative Law of Addition : *If a, b, c are any three integers, then*

$$(a+b)+c=a+(b+c)$$

Example. Consider the integers (–6), (–8) and 5, we have

$\{(-6)+(-8)\}+5=(-14)+5=-9$

And, $(-6)+\{(-8)+5\}=(-6)+(-3)=-9$

$\therefore\ \{(-6)+(-8)\}+5=(-6)+\{(-8)+5)\}$

Similarly, other examples may be taken up.

IV. Existence of Additive Identity : For any integer a, we have

$$a+0=0+a=a$$

0 is called the *additive identity* for integers.

Examples. (a) $8+0=0+8=8$ (b) $(-5)+0=0+(-5)=(-5)$

V. Existence of Additive Inverse : For any integer a, we have

$$a+(-a)=(-a)+a=0$$

The *opposite* of an integer a is $(-a)$.

Similarly, additive inverse of $(-a)$ is a.

The sum of an integer and its opposite is 0.

Additive inverse of a is $(-a)$.

Similarly, *additive inverse of* $(-a)$ is a.

Example. We have, $7 + (-7) = (-7) + 7 = 0$

So, the additive inverse of 7 is (-7).

And, the additive inverse of (-7) is 7.

SUBTRACTION OF INTEGERS

For any integers a and b, we define

(i) $a - b = a +$ (additive inverse of b) $= a + (-b)$

$\therefore$ $$a - b = a + (-b)$$

(ii) $a - (-b) = a +$ [additive inverse of $(-b)$] $= a + b$

$\therefore$ $$a - (-b) = a + b$$

Example 1. *Subtract :*

(*a*) 8 *from* 3 (*b*) -7 *from* 4 (*c*) 9 *from* (-8) (*d*) -6 *from* -2

Solution: We have

(a) $3 - 8 = 3 + (-8) = -5$

(b) $4 - (-7) = 4 + 7 = 11$

(c) $(-8) - 9 = (-8) + (-9) = -17$

(d) $-2 - (-6) = (-2) + 6 = 4$

Example 2. *Write :*

(*a*) *a negative integer and a positive integer whose difference is* -4.

(*b*) *a negative integer and a positive integer whose sum is* -6.

(*c*) *a pair of integers whose sum is* 0.

(*d*) *a pair of integers whose difference is* -12.

(e) *a pair of integers whose sum is* -8.

Solution: Clearly, we have

(a) $(-1) - 3 = -4$

(b) $(-8) + 2 = (-6)$

(c) $8 + (-8) = 0$

(d) $-15 - (-3) = (-15) + 3 = -12$

(e) $(-3) + (-5) = -8$

PROPERTIES OF SUBTRACTION OF INTEGERS

I. Closure Property for Subtraction : *If a and b are any two integers, then* $(a - b)$ *is always an integer.*

Examples. (a) $3 - 6 = 3 + (-6) = -3$, which is an integer.

(b) $(-3) - 7 = (-3) + (-7) = -10$, which is an integer.

(c) $4 - (-6) = 4 + 6 = 10$, which is an integer.

(d) $-3 - (-5) = -3 + 5 = 2$, which is an integer.

II. Subtraction of Integers is Not Commutative: *If a and b are any two integers, then*

$$a - b \neq b - a$$

Examples. (a) Consider the integers 5 and 7. We have :

$$(5 - 7) = 5 + (-7) = -2 \text{ and } (7 - 5) = 7 + (-5) = 2$$

$\therefore$ $$(5 - 7) \neq (7 - 5)$$

(b) Consider the integers (–4) and 2. We have

$$(-4)-2=(-4)+(-2)=-6 \text{ and } 2-(-4)=(2+4)=6$$

$\therefore$ $(-4)-2 \neq 2-(-4)$.

(c) Consider the integers (–8) and (–6). We have

$$(-8)-(-6)=(-8)+6=-2$$

and $(-6)-(-8)=(-6)+8=2$

$\therefore$ $(-8)-(-6) \neq (-6)-(-8)$

III. Subtraction of Integers is Not Associative : If a, b and c are any three integers, then

$$a-(b-c) \neq (a-b)-c$$

Example. Consider the integers 3, (– 4) and (–5). We have

$$\{3-(-4)\}-(-5)=(3+4)-(-5)=7-(-5)=(7+5)=12$$

And, $3-\{(-4)-(-5)\}=3-\{(-4)+5\}=(3-1)=2$

$\therefore$ $\{3-(-4)\}-(-5) \neq 3-\{(-4)-(-5)\}$

Example 3. *Write a pair of integers whose difference gives :*

(*a*) *an integer greater than only one of the integers.*

(*b*) *an integer greater than both the integers.*

(*c*) *an integer smaller than both the integers.*

(*d*) *a negative integer,*

(e) *zero,*

Solution: (a) Consider the integers (–5) and (–2). Then,

$$(-5)-(-2)=(-5)+2=-3$$

Clearly, $-3>-5$ and $-3<-2$

(b) Consider the integers 5 and (–3). Then,

$$5-(-3)=(5+3)=8$$

Clearly, $8>5$ and $8>-3$

(c) Consider the integers (–6) and 4. Then,

$$(-6)-4=(-6)+(-4)=-10$$

Clearly, $-10<-6$ and $-10<4$

(d) Consider the integers 4 and 6. Then,

$(4-6)=4+(-6)=-2$, which is a negative integer.

(e) Consider the integers 5 and 5.

Clearly, $(5-5)=0$

Example 4. *The sum of two integers is* -12. *If one of them is* 8, *find the other.*

Solution: Let the other integer be a. Then

$$8+a=-12 \Rightarrow a=(-12)-8=(-12)+(-8)=-20$$

Hence, the other integer is –20.

Example 5. *The difference of an integer a and* (–6) *is* –2. *Find the value of a.*

Solution: We have

$$a-(-6)=-2$$

$\Rightarrow$ $a+6=-2$

$\Rightarrow$ $a=-2-6=(-2)+(-6)=-8$

Hence, $a=-8$

Exercise 1A

1. Evaluate :

(a) $13+(-6)$ (b) $(-15)+8$ (c) $(-9)+(-21)$

(d) $(-22)+37$ (e) $43+(-16)$ (f) $(-38)+(-26)$

2. Find the sum of :

(a) 163 and – 312 (b) 1015 and –387 (c) –1025 and 357

(d) –379 and –214 (e) – 2000 and 1248 (f) –138 and 400

3. Find the additive inverse of :

(a) –38 (b) 465 (c) 0 (d) –1002

4. Subtract :

(a) 38 from –52 (b) –26 from 32 (c) –27 from –43 (d) –56 from –24

(e) 138 from 0 (f) –143 from –230 (g) –46 from 0 (h) –65 from 123

5. Subtract –134 from the sum of 38 and –87.

6. Subtract the sum of –1032 and 878 from –34.

7. Fill in the blanks :

(a) $(-31)+(\_\_\_\_\_)=-40$ (b) $(-60)-(\_\_\_\_\_)=-59$

(c) $-(-83)=\_\_\_\_\_$ (d) $(-72)+(\_\_\_\_\_)=-72$

(e) $(-68)+(-76)=(\_\_\_\_\_)+(-68)$ (f) $53+(-37)=(-37)+(\_\_\_\_\_)$

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

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

8. Find $36-(-64)$ and $(-64)-36$. Are they equal?

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

10. If $a=-9$ and $b=-6$, show that $(a-b)\neq(b-a)$.

11. If $a=-8, b=-7, c=6$, verify that $(a+b)+c=a+(b+c)$.

12. The difference of an integer a and (–6) is 4. Find the value of a.

13. The sum of two integers is –16. If one of them is 53, find the other.

14. The sum of two integers is 65. If one of them is –31, find the other.

15. For each of the following statements, write (T) for true and (F) for false :

(a) The sum of a negative integer and a positive integer is always a positive integer.

(b) The sum of two negative integers is a negative integer.

(c) Zero is larger than every negative integer.

(d) The smallest positive integer is zero.

(e) –10 is greater than –7.

MULTIPLICATION OF INTEGERS

Multiplication is repeated addition of integers.

1. **Multiplication of two positive integers :** When both integers are positive, then we multiply their values regardless of their signs and assign the positive (+) sign to the product.

   For example : $7\times8=56$, $12\times15=180$

2. **Multiplication of two negative integers :** When both integers are negative, then we multiply their values regardless of their signs and assign positive (+) sign to the product.

For example : $(-8) \times (-14) = +(8 \times 14) = 112$,

$(-30) \times (-11) = +(30 \times 11) = 330$

3. **Multiplication of a positive and a negative integer :** When both integers are of opposite signs, then we multiply their numerical values regardless of their signs and assign the negative (–) sign to the product.

For example : $12 \times (-5) = -(12 \times 5) = -60$,

$-15 \times 8 = -(15 \times 8) = -120$

$(+) \times (+) = (+)$ $(-) \times (-) = (+)$	Same signs — Positive
$(+) \times (-) = (-)$ $(-) \times (+) = (-)$	Opposite signs — Negative

PROPERTIES OF MULTIPLICATION OF INTEGERS

I. Closure Property for Multiplication : *The product of two integers is always an integer.*

Examples. (a) $6 \times 4 = 24$, which is an integer.

(b) $(-7) \times 5 = -35$, which is an integer.

(c) $8 \times (-4) = -32$, which is an integer.

(d) $(-9) \times (-6) = 54$, which is an integer.

II. Commutative Law for Multiplication : For any two integers a and b, we have

$$(a \times b) = (b \times a)$$

Examples. (a) $4 \times (-7) = -28$ and $(-7) \times 4 = -28$

$\therefore \quad 4 \times (-7) = (-7) \times 4$

(b) $(-8) \times (-5) = 40$ and $(-5) \times (-8) = 40$

$\therefore \quad (-8) \times (-5) = (-5) \times (-8)$

III. Associative Law for Multiplication : For any integers a, b, c, we have

$$(a \times b) \times c = a \times (b \times c).$$

Examples. (a) Consider the integres 3, –5 and –8. We have

$\{3 \times (-5)\} \times (-8) = (-15) \times (-8) = 120$

And $3 \times \{(-5) \times (-8)\} = (3 \times 40) = 120$

$\therefore \quad \{3 \times (-5)\} \times (-8) = 3 \times \{(-5) \times (-8)\}$

(b) Consider the integers (–8), (–6) and (–5). We have

$\{(-8) \times (-6)\} \times (-5) = 48 \times (-5) = -240$

And $(-8) \times \{(-6) \times (-5)\} = (-8) \times 30 = -240$

$\therefore \quad \{(-8) \times (-6)\} \times (-5) = (-8) \times \{(-6) \times (-5)\}$

IV. Distributive Law of Multiplication over Addition : For any integers a, b, c, we have

$$a \times (b + c) = (a \times b) + (a \times c)$$

Examples. (a) Consider the integres 5, (–6) and (–8). We have

$5 \times \{(-6) + (-8)\} = 5 \times (-14) = -70$

and $\{5 \times (-6)\} + \{5 \times (-8)\} = (-30) + (-40) = -70$

$\therefore \quad 5 \times \{(-6) + (-8)\} = \{5 \times (-6)\} + \{5 \times (-8)\}$.

