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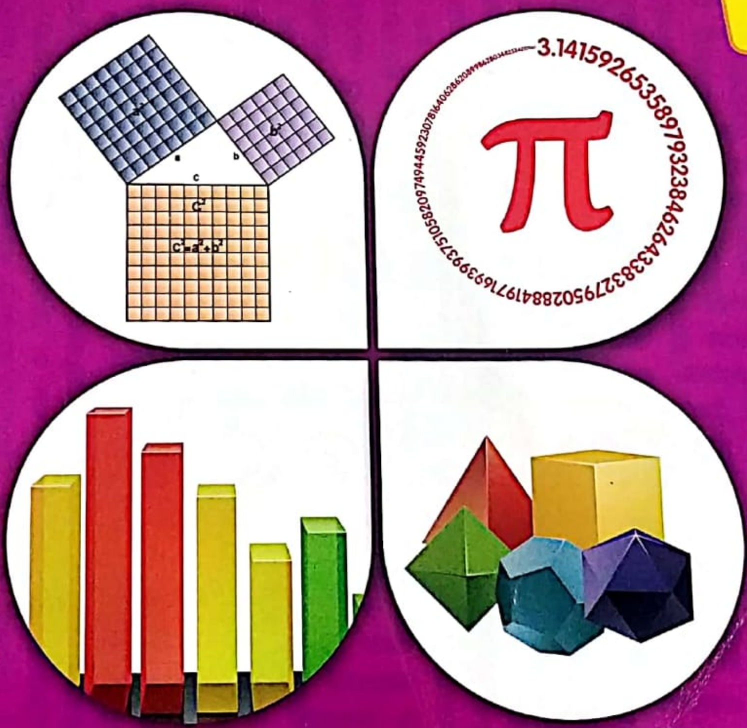
FREE SMART CLASS SOFTWARE WITH WEB SUPPORT

FOR TEACHERS ONLY

STEP BY STEP Mathematics

7



CORDOVA®

CONTENTS

1 Integers

Use **Cordova Smart Class Software** on the **smart board** in class to learn about integers.

INTEGERS

We can subtract a smaller number from a greater number but it is not possible to subtract a greater number from a smaller number.

$7 - 3 = 4$ $\qquad$ $8 - 5 = 3$ $\qquad$ $5 - 2 = 3$

$3 - 7 = ?$ $\qquad$ $5 - 8 = ?$ $\qquad$ $2 - 5 = ?$

So, a new type of numbers were introduced denoted by – 1, – 2, – 3, – 4, – 5, – 6, ... such that

$1 + (-1) = 0,\ 2 + (-2) = 0,\ 3 + (-3) = 0$ and so on.

Thus, we get numbers ..., – 5, – 4, – 3, – 2, – 1, 0, 1, 2, 3, 4, 5, ...

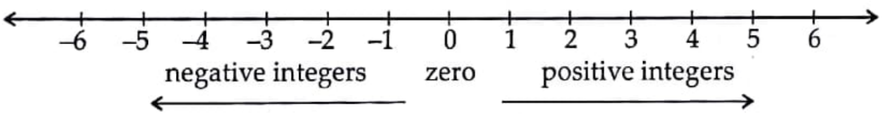
These numbers are called **integers.** Whole numbers and negative numbers form the collection of integers.

The numbers 1, 2, 3, 4, ... are called **positive integers.**

The numbers – 1, – 2, – 3, – 4, ... are called **negative integers.**

0 is simply an integer, neither positive nor negative.

The integers can be represented on the number line as shown below :



The arrows on both sides of the number line indicate that the number line can be extended infinitely in both directions. So, there is no smallest negative integer and there is no greatest positive integer.

Look at the number line carefully and observe :

An integer on the number line is greater than every number on its left.

Examples : (*i*) $3 > 2$ as 3 is to the right of 2.

(*ii*) $0 > -1$ as 0 is to the right of – 1.