(b) Consider the integers (–5), (–7) and (–9). We have

$$(-5)\times\{(-7)+(-9)\}=(-5)\times(-16)=80$$

And $\{(-5)\times(-7)\}+\{(-5)\times(-9)\}=(35+45)=80$

$\therefore$ $(-5)\times\{(-7)+(-9)\}=\{(-5)\times(-7)\}+\{(-5)\times(-9)\}$.

V. Existence of Multiplicative Identity : For every integer a, we have

$$(a\times 1)=(1\times a)=a$$

1 is called the multiplicative *identity* for integers.

Examples. (a) $(13\times 1)=13$ (b) $-17\times 1=-17$

VI. Existence of Multiplicative Inverse : Multiplicative inverse of a non-zero integer a is the number $\frac{1}{a}$, as

$$a\cdot\left(\frac{1}{a}\right)=\left(\frac{1}{a}\right)\cdot a=1$$

Examples. (a) Multiplicative inverse of 5 is $\frac{1}{5}$.

(b) Multiplicative inverse of –5 is $-\frac{1}{5}$.

VII. Property of Zero : For every integer a, we have

$$(a\times 0)=(0\times a)=0.$$

Examples. (a) $9\times 0=0\times 9=0$

(b) $(-7)\times 0=0\times(-7)=0$

Example 6. *Simplify :*

(*a*) $8\times(-15)+8\times 6$ (*b*) $15\times(-32)+15\times(-18)$

(*c*) $16\times(-9)+(-8)\times(-9)$ (*d*) $(-18)\times 7+(-18)\times(-4)$

Solution: Using the distributive law, we get

(a) $8\times(-15)+8\times 6=8\times\{(-15)+6\}$ $[\because a\times b+a\times c=a\times(b+c)]$

$=8\times(-9)$

$=-72$

(b) $15\times(-32)+15\times(-18)=15\times\{(-32)+(-18)\}$ $[\because a\times b+a\times c=a\times(b+c)]$

$=15\times(-50)$

$=-750$

(c) $16\times(-9)+(-8)\times(-9)=\{16+(-8)\}\times(-9)$ $[\because a\times c+b\times c=(a+b)\times c]$

$=8\times(-9)$

$=-72$

(d) $(-18)\times 7+(-18)\times(-4)=(-18)\times\{7+(-4)\}$ $[\because a\times b+a\times c=a\times(b+c)]$

$=(-18)\times 3$

$=-54$

IMPORTANT RESULTS

(i) $(-a_1)\times(-a_2)\times(-a_3)\times\ldots\times(-a_n)=-(a_1\times a_2\times a_3\times\ldots\times a_n)$, when n is odd.

(ii) $(-a_1)\times(-a_2)\times(-a_3)\times\ldots\times(-a_n)=(a_1\times a_2\times a_3\times\ldots\times a_n)$, when n is even.

(iii) $(-a)\times(-a)\times(-a)\times\ldots n$ times $=-a^n$, when n is odd.

(iv) $(-a)\times(-a)\times(-a)\times\ldots n$ times $=a^n$, when n is even.

(v) $(-1)\times(-1)\times(-1)\times\ldots n$ times $=-1$, when n is odd.

(vi) $(-1)\times(-1)\times(-1)\times\ldots n$ times $=1$, when n is even.

Example 4. *Evaluate :*

(a) $(-3)\times(-5)\times(-2)\times(-4)$

(b) $(-1)\times(-2)\times(-3)\times(-4)\times(-5)$

(c) $(-2)\times(-2)\times(-2)\times\ldots.$ 6 *times*

(d) $(-2)\times(-2)\times(-2)\times\ldots$ 7 *times*

(e) $(-1)\times(-1)\times(-1)\times\ldots$120 *times*

(f) $(-1)\times(-1)\times(-1)\times\ldots$ 505 *times*

Solution: (a) Number of negative integers in the given product is even.

Therefore, their product is positive.

$\therefore \quad (-3)\times(-5)\times(-2)\times(-4)=(3\times5\times2\times4)=120$

(b) Number of negative integers in the given product is odd.

Therefore, their product is negative.

$\therefore \quad (-1)\times(-2)\times(-3)\times(-4)\times(-5)=-(1\times2\times3\times4\times5)=-120$

(c) Number of negative integers in the given product is even.

Therefore, their product is positive.

$\therefore \quad (-2)\times(-2)\times(-2)\times\ldots 6 \text{ times} = 2^6 = 64$

(d) Number of negative integers in the given product is odd.

Therefore, their product is negative.

$\therefore \quad (-2)\times(-2)\times(-2)\times\ldots 7 \text{ times} = (-2)^7 = -128$

(e) Number of negative integers in the given product is even.

Therefore, their product is positive.

$\therefore \quad (-1)\times(-1)\times(-1)\times\ldots 120 \text{ times} = 1$

(f) Number of negative integers in the given product is odd.

Therefore, their product is negative.

$\therefore \quad (-1)\times(-1)\times(-1)\times\ldots 505 \text{ times} = -1$

Example 5. *What will be the sign of the product if we multiply together* 187 *negative and* 16 *positive integers?*

Solution: Whatever may be the number of positive integers, it will not affect the sign of the product.

Since 187 is odd and the product of odd number of negative integers is negative, so the given product is negative.

Exercise 1B

1. Multiply :

(a) 14 by 9 (b) 17 by – 6 (c) 34 by –11 (d) –22 by 14

(e) –43 by 18 (f) –75 by 0 (g) 0 by – 38 (h) –15 by –11

(i) –102 by –8 (j) – 45 by – 50 (k) – 87 by –1 (l) 35 by – 15

2. Find each of the following products :

(a) $2\times3\times(-4)$ (b) $3\times(-4)\times(-7)$ (c) $(-4)\times(-5)\times(-6)$ (d) $(-5)\times5\times(-5)$

(e) $6\times(-7)\times4$ (f) $(-6)\times(-5)\times2$

3. Find each of the following products :

(a) $(-30)\times(-20)\times(-5)$

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

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

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

(e) $(-5)\times(-5)\times(-5)\times\ldots$5 times

(f) $(-3)\times(-3)\times(-3)\times\ldots.$6 times

(g) $(-1)\times(-1)\times(-1)\times\ldots.$ 171 times

(h) $(-1)\times(-1)\times(-1)\times\ldots.$ 200 times

4. What will be the sign of the product, if we multiply 103 negative integers and 65 positive integers.
5. What will be the sign of the product, if we multiply 90 negative integers and 9 positive integers.
6. Simplify :

(a) $9 \times (-13) + 9 \times (-7)$ (b) $(-8) \times 9 + (-8) \times 7$

(c) $10 \times (-12) + 5 \times (-12)$ (d) $(-11) \times (-15) + (-11) \times (-25)$

(e) $(-16) \times (-15) + (-16) \times (-5)$ (f) $20 \times (-16) + 20 \times 14$

(g) $(-26) \times 72 + (-26) \times 28$ (h) $(-16) \times (-8) + (-4) \times (-8)$

7. Fill in the blanks :

(a) $(-5) \times (\_\_\_\_\_) = 0$ (b) $7 \times (-3) = (-3) \times (\_\_\_\_\_)$

(c) $(-18) \times (\_\_\_\_\_) = (-18)$ (d) $(-6) \times (\_\_\_\_\_) = 6$

(e) $(-8) \times (-9) = (-9) \times (\_\_\_\_\_)$ (f) $\{(-5) \times 3\} \times (-6) = (\_\_\_\_\_) \times \{3 \times (-6)\}$

8. Which of the following statements are true and which are false?

(a) Every non-zero integer has a multiplicative inverse as an integer.

(b) Multiplication on integers is associative.

(c) Multiplication on integers is commutative.

(d) Every integer when multiplied with –1 gives its multiplicative inverse.

(e) The product of three negative integers is a negative integer.

(f) The product of two negative integers is a negative integer.

(g) The product of a positive and a negative integer is negative.

DIVISION OF INTEGERS

Division is an inverse process of multiplication.

1. **Division of positive integers :** When both integers are positive, then we divide their values regardless of their signs and assign the positive (+) sign to the quotient.

For example : $54 \div 6 = 9$, $90 \div 10 = 9$

2. **Division of negative integers :** When both integers are negative, then we divide their values regardless of their signs and assign positive (+) sign to the quotient.

For example : $(-24) \div (-6) = +(24 \div 6)$, $(-50) \div (-10) = +(50 \div 10)$

$= +4$ $= +5$

3. **Division of a positive and a negative integer :** When both integers are of opposite signs, divide their numerical values regardless of their signs and assign negative (–) sign to the quotient.

For example : $63 \div (-7) = \frac{63}{-7} = -\left(\frac{63}{7}\right) = -9$,

$$(-140) \div 20 = \frac{-140}{20} = -\left(\frac{140}{20}\right) = -7$$

$(+) \div (+) = (+)$ $(-) \times (-) = (+)$	Same signs — Positive
$(+) \div (-) = (-)$ $(-) \div (+) = (-)$	Opposite signs — Negative

4. **Division by zero :** Can we divide an integer by zero?

Consider $5 \div 0$ and assume that $5 \div 0 = x$.

If it is true, by relationship of division and multiplication, then $5 = 0 \times x$, but it is not possible; since there does not exist such a number that can give 5, on multiplying by 0.

Therefore, we say that an integer divided by zero is undefined.

Example 1. *Evaluate :*

(*a*) $56 \div 7$ (*b*) $(-84) \div (-21)$ (*c*) $120 \div (-20)$ (*d*) $(-175) \div 5$

Solution:

(a) $56 \div 7 = \frac{56}{7} = 8$

(b) $(-84) \div (-21) = \frac{-84}{-21} = +\left(\frac{84}{21}\right) = 4$

(c) $120 \div (-20) = \frac{120}{-20} = -\left(\frac{120}{20}\right) = -6$

(d) $(-175) \div 5 = \frac{-175}{5} = -\left(\frac{175}{5}\right) = -35$

PROPERTIES OF DIVISION OF INTEGERS

I. *If a and b are integers then $(a \div b)$ is not necessary an integer.*

Examples. (a) 14 and 3 are both integers, but $(14 \div 3)$ is not an integer.

(b) (-9) and 5 are both integers, but $\{(-9) \div 5\}$ is not an integer.

II. *If a is an integer and $a \neq 0$, then $a \div a = 1$.*

Examples. (a) $14 \div 14 = 1$ (b) $(-9) \div (-9) = 1$

III. *If a is an integer, then $(a \div 1) = a$.*

Examples. (a) $5 \div 1 = 5$ (b) $(-7) \div 1 = -7$

IV. *If a is an integer and $a \neq 0$, then $(0 \div a) = 0$ but $(a \div 0)$ is not meaningful.*

Examples. (a) $0 \div 4 = 0$ (b) $0 \div (-6) = 0$ (c) $8 \div 0$ is meaningless.