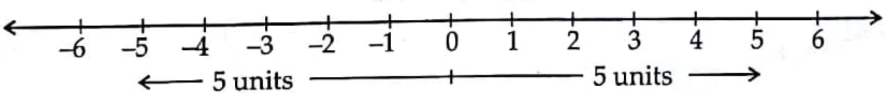
(*iii*) $-2 > -3$ as – 2 is to the right of – 3.

Absolute Value

The numerical value of an integer regardless of its sign is called its **absolute value.** The absolute value of an integer is always positive or zero. The symbol for absolute value is '| |'.

For example : 5 is 5 units away from 0. The absolute value of 5 is 5 *i.e.,* $|5| = 5$.

–5 is 5 units away from 0. The absolute value of – 5 is 5. *i.e.,* $|-5| = 5$.



ADDITION OF INTEGERS

Rule 1 : *To add two integers of like signs, we add their absolute values and put the common sign with the sum.*

Example 1 : Add : (*i*) (+ 15) and (+ 8). (*ii*) (– 8) and (– 5)

Solution : (*i*) (+ 15) + (+ 8) = + (15 + 8) = + 23

(*ii*) (– 8) + (– 5) = – (8 + 5) = – 13

Rule 2 : *To add a positive and a negative integer, we find the difference between their absolute values and put the sign of the integer with the greater absolute value to it.*

Example 2 : Add : (*i*) 15 and (– 7) (*ii*) (– 13) and 8

Solution : (*i*) (+ 15) + (– 7) = + (15 – 7) = + 8 (*ii*) (– 13) + (+ 8) = – (13 – 8) = – 5

Properties of Addition of Integers

1. **Closure Property :** If a and b are integers, then $a + b$ is also an integer.

   Examples : (*i*) – 8 + 5 = – (8 – 5) = – 3, which is an integer.

   (*ii*) – 4 + (– 3) = – (4 + 3) = – 7, which is an integer.

   (*iii*) – 9 + 13 = (13 – 9) = 4, which is an integer.

   The sum of two integers is always an integer. Integers are closed under addition.

2. **Commutative Property :** If a and b are integers, then $a + b = b + a$.

   Examples : (*i*) 6 + (– 11) = – 5 and (– 11) + 6 = – 5

   Hence, 6 + (– 11) = (– 11) + 6

   (*ii*) (– 9) + (– 5) = – (9 + 5) = – 14 and (– 5) + (– 9) = – (5 + 9) = – 14

   Hence, (– 9) + (– 5) = (– 5) + (– 9)

   The sum of two integers remains the same whatever be the order of the integers. Addition is commutative for integers.

3. **Associative Property :** If a, b and c are integers, then $(a + b) + c = a + (b + c)$.

   Example : {(– 6) + 7} + (– 9) = 1 + (– 9) = – 8

   and (– 6) + {7 + (–9)} = – 6 + (– 2) = – (6 + 2) = – 8

   Hence, {(– 6) + 7} + (– 9) = (– 6) + {7 + (– 9)}

   Addition is associative for integers.

4. **Additive Identity :** If a is any integer, then $a + 0 = 0 + a = a$.

   Examples : (*i*) 3 + 0 = 0 + 3 = 3

   (*ii*) (– 7) + 0 = 0 + (– 7) = – 7

   Hence, 0 is called the **additive identity** for integers.

5. **Additive Inverse :** If a is any integer, then there exists an integer $-a$ such that $a + (-a) = 0$ = – a + a

   $-a$ is called the **additive inverse** of a.

   Example : 7 + (– 7) = 0 = – 7 + 7

   – 7 is the additive inverse of 7 and vice-versa.

SUBTRACTION OF INTEGERS

Rule : *To subtract one integer from the other integer, add its additive inverse to the other.*

Example 3 : Subtract : (*i*) (– 8) from (– 15) (*ii*) 13 from (– 9)

Solution : (*i*) (– 15) – (– 8) = – 15 + 8 [Additive inverse of – 8 is 8]

= – (15 – 8) = – 7

(*ii*) (– 9) – 13 = – 9 + (– 13) [Additive inverse of 13 is – 13]

= – (9 + 13) = – 22

Properties of Subtraction of Integers

1. **Closure Property :** If a and b are two integers, then $a - b$ is also an integer.