V. *If a, b, c are integers, then $(a \div b) \div c \neq a \div (b \div c)$, unless $c = 1$.*

Thus, division on integers is not associative.

Examples. Let $a = -8, b = 4$ and $c = -2$. Then,

$(a \div b) \div c = \{(-8) \div 4\} \div (-2) = (-2) \div (-2) = 1$

$a \div (b \div c) = (-8) \div \{4 \div (-2)\} = (-8) \div (-2) = 4$

$\therefore \quad (a \div b) \div c \neq a \div (b + c)$.

However, if $a = -8$, $b = 4$ and $c = 1$, then

$(a \div b) \div c = \{(-8) \div 4)\} \div 1 = (-2) \div 1 = -2$

$a \div (b \div c) = (-8) \div \{4 \div 1\} = (-8) \div 4 = -2$

So, in this case, $(a \div b) \div c = a \div (b \div c)$

VI. *If a, b, c are non-zero integers and a > b, then*

(a) $(a \div c) > (b \div c)$, if *c* is positive.

(b) $(a \div c) < (b \div c)$, if *c* is negative.

Examples. (a) $27 > 18$ and 9 is positive.

$\therefore \quad \frac{27}{9} > \frac{18}{9}$

(b) $27 > 18$ and (-9) is negative.

$\therefore \quad \frac{27}{-9} < \frac{18}{-9}$

Exercise 1C

1. Divide :

(a) 70 by –14 (b) –91 by 13 (c) –72 by 18 (d) –143 by 13
(e) –125 by 25 (f) –108 by –18 (g) –105 by –15 (h) –63 by –1
(i) 0 by –21 (j) –36 by 36 (k) – 32 by – 32 (l) –6 by 1

2. Fill in the blanks :

(a) $(76) \div (\_\_\_\_\_) = -4$ (b) $-28 \div (\_\_\_\_\_) = -4$
(c) $(\_\_\_\_\_) \div (-4) = 21$ (d) $(\_\_\_\_\_) \div 35 = 0$
(e) $(\_\_\_\_\_) \div (-1) = 53$ (f) $(\_\_\_\_\_) \div 1 = -73$
(g) $39 \div (\_\_\_\_\_) = -1$ (h) $(1) \div (\_\_\_\_\_) = -1$
(i) $(-1) \div (\_\_\_\_\_) = -1$

3. Write (T) for true and (F) for false for each of the following statements :

(a) $(-9) \div (-1) = 9$ (b) $(-1) \div (-1) = -1$ (c) $(-8) \div 1 = -8$
(d) $(-5) \div (-1) = -5$ (e) $(-6) \div 0 = 0$ (f) $0 \div (-4) = 0$

Exercise 1D

OBJECTIVE QUESTIONS

Mark (✓) against the correct answer in each of the following:

1. $-9 - (-6) = ?$

(a) – 15 (b) – 3 (c) 3 (d) none of these

2. $6 - (-8) = ?$

(a) – 2 (b) 2 (c) 14 (d) none of these

3. On subtracting 4 from –4, we get

(a) 8 (b) – 8 (c) 0 (d) none of these

4. On subtracting 6 from –5, we get :

(a) 1 (b) 11 (c) –11 (d) none of these

5. On subtracting –13 from –8, we get :

(a) –21 (b) 21 (c) 5 (d) – 5

6. What must be subtracted from –3 to get –9 ?

(a) – 6 (b) 12 (c) 6 (d) – 12

7. $(-8) \div 0 = ?$

(a) – 8 (b) 0 (c) 8 (d) not defined

8. $0 \div (-5) = ?$

(a) –5 (b) 0 (c) 5 (d) not defined

9. $(-36) \div (-9) = ?$

(a) 4 (b) –4 (c) 9 (d) none of these

10. The sum of two integers is 6. If one of them is –3, then the other is :

(a) –9 (b) 9 (c) 3 (d) –3

11. The sum of two integers is – 4. If one of them is 6, then the other is :

(a) – 10 (b) 10 (c) 2 (d) – 2

12. The additive inverse of – 6 is :

(a) $\frac{1}{6}$ (b) $-\frac{1}{6}$ (c) 6 (d) 5

13. $(-15)\times 8+(-15)\times 2=?$

(a) 150 (b) –150 (c) 90 (d) –90

14. $30\times(-23)+30\times 14=?$

(a) –270 (b) 270 (c) 1110 (d) –1110

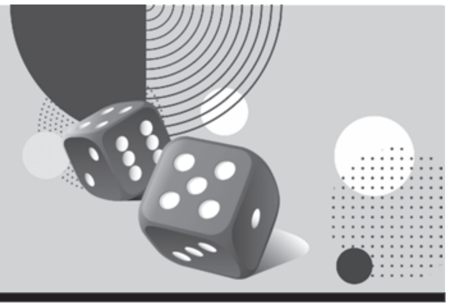
15. $(?)\div(-18)=-5$

(a) –90 (b) 90 (c) 18 (d) none of these

THINGS TO REMEMBER

- The collection of numbers ..., –4, –3, –2, –1, 0, 1, 2, 3, 4, ... are integers.
- Zero (0) is an integer which is neither positive nor negative.
- Zero (0) is less than every positive integer and greater than every negative integer.
- Every positive integer is greater then every negative integer.
- If x and y are integers such that $x > y$ then $-x < -y$.
- The absolute value of an integer is its numerical value regardless of its sign.
- To add two integers with like signs, we add their numerical values and give the sign of the addends to the sum.
- To add two integers with unlike signs, we take the difference of their numerical values and give the sign of the integer having the greater absolute value of the difference.
- To subtract an integer b from an integer a, we change the sign of b and add it to a.
- All properties of operations on whole numbers are satisfied by these operations on integers.
- Zero (0) is called additive identity for integers.
- $-a$ and a are negatives, or additive inverses of each other.
- To find the product of two integers with like signs, we multiply their numerical values and give a plus sign to the product.
- To find the product of two integers with unlike signs, we multiply their numerical values and give a minus sign to the product.
- 1 is called multiplicative identity for integers.
- The quotient of two negative or two positive integers is always postiive.
- The quotient of one positive and one negative integer is always negative.

2 Fractions



The word fraction means ‘part of a whole’. When an object or group of objects is divided into equal parts, each part is called a fraction.

A fraction is written in the form $\frac{x}{y}$, where both x and y are natural numbers. In the fration $\frac{x}{y}$, x is called the numerator and y is called the denominator.

For example : $\frac{5}{6}, \frac{12}{11}, \frac{41}{87}$, etc., are all fractions.

VARIOUS TYPES OF FRACTIONS

(i) Decimal fraction : *A fraction whose denominator is in the form of* 10,100,1000*, etc., is called a decimal fraction.*

For example : Each of the fractions $\frac{3}{10}, \frac{27}{100}, \frac{31}{1000}$, etc., is a decimal fraction.

(ii) Vulgar fraction : *A fraction whose denominator is a whole number, other than* 10, 100, 1000*, etc. is called a vulgar fraction.*

For example : $\frac{2}{9}, \frac{4}{13}, \frac{13}{20}, \frac{27}{109}$, etc., are all vulgar fraction.

(iii) Proper fraction : *A fraction whose numerator is less than its denominator, is called a proper fraction. The value of a proper fraction is always less than one.*

For example : $\frac{3}{7}, \frac{5}{11}, \frac{23}{40}, \frac{73}{100}$, etc., are all proper fractions.

(iv) Improper fraction : *A fraction whose numerator is greater than or equal to its denominator, is called an improper fraction. The value of an improper fraction is always greater than or equal to one.*

For example : $\frac{11}{7}, \frac{25}{12}, \frac{41}{36}, \frac{53}{53}$, etc., are all improper fractions.

(v) Mixed fraction : *A fraction which is expressed as the sum of a natural number and a proper fraction, is called a mixed fraction.*

For example : $1\frac{3}{4}, 4\frac{5}{7}, 7\frac{9}{13}, 12\frac{6}{25}$, etc., are all mixed fractions.

Example 1. *Convert each of the following into an improper fraction :*

(*a*) $3\frac{1}{7}$ (*b*) $4\frac{2}{5}$ (*c*) $13\frac{1}{4}$ (*d*) $8\frac{19}{23}$

Solution: We have

(a) $3\frac{1}{7} = \frac{3 \times 7 + 1}{7} = \frac{22}{7}$

(b) $4\frac{2}{5} = \frac{4 \times 5 + 2}{5} = \frac{22}{5}$

(c) $13\frac{1}{4} = \frac{13 \times 4 + 1}{4} = \frac{53}{4}$

(d) $8\frac{19}{23} = \frac{8 \times 23 + 19}{23} = \frac{203}{23}$

Example 2. *Convert each of the following into a mixed fraction :*

(*a*) $\frac{33}{8}$ (*b*) $\frac{37}{15}$ (*c*) $\frac{95}{6}$

Solution: (a) On dividing 33 by 8, we get quotient = 4 and remainder = 1

$\therefore \quad \frac{33}{8} = 4\frac{1}{8}$

8)33(4
−32
1

(b) On dividing 37 by 15, we get quotient = 2 and remainder = 7

$\therefore \quad \frac{37}{15} = 2\frac{7}{15}$

15)37(2
−30
7

(c) On dividing 95 by 6, we get quotient = 15 and remainder = 5

$\therefore \quad \frac{95}{6} = 15\frac{5}{6}$

6)95(15
−6
35
−30
5

An Important Property : If the numerator and the denominator of a fraction are both multiplied by the same non-zero number, then its value is not changed.

Thus, $\frac{3}{4} = \frac{3 \times 2}{4 \times 2} = \frac{3 \times 3}{4 \times 3} = \frac{3 \times 4}{4 \times 4}$, etc.

(vi) Equivalent fractions : *Fractions showing the same value are called equivalent fractions. They can be obtained by multiplying or dividing the numerator and denominator of a fraction by the same non-zero number.*

Thus, $\frac{3}{4}, \frac{6}{8}, \frac{9}{12}, \frac{12}{16}$, etc., are all equivalent fractions.

(vii) Like fractions : *Fractions having the same denominator but different numerators are called like fractions.*

For example : $\frac{5}{14}, \frac{9}{14}, \frac{11}{14}$, etc. are like fractions.

(viii) Unlike fractions : *Fractions having different denominators are called unlike fractions.*

For example : $\frac{2}{5}, \frac{5}{7}, \frac{9}{13}$, etc., are unlike fractions.

METHOD OF CHANGING UNLIKE FRACTIONS TO LIKE FRACTIONS

Step 1. *First we find the LCM of the denominators of all the given fractions.*

Step 2. *Now, multiply each fraction by a suitable number so as to make the denominator of each fraction equal to the LCM.*

Example 3. *Convert the fractions* $\frac{3}{28}, \frac{5}{14}, \frac{9}{35}$ *into like fractions.*

Solution: $\frac{3}{28}, \frac{5}{14}, \frac{9}{35}$

LCM of 28, 14 and 35 is 140.