   Examples : (*i*) 11 – 5 = 6, which is an integer

   (*ii*) (– 13) – 2 = – (13 + 2) = – 15, which is an integer

   (*iii*) (– 15) – (– 8) = – 15 + 8 = – 7, which is an integer

   Integers are closed under subtraction.

2. **Commutative Property :** Subtraction is not commutative for integers.

   If a and b are integers, then $a - b \neq b - a$.

   Examples : (*i*) 3 – 5 = – 2, 5 – 3 = 2

   Hence, 3 – 5 ≠ 5 – 3

   (*ii*) (– 4) – (– 7) = – 4 + 7 = 3,

   (– 7) – (– 4) = – 7 + 4 = – 3

   Hence, (– 4) – (– 7) ≠ (– 7) – (– 4)

3. **Associative Property :** Subtraction is not associative for integers.

   If a, b and c are integers, then

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

   Example : (9 – 3) – 4 = 6 – 4 = 2,

   9 – (3 – 4) = 9 – (– 1) = 9 + 1 = 10

   ∴ (9 – 3) – 4 ≠ 9 – (3 – 4)

Example 4 : Evaluate :

(*i*) 13 + (– 7) (*ii*) (– 17) + 6 (*iii*) (– 7) + (– 13)

Solution : (*i*) 13 + (– 7) = 13 – 7 = 6

(*ii*) (– 17) + 6 = – (17 – 6) = – 11

(*iii*) (– 7) + (– 13) = – (7 + 13) = – 20

Example 5 : Find the additive inverse of

(*i*) – 72 (*ii*) 325

Solution : (*i*) The opposite of integer – 72 is + 72, such that – 72 + 72 = 0.

∴ The additive inverse of – 72 is 72.

(*ii*) The opposite of integer 325 is – 325, such that 325 + (– 325) = 0.

∴ The additive inverse of 325 is – 325.

Example 6 : Evaluate :

(*i*) (– 11) + (– 5) + 3 + (– 1) – 2 (*ii*) |– 5| – |4| + |–3| – |– 2|

Solution : (*i*) (– 11) + (– 5) + 3 + (– 1) – 2 = (– 11) + (– 5) + 3 + (– 1) + (– 2)

= {(– 11) + (– 5) + (– 1) + (– 2)} + 3

= – 19 + 3 = – 16

(*ii*) |– 5| – |4| + |– 3| – |– 2| = 5 – 4 + 3 – 2

= 5 + 3 – 4 – 2

= 8 – 6 = 2

EXERCISE 1.1

Use Cordova Smart Class Software on the smart board in class to do Exercise.

1. Find the sum of :
   (i) 256 and – 312 (ii) – 319 and – 136 (iii) – 127 and 300
2. Subtract :
   (i) 32 from – 56 (ii) – 73 from – 80 (iii) – 63 from 72
3. Subtract the sum of – 524 and 678 from – 92.
4. Subtract – 341 from the sum of 83 and – 56.
5. The sum of two integers is – 278. If one of the integers is – 156, find the other.
6. Subtract the sum of – 42 and – 147 from the difference of – 283 and – 415.
7. Simplify : 14 – (– 18) + [– 32 – (– 15)]
8. If $a = -10$, $b = -4$, show that $a - b \neq b - a$.
9. Find the value of :
   (i) $3 + |-4| + |-5| - |-4|$ (ii) $|-6| + |-9| + |-41|$
10. Simplify :
    (i) 23 – (– 9) + 12 – (– 6) (ii) – 15 + (– 63) – (– 45) + (– 16)

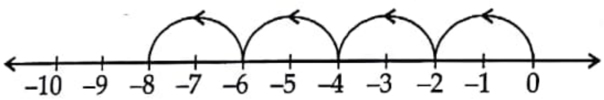
MULTIPLICATION OF INTEGERS

Multiplication is simply repeated addition. Multiplication of integers can also be shown on the number line.