Now, $\frac{3}{28} = \frac{3 \times 5}{28 \times 5} = \frac{15}{140}$

$\frac{5}{14} = \frac{5 \times 10}{14 \times 10} = \frac{50}{140}$

And $\frac{9}{35} = \frac{9 \times 4}{35 \times 4} = \frac{36}{140}$

2	28, 14, 35
2	14, 7, 35
5	7, 7, 35
7	7, 7, 7
	1, 1, 1

Hence, $\frac{15}{140}, \frac{50}{140}$ and $\frac{36}{140}$ are like fractions.

(ix) Irreducible fractions : *A fractions $\frac{a}{b}$ is said to be irreducible or in lowest term, if HCF of a and b is 1.*

If HCF of a and b is other than 1 then $\frac{a}{b}$ is said to be reducible.

Example 4. *Convert $\frac{84}{98}$ into irreducible form.*

Solution: First we find the HCF of 84 and 98.

Clearly, HCF of 84 and 98 is 14.

84) 98 (1
 −84
  14) 84 (6
   −84
    ×

So, we divide the numerator and denominator of the given fraction by 14.

$\therefore \quad \frac{84}{98} = \frac{84 \div 14}{98 \div 14} = \frac{6}{7}$

Hence, $\frac{84}{98}$ in irreducible form is $\frac{6}{7}$.

COMPARING FRACTIONS

Let $\frac{p}{q}$ and $\frac{r}{s}$ be two given fractions. Then,

(i) $\frac{p}{q} > \frac{r}{s} \Leftrightarrow ps > rq$ (ii) $\frac{p}{q} = \frac{r}{s} \Leftrightarrow ps = rq$ (iii) $\frac{p}{q} < \frac{r}{s} \Leftrightarrow ps < rq$

Example 5. *Compare the fractions : (a) $\frac{3}{9}, \frac{2}{7}$ (b) $\frac{8}{19}, \frac{13}{20}$*

Solution: (a) By cross multiplication, we have :

$3 \times 7 = 21$ and $2 \times 9 = 18$

But, $21 > 18$

$\therefore \quad \frac{3}{9} > \frac{2}{7}$

(b) By cross multiplication, we have

$8 \times 20 = 160$ and $13 \times 19 = 247$

But, $160 < 247$

$\therefore \quad \frac{8}{19} < \frac{13}{20}$

METHOD OF COMPARING MORE THAN TWO FRACTIONS

Step 1. *Find the LCM of the denominators of the given fractions. Let it be m.*

Step 2. *Convert all the given fractions into like fractions, each having m as denominator.*

Step 3. *Now, if we compare any two of these like fractions, then the one having larger numerator is larger.*

Example 6. *Arrange the fractions* $\frac{2}{5}, \frac{3}{10}, \frac{9}{14}, \frac{16}{35}$ *in ascending order.*

Solution: The given fractions are $\frac{2}{5}, \frac{3}{10}, \frac{9}{14}, \frac{16}{35}$.

LCM of 5, 10, 14, 35 $= (5 \times 2 \times 7) = 70$

Now, let us change each of the given fractions into an equivalent fraction having 70 as its denominator.

2	5, 10, 14, 35
5	5, 5, 7, 35
7	1, 1, 7, 7
	1, 1, 1, 1

Now, $\frac{2}{5} = \frac{2 \times 14}{5 \times 14} = \frac{28}{70}$

$\frac{3}{10} = \frac{3 \times 7}{10 \times 7} = \frac{21}{10}$

$\frac{9}{14} = \frac{9 \times 5}{14 \times 5} = \frac{45}{70}$

And $\frac{16}{35} = \frac{16 \times 2}{35 \times 2} = \frac{32}{70}$

Clearly, $\frac{21}{70} < \frac{28}{70} < \frac{32}{70} < \frac{45}{70}$

Hence, $\frac{3}{10} < \frac{2}{5} < \frac{16}{35} < \frac{9}{14}$

Hence, the given fractions in ascending order are $\frac{3}{10}, \frac{2}{5}, \frac{16}{35}, \frac{9}{14}$.

ADDITION AND SUBTRACTION OF FRACTIONS

ADDITION OF FRACTIONS

Rule 1. If the given fractions are like fractions, then simply add their numerators and retain the common denominator.

Examples. (a) $\frac{1}{9} + \frac{4}{9} = \frac{1+4}{9} = \frac{5}{9}$ (b) $\frac{4}{15} + \frac{7}{15} = \frac{4+7}{15} = \frac{11}{15}$

Rule 2. If the given fractions are unlike fractions, then convert all the fractions into like fractions and simplify.

Example 7. *Add :* $\frac{3}{10} + \frac{8}{15}$

Solution: LCM of 10 and 15 $= (5 \times 2 \times 3) = 30$.

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

$\therefore \quad \frac{3}{10} = \frac{3 \times 3}{10 \times 3} = \frac{9}{30}$ and $\frac{8}{15} = \frac{8 \times 2}{15 \times 2} = \frac{16}{30}$

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

Short Cut Method :

$\frac{3}{10} + \frac{8}{15} = \frac{9+16}{30} = \frac{25}{30} = \frac{5}{6}$ $\left[\begin{array}{l} 30 \div 10 = 3 \text{ and } 3 \times 3 = 9 \\ 30 \div 15 = 2 \text{ and } 2 \times 8 = 16 \end{array}\right]$

Example 8. *Find the sum :* $\frac{13}{14}+\frac{27}{35}$

Solution: LCM of 14, 35 = $(7\times2\times5)=70$

2	14, 35
5	7, 35
7	7, 7
	1, 1

$$\therefore \quad \frac{13}{14}+\frac{27}{35}=\frac{65+54}{70} \qquad \begin{bmatrix}70\div14=5 \text{ and } 5\times13=65\\ 70\div35=2 \text{ and } 2\times27=54\end{bmatrix}$$

$$\therefore \quad =\frac{119}{70}=\frac{17}{10}=1\frac{7}{10}.$$

Properties of Addition of Fractions

(i) *Addition of fractions is associative, i.e.,* $\left(\frac{a}{b}+\frac{c}{d}\right)+\frac{e}{f}=\frac{a}{b}+\left(\frac{c}{d}+\frac{e}{f}\right)$.

(ii) *Addition of fractions is commutative, i.e.,* $\left(\frac{a}{b}+\frac{c}{d}\right)=\left(\frac{c}{d}+\frac{a}{b}\right)$.

SUBTRACTION OF FRACTIONS

Rule 1. If the given fractions are like fractions, then subtract their numerators and retain the common denominator.

Rule 2. If the given fractions are unlike fractions, then convert all the fractions into like fractions and simplify.

Example 9. *Find the difference :*

(*a*) $\frac{7}{9}-\frac{5}{9}$ (*b*) $\frac{13}{16}-\frac{7}{12}$

Solution: We have

(a) $\frac{7}{9}-\frac{5}{9}=\frac{(7-5)}{9}=\frac{2}{9}$

(b) LCM of 16 and 12 = $(4\times4\times3)=48$

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

$$\therefore \quad \frac{13}{16}-\frac{7}{12}=\frac{39-28}{48} \qquad \begin{bmatrix}48\div16=3 \text{ and } 3\times13=39\\ 48\div12=4 \text{ and } 4\times7=28\end{bmatrix}$$

$$=\frac{11}{48}$$

Example 10. *Simplify :* $\frac{5}{10}+\frac{6}{15}-\frac{17}{20}$

Solution: LCM of 10, 15, 20 = $(5\times3\times2\times2)=60$

5	10, 15, 20
3	2, 3, 4
2	2, 1, 4
2	1, 1, 2
	1, 1, 1

$$\therefore \quad \frac{5}{10}+\frac{6}{15}-\frac{17}{20}=\frac{30+24-51}{60} \qquad \begin{bmatrix}60\div10=6 \text{ and } 6\times15=30\\ 60\div15=4 \text{ and } 4\times6=24\\ 60\div20=3 \text{ and } 3\times17=51\end{bmatrix}$$

$$=\frac{54-51}{60}$$

$$=\frac{3}{60}$$

Example 11. *Simplify :* $3\frac{1}{5}+2\frac{1}{10}-1\frac{1}{2}-\frac{1}{4}$

Solution: We have

$$3\frac{1}{5}+2\frac{1}{10}-1\frac{1}{2}-\frac{1}{4}=\frac{16}{5}+\frac{21}{10}-\frac{3}{2}-\frac{1}{4}$$

$$=\frac{64+42-30-5}{20}$$

$$=\frac{(106-35)}{20}=\frac{71}{20}=3\frac{11}{20}$$

2	5, 10, 2, 4
5	5, 5, 1, 2
	1, 1, 1, 2

[$\because$ LCM of 5, 10, 2, 4 = 2 × 5 × 2]

Example 12. *What should be added to* $15\frac{2}{3}$ *to get* $18\frac{5}{6}$*?*

Solution: Required number to be added $=\left(18\frac{5}{6}-15\frac{2}{3}\right)=\left(\frac{113}{6}-\frac{47}{3}\right)$

$$=\frac{(113-94)}{6}=\frac{19}{6}=3\frac{1}{6}.$$

Example 13. *What should be subtracted from* $17\frac{3}{4}$ *to get* $11\frac{2}{3}$*?*

Solution: Required number to be subtracted $=\left(17\frac{3}{4}-11\frac{2}{3}\right)=\left(\frac{71}{4}-\frac{35}{3}\right)$

$$=\frac{(213-140)}{12}=\frac{73}{12}=6\frac{1}{12}$$

Example 14. *Renu bought* $5\frac{3}{4}$ *kg potatoes and* $3\frac{1}{2}$ *kg tomatoes from a vendor. What is the total weight of vegetables bought by her?*

Solution: Total weight of vegetables bought by Renu

$$=\left(\frac{23}{4}+\frac{7}{2}\right)\text{kg}=\frac{(23+14)}{4}\text{kg}=\frac{37}{4}\text{kg}=9\frac{1}{4}\text{ kg}$$

Example 15. *Ankit ate* $\frac{4}{7}$ *part of an apple and his sister Nisha ate the remaining part of it? Who ate more and by how much?*

Solution: Part of apple eaten by Ankit $=\frac{4}{7}$

Remaining part of apple $=\left(1-\frac{4}{7}\right)=\frac{(7-4)}{7}=\frac{3}{7}$

$\therefore$ Part of apple eaten by Nisha $=\frac{3}{7}$

Clearly, $\frac{4}{7}>\frac{3}{7}$

So, Ankit ate more.

Difference of their parts $=\left(\frac{4}{7}-\frac{3}{7}\right)=\frac{(4-3)}{7}=\frac{1}{7}$

Exercise 2A

1. Convert the following fractions into like fractions :

(a) $\frac{5}{14}, \frac{9}{28}, \frac{3}{7}, \frac{8}{21}$ (b) $\frac{5}{22}, \frac{6}{11}, \frac{8}{33}, \frac{9}{44}$ (c) $\frac{13}{25}, \frac{9}{10}, \frac{3}{5}, \frac{17}{20}$

2. Compare the following fractions by cross multiplication method :

(a) $\frac{7}{18}$ and $\frac{3}{7}$ (b) $\frac{15}{16}$ and $\frac{13}{14}$ (c) $\frac{5}{13}$ and $\frac{16}{23}$

3. Compare the following fractions by making like fractions :

(a) $\frac{3}{5}$ and $\frac{5}{8}$ (b) $\frac{7}{15}$ and $\frac{8}{25}$ (c) $\frac{11}{12}$ and $\frac{15}{16}$

4. Arrange the following fractions in the ascending order :

(a) $\frac{3}{4}, \frac{5}{6}, \frac{7}{9}$ and $\frac{11}{12}$ (b) $\frac{4}{5}, \frac{7}{10}, \frac{11}{15}$ and $\frac{17}{20}$ (c) $\frac{5}{12}, \frac{7}{18}$ and $\frac{19}{36}$

5. Arrange the following fractions in the descending order :

(a) $\frac{3}{4}, \frac{7}{12}, \frac{7}{8}$ and $\frac{17}{24}$ (b) $\frac{8}{15}, \frac{3}{5}, \frac{2}{3}$ and $\frac{7}{10}$ (c) $\frac{1}{5}, \frac{4}{15}, \frac{8}{25}$ and $\frac{9}{20}$

6. Neena got $\frac{2}{7}$ part of an apple while Seema got $\frac{4}{5}$ part of it. Who got the larger part and by how much ?

7. Find the sum :

(a) $\frac{2}{11} + \frac{5}{11}$ (b) $\frac{8}{9} + \frac{7}{12}$ (c) $\frac{3}{25} + \frac{9}{25} + \frac{4}{25}$

(d) $\frac{7}{12} + \frac{11}{16} + \frac{9}{24}$ (e) $8\frac{3}{4} + 10\frac{2}{5}$ (f) $3\frac{4}{5} + 2\frac{3}{10} + 1\frac{1}{15}$

8. Find the difference :

(a) $\frac{7}{18} - \frac{5}{18}$ (b) $\frac{5}{6} - \frac{3}{4}$ (c) $3\frac{1}{5} - \frac{9}{10}$

(d) $8 - 4\frac{2}{3}$ (e) $5\frac{3}{10} - 2\frac{2}{15}$ (f) $6\frac{2}{5} - 2\frac{4}{10}$

9. Simplify :

(a) $\frac{3}{10} + \frac{4}{15} - \frac{9}{20}$ (b) $9 - 4\frac{1}{2} - 2\frac{1}{4}$ (c) $18\frac{2}{3} - 15\frac{5}{6} + 4\frac{1}{8}$

10. What should be added to $7\frac{3}{5}$ to get 18?

11. What should be subtracted from 10 to get $3\frac{3}{4}$?

12. The cost of a pen is ₹ $16\frac{3}{5}$ and that of a pencil is ₹ $4\frac{3}{4}$. Which costs more and by how much?

13. Sunita bought $3\frac{3}{4}$ kg apples and $4\frac{1}{2}$ kg guava. What is the total weight of fruits purchased by her?

14. A picture is $7\frac{3}{5}$ cm wide. How much should it be trimmed to fit in a frame $7\frac{3}{10}$ cm wide?

15. A piece of wire $3\frac{3}{4}$ m long broke into two pieces. One piece is $1\frac{1}{2}$ m long. How long is the other piece?

MULTIPLICATION OF FRACTIONS

Rule : Product of fractions $= \dfrac{\text{Product of their Numerators}}{\text{Product of their Denominators}}$

Thus, $\left(\dfrac{a}{b}\times\dfrac{c}{d}\right)=\dfrac{(a\times c)}{(b\times d)}$ and $\left(\dfrac{a}{b}\times c\right)=\dfrac{(a\times c)}{b}$

Example 1. *Find the product :*

(*a*) $\dfrac{3}{4}\times\dfrac{5}{2}$ (*b*) $\dfrac{5}{8}\times\dfrac{3}{4}$ (*c*) $\dfrac{5}{12}\times 9$ (*d*) $\dfrac{9}{16}\times\dfrac{8}{15}$

Solution: (a) $\dfrac{3}{4}\times\dfrac{5}{2}=\dfrac{3\times 5}{4\times 2}=\dfrac{15}{8}=1\dfrac{7}{8}$ (b) $\dfrac{5}{8}\times\dfrac{3}{4}=\dfrac{5\times 3}{8\times 4}=\dfrac{15}{32}$

(c) $\dfrac{5}{12}\times 9=\dfrac{5}{12}\times\dfrac{9}{1}=\dfrac{5\times 9}{12\times 1}=\dfrac{15}{4}=3\dfrac{3}{4}$ (d) $\dfrac{9}{16}\times\dfrac{8}{15}=\dfrac{9\times 8}{16\times 15}=\dfrac{3}{10}$

Example 2. *Multiply :*

(*a*) $3\dfrac{5}{9}$ *by* $\dfrac{3}{2}$ (*b*) $9\dfrac{3}{8}$ *by* 12 (*c*) $6\dfrac{11}{14}$ *by* $3\dfrac{1}{2}$

Solution: (a) $3\dfrac{5}{9}\times\dfrac{3}{2}=\dfrac{32}{9}\times\dfrac{3}{2}=\dfrac{32\times 3}{9\times 2}=\dfrac{16}{3}=5\dfrac{1}{3}$

(b) $9\dfrac{3}{8}\times 12=\dfrac{75}{8}\times\dfrac{12}{1}=\dfrac{225}{2}=112\dfrac{1}{2}$

(c) $6\dfrac{11}{14}\times 3\dfrac{1}{2}=\dfrac{95}{14}\times\dfrac{7}{2}=\dfrac{95\times 7}{14\times 2}=\dfrac{95}{4}=23\dfrac{3}{4}$

Example 3. *Simplify :*

(*a*) $\dfrac{14}{25}\times\dfrac{35}{51}\times\dfrac{34}{49}$ (*b*) $3\dfrac{4}{7}\times 2\dfrac{2}{5}\times 1\dfrac{3}{4}$

Solution: (a) $\dfrac{14}{25}\times\dfrac{35}{51}\times\dfrac{34}{49}=\dfrac{14\times 35\times 34}{25\times 51\times 49}=\dfrac{4}{15}$

(b) $3\dfrac{4}{7}\times 2\dfrac{2}{5}\times 1\dfrac{3}{4}=\dfrac{25}{7}\times\dfrac{12}{5}\times\dfrac{7}{4}=\dfrac{25\times 12\times 7}{7\times 5\times 4}=15$

USE OF 'OF'

We define : $\dfrac{a}{b}$ of $c=\left(c\times\dfrac{a}{b}\right)$

Example 4. *Find :*

(*a*) $\dfrac{5}{9}$ *of* 48 (*b*) $\dfrac{2}{5}$ *of* 40 (*c*) $\dfrac{11}{14}$ *of* 63

Solution: (a) $\dfrac{5}{9}$ of $48=\dfrac{5}{9}$ of $\dfrac{48}{1}=\dfrac{48}{1}\times\dfrac{5}{9}=\dfrac{48\times 5}{1\times 9}=\dfrac{80}{3}=26\dfrac{2}{3}$

(b) $\dfrac{2}{5}$ of $40=\dfrac{2}{5}$ of $\dfrac{40}{1}=\dfrac{40}{1}\times\dfrac{2}{5}=\dfrac{40\times 2}{1\times 5}=16$

(c) $\dfrac{11}{14}$ of $63=\dfrac{11}{14}$ of $\dfrac{63}{1}=\dfrac{63}{1}\times\dfrac{11}{14}=\dfrac{63\times 11}{1\times 14}=\dfrac{99}{2}=49\dfrac{1}{2}$

Example 5. *Find :*

(*a*) $\frac{1}{4}$ *of a rupee* (*b*) $\frac{1}{3}$ *of an year* (*c*) $\frac{5}{12}$ *of a day*

(*d*) $\frac{7}{10}$ *of a kilogram* (*e*) $\frac{11}{25}$ *of a litre* (*f*) $\frac{4}{5}$ *of an hour*

Solution: We have

(a) $\frac{1}{4}$ of a rupee $= \frac{1}{4}$ of 100 paise $= \left(100 \times \frac{1}{4}\right)$ paise

$= \left(\frac{100}{1} \times \frac{1}{4}\right)$ paise $= \left(\frac{100 \times 1}{1 \times 4}\right)$ paise $=$ 25 paise

(b) $\frac{1}{3}$ of an year $= \frac{1}{3}$ of 12 months $= \left(12 \times \frac{1}{3}\right)$ months

$= \left(\frac{12}{1} \times \frac{1}{3}\right)$ months $= \frac{(12 \times 1)}{(1 \times 3)}$ months $=$ 4 months

(c) $\frac{5}{12}$ of a day $= \frac{5}{12}$ of 24 hours $= \left(24 \times \frac{5}{12}\right)$ hours

$= \left(\frac{24}{1} \times \frac{5}{12}\right)$ hours $= \left(\frac{24 \times 5}{1 \times 12}\right)$ hours $=$ 10 hours

(d) $\frac{7}{10}$ of a kilogram $= \frac{7}{10}$ of 1000 g $= \left(1000 \times \frac{7}{10}\right)$ g

$= \left(\frac{1000}{1} \times \frac{7}{10}\right)$ g $= \left(\frac{1000 \times 7}{1 \times 10}\right)$ g $=$ 700 g

(e) $\frac{11}{25}$ of a litre $= \frac{11}{25}$ of 1000 m*l* $= \left(1000 \times \frac{11}{25}\right)$ m*l* $=$ 440 m*l*

(f) $\frac{4}{5}$ of an hour $= \frac{4}{5}$ of 60 min $= \left(60 \times \frac{4}{5}\right)$ min

$= \left(\frac{60}{1} \times \frac{4}{5}\right)$ min $= \left(\frac{60 \times 4}{1 \times 5}\right)$ min $=$ 48 min

Example 6. *Milk is sold at* ₹ $48\frac{1}{4}$ *per litre. Find the cost of 12 litres of milk.*

Solution: Cost of 1 litre of milk = ₹ $48\frac{1}{4}$ = ₹ $\frac{193}{4}$

Cost of 12 litres of milk = ₹$\left(\frac{193}{4} \times 12\right)$ = ₹ (193 × 3) = ₹ 579

Hence, the cost of 12 litres of milk is ₹ 579.

Example 7. *A carton contains* 16 *boxes and each box weighs* $4\frac{3}{4}$ *kg. How much would a carton weigh ?*

Solution: Weight of 1 box $= 4\frac{3}{4}$ kg $= \frac{19}{4}$ kg

Weight of 16 boxes $= \left(\frac{19}{4} \times 16\right)$ kg $= \left(\frac{19}{4} \times \frac{16}{1}\right)$ kg $= \left(\frac{19 \times 16}{4 \times 1}\right)$ kg $=$ 76 kg

Hence, the weight of a carton is 76 kg.

Example 8. *Mohit can walk $2\frac{2}{5}$ km in an hour. How much distance will he cover in $3\frac{1}{3}$ hour?*

Solution: Distance covered by Mohit in 1 hour $= 2\frac{2}{5}$ km $= \frac{12}{5}$ km

Distance covered by Mohit in $3\frac{1}{3}$ hours $= \left(\frac{12}{5} \times \frac{10}{3}\right)$km $= \left(\frac{12 \times 10}{5 \times 3}\right)$km $=$ 8 km

Hence, the distance covered by Mohit in 1 hour is 8 km.

Example 9. *A novel consists of 216 pages. During last week Rajat read $\frac{3}{4}$ of the novel. How many pages did he read?*

Solution: Total number of pages in the novel = 216

Number of pages read $= \left(\frac{3}{4} \text{of } 216\right) = \left(216 \times \frac{3}{4}\right) = \left(\frac{216}{1} \times \frac{3}{4}\right) = \left(\frac{216 \times 3}{1 \times 4}\right) = 162$

Example 10. *A tin contains 18l oil. After consuming $\frac{2}{3}$ of it, how much oil is left in the tin?*

Solution: Total quantity of oil in the tin $= 18\,l$

Quantity of oil consumed $= \frac{2}{3}$ of $18\,l = \left(18 \times \frac{2}{3}\right)l$

$= \left(\frac{18}{1} \times \frac{2}{3}\right)l = \left(\frac{18 \times 2}{1 \times 3}\right)l = 12\,l$

Quantity of oil left in the tin $= (18 - 12)l = 6l$

Example 11. *Payal spends $\frac{4}{5}$ of her income on household expenses. Her monthly income is ₹ 30000. How much does she save every month?*

Solution: Total monthly income = ₹ 30000

Monthly expenditure $= \frac{4}{5}$ of ₹ 30000

$=$ ₹ $\left(30000 \times \frac{4}{5}\right)$ $=$ ₹ $\left(\frac{30000}{1} \times \frac{4}{5}\right)$

$=$ ₹ $\left(\frac{30000 \times 4}{1 \times 5}\right)$ $=$ ₹ 24000

∴ Monthly savings = ₹(30000 – 24000) = ₹ 6000

Exercise 2B

1. Find the product :

(a) $\frac{5}{8} \times \frac{4}{7}$ (b) $\frac{3}{5} \times \frac{7}{11}$ (c) $\frac{4}{9} \times \frac{15}{16}$

(d) $\frac{9}{5} \times 45$ (e) $\frac{6}{7} \times 42$ (f) $\frac{5}{8} \times 1000$

(g) $2\frac{4}{15} \times 12$ (h) $3\frac{1}{8} \times 16$ (i) $9\frac{1}{2} \times 1\frac{9}{19}$

2. Simplify :

(a) $\frac{2}{5}\times\frac{6}{11}\times\frac{15}{18}$ (b) $\frac{10}{27}\times\frac{28}{65}\times\frac{39}{56}$ (c) $\frac{12}{25}\times\frac{15}{28}\times\frac{35}{36}$

(d) $2\frac{2}{17}\times7\frac{2}{9}\times1\frac{33}{52}$ (e) $3\frac{1}{16}\times7\frac{3}{7}\times1\frac{25}{39}$ (f) $1\frac{4}{7}\times1\frac{13}{22}\times1\frac{1}{15}$

3. Find :

(a) $\frac{1}{4}$ of 24 (b) $\frac{3}{8}$ of 32 (c) $\frac{3}{5}$ of 45

(d) $\frac{7}{50}$ of 2000 (e) $\frac{3}{20}$ of 1040 (f) $\frac{5}{11}$ of ₹ 330

(g) $\frac{4}{9}$ of 63 metres (h) $\frac{6}{7}$ of 42 litres (i) $\frac{1}{12}$ of an hour

(j) $\frac{3}{4}$ of an year (k) $\frac{7}{25}$ of a kg (l) $\frac{7}{20}$ of a metre

(m) $\frac{7}{12}$ of a day (n) $\frac{2}{7}$ of a week (o) $\frac{11}{50}$ of a litre

4. One tin holds $12\frac{3}{4}$ kg of ghee. How many kg of ghee can 26 such tins hold?

5. Mangoes are sold at ₹ $48\frac{4}{5}$ per kg. What is the cost of $3\frac{3}{4}$ kg of mangoes?

6. Cloth is being sold at ₹ $42\frac{1}{2}$ per metre. What is the cost of $5\frac{3}{5}$ metres of this cloth?

7. A motorbike covers a certain distance at a uniform speed of $66\frac{2}{3}$ km per hour. How much distance will it cover in 9 hours?

8. Nine boards are stacked on the top of each other. The thickness of each board is $3\frac{2}{3}$ cm. How high is the stack?

9. For a particular film show each ticket costs ₹ $35\frac{1}{2}$. If 308 tickets are sold for the show, how much amount has been collected?

10. There are 42 students in a class and $\frac{5}{7}$ of the students are girls. How many boys are there in the class?

11. Sonali takes $4\frac{4}{5}$ minutes to make a complete round of a circular park. How much time will she take to make 15 rounds?

12. Nidhi weighs 35 kg. Her brother Harsh's weight is $\frac{3}{5}$ of Nidhi's weight. How much does Harsh weigh?

13. Each side of a square field is $4\frac{2}{3}$ m. Find its area.

14. Find the area of a rectangular park which is $41\frac{2}{3}$ m long and $18\frac{3}{5}$ m broad.

15. Bindu earns ₹ 24000 per month. She spends $\frac{7}{8}$ of her income and deposits rest of the money in a bank. How much money does she deposit in the bank each month?

DIVISION OF FRACTIONS

RECIPROCAL OF A FRACTION

Reciprocal is also called multiplicative inverse.

Reciprocal of a proper fraction is an improper fraction and *vice-versa*.

Two fractions are said to be the reciprocal of each other, if their product is 1.

For example, $\frac{4}{9}$ and $\frac{9}{4}$ are the reciprocals of each other, since $\left(\frac{4}{9}\times\frac{9}{4}\right)=1$.

In general, if $\frac{a}{b}$ is a fraction, then its reciprocal is $\frac{b}{a}$.

Reciprocal of 0 does not exist.

Example 1. *Write down the reciprocal of :*

(a) $\frac{4}{9}$ (b) $\frac{1}{8}$ (c) 7 (d) $2\frac{5}{8}$

Solution: We have

(a) Reciprocal of $\frac{4}{9}$ is $\frac{9}{4}$. $\left[\because \frac{4}{9}\times\frac{9}{4}=1\right]$

(b) Reciprocal of $\frac{1}{8}$ is $\frac{8}{1}$ or 8. $\left[\because \frac{1}{8}\times 8=1\right]$

(c) Reciprocal of 7 is $\frac{1}{7}$. $\left[\because 7\times\frac{1}{7}=1\right]$

(d) Reciprocal of $2\frac{5}{8}$ = reciprocal of $\frac{21}{8}=\frac{8}{21}$ $\left[\because \frac{21}{8}\times\frac{8}{21}=1\right]$

DIVISION OF FRACTIONS

Rule : To divide a fraction by another fraction, the first fraction is multiplied by the reciprocal of the second.

Thus, $\left(\frac{a}{b}\div\frac{c}{d}\right)=\left(\frac{a}{b}\times\frac{d}{c}\right)$ and $\left(\frac{a}{b}\div c\right)=\left(\frac{a}{b}\times\frac{1}{c}\right)$

Example 2. *Simplify :*

(*a*) $\frac{4}{9}\div\frac{5}{6}$ (*b*) $\frac{5}{7}\div 10$ (*c*) $5\frac{3}{5}\div 2\frac{1}{10}$

Solution: (a) $\frac{4}{9}\div\frac{5}{6}=\frac{4}{9}\times\frac{6}{5}$ $\left[\because \text{the reciprocal of } \frac{5}{6} \text{ is } \frac{6}{5}\right]$

$=\frac{4\times 6}{9\times 5}=\frac{8}{15}$

(b) $\frac{5}{7}\div 10=\frac{5}{7}\div\frac{10}{1}=\frac{5}{7}\times\frac{1}{10}$ $\left[\because \text{the reciprocal of } \frac{10}{1} \text{ is } \frac{1}{10}\right]$

$=\frac{5\times 1}{7\times 10}=\frac{1}{14}$

(c) $5\frac{3}{5} \div 2\frac{1}{10} = \frac{28}{5} \div \frac{21}{10}$

$= \frac{28}{5} \times \frac{10}{21}$ $\left[\because \text{ the reciprocal of } \frac{21}{10} \text{ is } \frac{10}{21}\right]$

$= \frac{28 \times 10}{5 \times 21} = \frac{8}{3} = 2\frac{2}{3}$

Example 3. *Divide :*

(*a*) 28 *by* $\frac{7}{4}$ (*b*) 36 *by* $6\frac{2}{3}$

Solution: We have

(a) $28 \div \frac{7}{4} = \frac{28}{1} \div \frac{7}{4} = \frac{28}{1} \times \frac{4}{7}$ $\left[\because \text{ the reciprocal of } \frac{7}{4} \text{ is } \frac{4}{7}\right]$

$= \frac{28 \times 4}{1 \times 7} = \frac{16}{1} = 16$

(b) $36 \div 6\frac{2}{3} = \frac{36}{1} \div \frac{20}{3}$

$= \frac{36}{1} \times \frac{3}{20}$ $\left[\because \text{ the reciprocal of } \frac{20}{3} \text{ is } \frac{3}{20}\right]$

$= \frac{36 \times 3}{1 \times 20} = \frac{27}{5} = 5\frac{2}{5}$

Example 4. *Divide :*

(*a*) $\frac{5}{9}$ *by* $\frac{2}{3}$ (*b*) $5\frac{4}{7}$ *by* $\frac{13}{14}$ (*c*) $4\frac{2}{7}$ *by* $2\frac{2}{5}$

Solution: (a) $\frac{5}{9} \div \frac{2}{3} = \frac{5}{9} \times \frac{3}{2}$ $\left[\because \text{ the reciprocal of } \frac{2}{3} \text{ is } \frac{3}{2}\right]$

$= \frac{5 \times 3}{9 \times 2} = \frac{5}{6}$

(b) $5\frac{4}{7} \div \frac{13}{14} = \frac{39}{7} \div \frac{13}{14}$

$= \frac{39}{7} \times \frac{14}{13}$ $\left[\because \text{ the reciprocal of } \frac{13}{14} \text{ is } \frac{14}{13}\right]$

$= \frac{39 \times 14}{7 \times 13} = \frac{6}{1} = 6$

(c) $4\frac{2}{7} \div 2\frac{2}{5} = \frac{30}{7} \div \frac{12}{5} = \frac{30}{7} \times \frac{5}{12}$ $\left[\because \text{ the reciprocal of } \frac{12}{5} \text{ is } \frac{5}{12}\right]$

$= \frac{30 \times 5}{7 \times 12} = \frac{25}{14} = 1\frac{11}{14}$

Example 5. *The product of two numbers is* $15\frac{5}{6}$. *If one of the numbers is* $6\frac{2}{3}$, *find the other.*

Solution: Product of two numbers $= 15\frac{5}{6} = \frac{95}{6}$

One of the numbers $= 6\frac{2}{3} = \frac{20}{3}$

The other number $= \frac{95}{6} \div \frac{20}{3}$

$= \left(\frac{95}{6} \times \frac{3}{20}\right)$ $\left[\because \text{ the reciprocal of } \frac{20}{3} \text{ is } \frac{3}{20}\right]$

$= \frac{95 \times 3}{6 \times 20} = \frac{19}{8} = 2\frac{3}{8}$

Hence, the other number is $2\frac{3}{8}$.

Example 6. *By what number should* $6\frac{2}{9}$ *be multiplied to get* 40?

Solution: Product of two numbers = 40

One of the numbers $= 6\frac{2}{9} = \frac{56}{9}$

The other number $= \left(40 \div \frac{56}{9}\right) = \left(\frac{40}{1} \div \frac{56}{9}\right)$

$= \left(\frac{40}{1} \times \frac{9}{56}\right) = \frac{40 \times 9}{1 \times 56} = \frac{45}{7} = 6\frac{3}{7}$

Hence, the other number is $6\frac{3}{7}$.

Example 7. *If the cost of* $5\frac{2}{5}$ *litres of oil is* ₹ $236\frac{1}{4}$, *find its cost per litre.*

Solution: Cost of $\frac{27}{5}$ litres of oil $=$ ₹ $\frac{945}{4}$

$\Rightarrow$ Cost of 1 litre of oil $=$ ₹ $\left(\frac{945}{4} \div \frac{27}{5}\right)$

$=$ ₹ $\left(\frac{945}{4} \times \frac{5}{27}\right)$ $\left[\because \text{ the reciprocal of } \frac{27}{5} \text{ is } \frac{5}{27}\right]$

$=$ ₹ $\frac{175}{4} =$ ₹ $43\frac{3}{4}$

Hence, the cost of oil per litre is ₹ $43\frac{3}{4}$.

Example 8. *A wire of length* $9\frac{3}{4}$ *m is cut into* 6 *pieces of equal length. Find the length of each piece.*

Solution: Length of the wire $= 9\frac{3}{4}$ m $= \frac{39}{4}$ m

Number of equal pieces = 6

Length of each piece $= \left(\frac{39}{4} \div 6\right)$m $= \left(\frac{39}{4} \div \frac{6}{1}\right)$m

$= \left(\frac{39}{4} \times \frac{1}{6} \text{m}\right)$ $\left[\because \text{ reciprocal of 6 is } \frac{1}{6}\right]$

$= \frac{39 \times 1}{4 \times 6}$ m $= \frac{13}{8}$ m $= 1\frac{5}{8}$ m

Hence, the length of each piece is $1\frac{5}{8}$ m

Example 9. *The cost of $5\frac{1}{4}$ kg of apples is ₹ 231. At what rate per kg are the apples being sold?*

Solution: Cost of $\frac{21}{4}$ kg of apples = ₹ 231

Cost of 1 kg of apples $= ₹\left(231 \div \frac{21}{4}\right)$

$= ₹\left(231 \times \frac{4}{21}\right)$ $\left[\because \text{reciprocal of } \frac{21}{4} \text{ is } \frac{4}{21}\right]$

= ₹ 44

Hence, the apples are being sold at ₹ 44 per kg.

Exercise 2C

1. Write down the reciprocal of :
   (a) $\frac{4}{9}$ (b) 5 (c) $\frac{1}{15}$ (d) $3\frac{17}{21}$
2. Simplify :
   (a) $\frac{7}{10} \div \frac{3}{5}$ (b) $\frac{4}{7} \div \frac{9}{14}$ (c) $9 \div \frac{1}{3}$ (d) $24 \div \frac{6}{7}$
   (e) $\frac{8}{9} \div 16$ (f) $3\frac{3}{7} \div \frac{8}{21}$ (g) $3\frac{3}{5} \div \frac{4}{5}$ (h) $15\frac{3}{7} \div 1\frac{23}{49}$
   (i) $5\frac{4}{7} \div 1\frac{3}{10}$
3. Divide :
   (a) $\frac{7}{15}$ by $\frac{14}{15}$ (b) 32 by $1\frac{3}{5}$ (c) 45 by $1\frac{4}{5}$ (d) 63 by $2\frac{1}{4}$
   (e) $6\frac{7}{8}$ by $\frac{11}{16}$ (f) $5\frac{5}{9}$ by $3\frac{1}{3}$
4. By what number should $9\frac{4}{5}$ be multiplied to get 42?
5. By what number should $6\frac{2}{9}$ be divided to obtain $4\frac{2}{3}$?
6. The product of two numbers is $15\frac{5}{6}$. If one of the numbers is $6\frac{1}{3}$, find the other.
7. A wire of length $13\frac{1}{2}$ m has been divided into 9 pieces of the same length. What is the length of each piece?
8. 18 boxes weigh equally and their total weight is $49\frac{1}{2}$ kg. How much does each box weigh?
9. If the cost of a book is ₹ $27\frac{3}{4}$, how many books can be purchased for ₹ $249\frac{3}{4}$?
10. Reena bought $8\frac{1}{2}$ kg of sugar for ₹ $242\frac{1}{4}$. Find the price of sugar per kg.

11. By selling pens at the rate of ₹ $6\frac{3}{4}$ per pen, a shopkeeper gets ₹378. How many pens does he sell?

12. Apples are sold at ₹ $43\frac{1}{2}$ per kg. What is the weight of apples available for ₹ $326\frac{1}{4}$?

13. Atul can cover a distance of $20\frac{2}{3}$ km in $7\frac{3}{4}$ hours on foot. How many km per hour does he walk?

14. 24 litres of juice was distributed equally among all the students of a hostel. If each student got $\frac{2}{5}$ litre of juice, how many students are there in the hostel?

15. A group of students arranged a picnic. Each student contributed ₹ $261\frac{1}{2}$. The total contribution was ₹ $2876\frac{1}{2}$. How many students are there in the group?

16. At a charity show the price of each ticket was ₹ $32\frac{1}{2}$. The total amount collected by a boy was ₹ $877\frac{1}{2}$. How many tickets were sold by him?

Exercise 2D

OBJECTIVE QUESTIONS

Mark (✓) against the correct answer in each of the following:

1. Which of the following is an improper fraction?

(a) $\frac{7}{10}$ (b) $\frac{7}{9}$ (c) $\frac{9}{7}$ (d) none of these

2. Which of the following is a reducible fraction?

(a) $\frac{105}{112}$ (b) $\frac{104}{121}$ (c) $\frac{77}{72}$ (d) $\frac{46}{63}$

3. Which of the following is a vulgar fraction?

(a) $\frac{3}{10}$ (b) $\frac{13}{10}$ (c) $\frac{10}{3}$ (d) none of these

4. Reciprocal of $1\frac{3}{4}$ is :

(a) $1\frac{4}{3}$ (b) $4\frac{1}{3}$ (c) $3\frac{1}{4}$ (d) none of these

5. $\left(\frac{3}{10}+\frac{8}{15}\right)=?$

(a) $\frac{11}{10}$ (b) $\frac{11}{15}$ (c) $\frac{5}{6}$ (d) none of these

6. $\left(3\frac{1}{4}-2\frac{1}{3}\right)=?$

(a) $1\frac{1}{12}$ (b) $\frac{1}{12}$ (c) $1\frac{1}{11}$ (d) $\frac{11}{12}$

7. By what number should $1\frac{1}{2}$ be divided to get $\frac{2}{3}$?

(a) $2\frac{2}{3}$ (b) $1\frac{2}{3}$ (c) $\frac{4}{9}$ (d) $2\frac{1}{4}$

8. By what number should $2\frac{3}{5}$ be multiplied to get $1\frac{6}{7}$?

(a) $1\frac{5}{7}$ (b) $\frac{5}{7}$ (c) $1\frac{1}{7}$ (d) $\frac{1}{7}$

9. Vipin reads a book for $1\frac{3}{4}$ hours every day and reads the entire book in 6 days. How many hours does he take to read the entire book ?

(a) $10\frac{1}{2}$ hours (b) $9\frac{1}{2}$ hours (c) $7\frac{1}{2}$ hours (d) $11\frac{1}{2}$ hours

10. A car runs 16 km using 1 litre of petrol. How much distance will it cover in $2\frac{3}{4}$ litres of petrol?

(a) 24 km (b) 36 km (c) 44 km (d) $32\frac{3}{4}$ km

THINGS TO REMEMBER

- The numbers in the form $\frac{x}{y}$, where x and y are natural numbers, are called fractions.
- In $\frac{x}{y}$, we call x as numerator and y as denominator.
- A fraction whose denominator is in the form of 10 or 100 or 1000, etc., is called a decimal fraction.
- The numerator of a proper fraction is smaller than its denominator.
- The numerator of an improper fraction is equal to or greater than its denominator.
- A mixed fraction is expressed as the sum of a natural number and a proper fraction.
- Equivalent fractions have same value.
- The denominators of like fractions are same but the denominators of unlike fractions are not same.
- A fraction $\frac{a}{b}$ is said to be irreducible or in the lowest term if HCF of a and b is 1.
- $\left(\frac{a}{b}\times\frac{c}{d}\right)=\left(\frac{a\times c}{b\times d}\right)$ and $\left(\frac{a}{b}\times c\right)=\frac{(a\times c)}{(b)}$
- Reciprocal of a non-zero fraction $\frac{a}{b}$ is $\frac{b}{a}$.
- $\left(\frac{a}{b}\div\frac{c}{d}\right)=\left(\frac{a}{b}\times\frac{d}{c}\right)$ and $\left(\frac{a}{b}\div c\right)=\left(\frac{a}{b}\times\frac{1}{c}\right)$

ANSWER SHEET

Exercise 1A

1. (a) 7 (b) –7 (c) –30 (d) 15 (e) 27 (f) – 64
2. (a) –149 (b) 628 (c) – 668 (d) –593 (e) –752 (f) 262
3. (a) 38 (b) – 465 (c) 0 (d) 1002
4. (a) –90 (b) 58 (c) –16 (d) 32 (e) – 138 (f) – 87 (g) 46 (h) 188 **5.** 85 **6.** 120
7. (a) –9 (b) –1 (c) 83 (d) 0 (e) – 76 (f) 53 (g) – 83 (h) – 41
8. 100; –100; No **9.** 29 **12.** –2 **13.** –69 **14.** 96
15. (a) F (b) T (c) T (d) F (e) F

Exercise 1B

1. (a) 126 (b) –102 (c) –374 (d) –308 (e) –774 (f) 0 (g) 0 (h) 165 (i) 816 (j) 2250 (k) 87 (*l*) – 525
2. (a) –24 (b) 84 (c) –120 (d) 125 (e) –168 (f) 60
3. (a) –3000 (b) 3000 (c) –1260 (d) 1600 (e) –3125 (f) 729 (g) –1 (h) 1
4. Negative (minus) **5.** Positive (plus)
6. (a) –180 (b) –128 (c) –180 (d) 440 (e) 320 (f) – 40 (g) –2600 (h) 160
7. (a) 0 (b) 7 (c) 1 (d) –1 (e) – 8 (f) – 5
8. (a) T (b) T (c) T (d) F (e) T (f) F (g) T

Exercise 1C

1. (a) –5 (b) –7 (c) – 4 (d) –11 (e) –5 (f) 6 (g) 7 (h) 63 (i) 0 (j) –1 (k) 1 (*l*) – 6
2. (a) –19 (b) 7 (c) – 84 (d) 0 (e) –53 (f) –73 (g) –39 (h) –1 (i) 1
3. (a) T (b) F (c) T (d) F (e) F (f) T

Exercise 1D

1. (b) **2.** (c) **3.** (b) **4.** (c) **5.** (c)
6. (c) **7.** (d) **8.** (b) **9.** (a) **10.** (b)
11. (a) **12.** (c) **13.** (b) **14.** (a) **15.** (b)

Exercise 2A

1. (a) $\frac{30}{84}, \frac{27}{84}, \frac{36}{84}, \frac{32}{21}$ (b) $\frac{30}{132}, \frac{72}{132}, \frac{32}{132}, \frac{27}{132}$ (c) $\frac{52}{100}, \frac{90}{100}, \frac{60}{100}, \frac{85}{100}$
2. (a) < (b) > (c) < **3.** (a) < (b) > (c) <
4. (a) $\frac{3}{4}, \frac{7}{9}, \frac{5}{6}, \frac{11}{12}$ (b) $\frac{7}{10}, \frac{11}{15}, \frac{4}{5}, \frac{17}{20}$ (c) $\frac{7}{18}, \frac{5}{12}, \frac{19}{36}$
5. (a) $\frac{7}{8}, \frac{3}{4}, \frac{17}{24}, \frac{7}{12}$ (b) $\frac{7}{10}, \frac{2}{3}, \frac{3}{5}, \frac{8}{15}$ (c) $\frac{9}{20}, \frac{8}{25}, \frac{4}{15}, \frac{1}{5}$
6. Seema; $\frac{18}{35}$
7. (a) $\frac{7}{11}$ (b) $\frac{53}{36}$ (c) $\frac{16}{25}$ (d) $\frac{79}{48}$ (e) $19\frac{3}{20}$ (f) $7\frac{1}{6}$
8. (a) $\frac{1}{9}$ (b) $\frac{1}{12}$ (c) $2\frac{3}{10}$ (d) $3\frac{1}{3}$ (e) $3\frac{1}{6}$ (f) 4
9. (a) $\frac{7}{60}$ (b) $2\frac{1}{4}$ (c) $6\frac{23}{24}$ **10.** $10\frac{2}{5}$ **11.** $6\frac{1}{4}$
12. Pen; ₹ $11\frac{17}{20}$ **13.** $8\frac{1}{4}$ kg **14.** $\frac{3}{10}$ cm **15.** $2\frac{1}{4}$ m

Exercise 2B

1. (a) $\frac{5}{14}$ (b) $\frac{21}{55}$ (c) $\frac{5}{12}$ (d) 81 (e) 36 (f) 625 (g) $27\frac{1}{5}$ (h) 50 (i) 14
2. (a) $\frac{2}{11}$ (b) $\frac{1}{9}$ (c) $\frac{1}{4}$ (d) 25 (e) $37\frac{1}{3}$ (f) $\frac{8}{3}$
3. (a) 6 (b) 12 (c) 27 (d) 280 (e) 156 (f) ₹ 150 (g) 28 metres (h) 36 litres (i) 5 minutes (j) 9 months (k) 280 gm (*l*) 35 cm (m) 14 hours (n) 2 days (o) 22l m*l*
4. $331\frac{1}{2}$ kg **5.** ₹ 183 **6.** ₹ 238 **7.** 600 km
8. 33 cm **9.** ₹ 10,934 **10.** 12 boys
11. 1 hour and 12 minutes **12.** 21 kg
13. $21\frac{7}{9}$ m^2 **14.** 775 m^2 **15.** ₹ 3000

Exercise 2C

1. (a) $\frac{9}{4}$ (b) $\frac{1}{5}$ (c) 15 (d) $\frac{21}{80}$
2. (a) $\frac{7}{6}$ (b) $\frac{8}{9}$ (c) 27 (d) 28 (e) $\frac{1}{18}$ (f) 9 (g) $4\frac{1}{2}$ (h) $10\frac{1}{2}$ (i) $4\frac{2}{7}$
3. (a) $\frac{1}{2}$ (b) 20 (c) 25 (d) 28 (e) 10 (f) $\frac{5}{3}$
4. $4\frac{2}{7}$ **5.** $1\frac{1}{3}$ **6.** $2\frac{1}{2}$ **7.** $1\frac{1}{2}$ m **8.** $2\frac{3}{4}$ kg
9. 9 books **10.** ₹ $28\frac{1}{2}$ **11.** 56 pens

12. $7\frac{1}{2}$ kg **13.** $2\frac{2}{3}$ km per hour

14. 60 students **15.** 11 students **16.** 27 tickets

Exercise 2D

1. (c) **2.** (a) **3.** (c) **4.** (d) **5.** (c)
6. (d) **7.** (d) **8.** (b) **9.** (a) **10.** (c)

Exercise 3A

1. (a) 3.50, 0.67, 15.60, 4.00
(b) 6.500, 16.030, 0.274, 119, 400

2. (a) 600 (b) $\frac{5}{1000}$ (c) $\frac{2}{10}$ (d) 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) 350.058 (b) 824.9002

5. (a) $10+7+\frac{3}{10}+\frac{6}{1000}$
(b) $400+50+6+\frac{2}{10}+\frac{3}{100}+\frac{7}{1000}$
(c) $100+\frac{6}{1000}$
(d) $200+90+2+\frac{4}{10}+\frac{2}{100}+\frac{5}{1000}$

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

7. (a) $<$ (b) $>$ (c) $<$ (d) $<$ (e) $>$ (f) $>$

8. (a) 2.002, 2.02, 2.2, 2.202, 22.2
(b) 4.06, 4.58, 4.6, 7.32, 7.4
(c) 0.05, 0.5, 5.05, 5.5, 5.55
(d) 6.08, 6.4, 6.48, 6.8, 6.84

9. (a) 2.6, 2.3, 2.26, 2.06, 2.007
(b) 74.4, 8.34, 7.44, 7.4, 0.74

10. (a) $\frac{3}{5}$ (b) $\frac{1}{4}$ (c) $\frac{1}{20}$ (d) $\frac{7}{40}$

11. (a) $5\frac{3}{5}$ (b) $12\frac{1}{4}$ (c) $4\frac{5}{8}$ (d) $6\frac{1}{250}$

12. (a) 0.85 (b) 3.125 (c) 4.7 (d) 1.56 (e) 25.16
(f) 3.524 (g) 2.08 (h) 3.4

13. 4.5 cm; 0.045 m; 0.000045 km

14. (a) ₹ 0.04 (b) ₹ 8.05 (c) ₹ 9.75

15. (a) 0.075 km (b) 0.225 km (c) 5.005 km

Exercise 3B

1. (a) 739.932 (b) 119.988 (c) 40.21 (d) 266.278
(e) 122.085 (f) 247.418 (g) 278.457 (h) 112.83

2. (a) 2.269 (b) 5.4693 (c) 4.5822 (d) 0.327
(e) 9.081 (f) 8.124 (g) 15.86 (h) 57.64

3. (a) 20.1094 (b) 69.0936 (c) 34.449 (d) 127.359

4. 3.354 **5.** 28.42 **6.** 7.287 **7.** 27.43 **8.** 47.43

9. ₹ 7.5 **10.** 42.96 m

Exercise 3C

1. (a) 628.1 (b) 64.3 (c) 730.02 (d) 7.2 (e) 6 (f) 0.21

2. (a) 328.6 (b) 572 (c) 380 (d) 7 (e) 80 (f) 0.4

3. (a) 5623.5 (b) 293 (c) 65 (d) 7360 (e) 5900 (f) 50

4. (a) 68.8 (b)52.06 (c) 8.916 (d) 1229.76 (e) 699.266
(f) 15378.75 (g) 622.604 (h) 1.7388 (i) 0.77172

5. (a) 21.735 (b) 0.1458 (c) 18.24 (d) 0.5886
(e) 4.8375 (f) 2.7832 (g) 0.00644 (h) 0.0228
(i) 0.46725 (j) 7.968 (k) 0.108 (*l*) 95.92

6. (a) 0.009261 (b) 1.3431 (c) 0.000008 (d) 0.14
(e) 9 (f) 2.197

7. 1125 km **8.** 775.2 kg **9.** 756 kg **10.** 48900 kg

11. 23.125 kg **12.** 60.84 kg **13.** ₹ 923

14. 808.8 litres **15.** ₹ 2007.25

Exercise 3D

1. (a) 24.27 (b) 4.367 (c) 0.549 (d) 0.045
(e) 0.009 (f) 0.0073

2. (a) 2.483 (b) 0.345 (c) 0.058 (d) 0.004
(e) 0.0069 (f) 0.0005

3. (a) 2.3976 (b) 0.46527 (c) 0.0497 (d) 0.0057
(e) 0.0009 (f) 0.004

4. (a) 0.823 (b) 13.46 (c) 0.24 (d) 0.784
(e) 0.0452 (f) 0.0256

5. (a) 2.5 (b) 0.6875 (c) 0.775 (d) 2.35
(e) 4.2 (f) 4.04

6. (a) 0.76 (b) 0.085 (c) 7.2 (d) 5.04 (e) 5.6 (f) 12.08
(g) 0.103 (h) 0.545 (i) 0.142 (j) 0.0302 (k) 0.007
(*l*) 0.048 (m) 0.0265 (n) 0.0715 (o) 0.345

7. (a) 0.32 (b) 4.1 (c) 11.38 (d) 0.6 (e) 2.31 (f) 16.93
(g) 6.9 (h) 0.57 (i) 13.4 (j) 0.4 (k) 3.07
(*l*) 2000 (m) 1200 (n) 50 (o) 0.0375