Multiplication of a positive and a negative integer

We have, (–2) + (–2) + (–2) + (–2) = – 8

or, 4 × (–2) = – 8



To find 4 × (–2), we can first find 4 × 2 = 8 and then put minus sign before the product to get – 8.

Thus, 4 × (–2) = – (4 × 2) = – 8

Now, let us find (– 4) × 2.

Observe the following pattern :

4 × 2 = 8
3 × 2 = 6 = 8 – 2
2 × 2 = 4 = 6 – 2
1 × 2 = 2 = 4 – 2
0 × 2 = 0 = 2 – 2
– 1 × 2 = – 2 = 0 – 2
– 2 × 2 = – 4 = – 2 – 2
– 3 × 2 = – 6 = – 4 – 2
– 4 × 2 = – 8 = – 6 – 2

We get, (– 4) × 2 = 4 × (–2) = – 8

To multiply a positive and a negative integer, we multiply them as natural numbers and put a minus sign before the product so obtained. The product of a positive and a negative integer is a negative integer.

In general, if a and b are any two positive integers, then $a \times (-b) = (-a) \times b = -(a \times b)$.

Multiplication of Two Negative Integers

Let us find (– 4) × (– 2).

Observe the pattern.

$$(-4) \times 2 = -8$$
$$(-4) \times 1 = -4 = -8 - (-4)$$
$$(-4) \times 0 = 0 = -4 - (-4)$$
$$(-4) \times (-1) = 4 = 0 - (-4)$$
$$(-4) \times (-2) = 8 = 4 - (-4)$$

Thus, $(-4) \times (-2) = 8 = 4 \times 2$

Similarly, $(-5) \times (-4) = 20 = 5 \times 4$

$(-7) \times (-3) = 21 = 7 \times 3$

Thus, the product of two negative integers is a positive integer. To multiply two negative integers, we multiply them as natural numbers and put the plus sign before the product.

For any two positive integers a and b, $(-a) \times (-b) = ab$.

We can sum up the findings in the following rules.

Rule 1 : *The product of two integers with like signs is equal to the product of their absolute values with positive sign.*

Examples : (*i*) $4 \times 6 = +(4 \times 6) = 24$, [(+) × (+) = (+)]

(*ii*) $(-5) \times (-4) = +(5 \times 4) = 20$, [(–) × (–) = (+)]

Rule 2 : *The product of two integers with unlike signs is equal to the product of their absolute values with negative sign.*

Examples : (*i*) $4 \times (-9) = -(4 \times 9) = -36$ [(+) × (–) = (–)]

(*ii*) $(-8) \times 7 = -(8 \times 7) = -56$ [(–) × (+) = (–)]

Example 7 : Evaluate :

(*i*) (– 15) × 8 (*ii*) 9 × (– 12) (*iii*) (– 7) × (– 9) (*iv*) 21 × 6

Solution : (*i*) $(-15) \times 8 = -(15 \times 8) = -120$ (*ii*) $9 \times (-12) = -(9 \times 12) = -108$

(*iii*) $(-7) \times (-9) = +(7 \times 9) = 63$ (*iv*) $21 \times 6 = 126$

Properties of Multiplication of Integers

1. **Closure Property :** If a and b are integers, then $a \times b$ is also an integer.

   Examples : (*i*) $6 \times 5 = 30$, which is an integer.

   (*ii*) $8 \times (-6) = -(8 \times 6) = -48$, which is an integer.

   (*iii*) $(-4) \times 9 = -(4 \times 9) = -36$, which is an integer.

   (*iv*) $1 \times (-7) = -(1 \times 7) = -7$, which is an integer.

   We see that product of two integers is always an integer.

   Integers are closed under multiplication.

2. **Commutative Property :** If a and b are two integers, then $a \times b = b \times a$.

   Example : $(-6) \times 7 = -(6 \times 7) = -42$ and $7 \times (-6) = -(7 \times 6) = -42$

   Hence, $(-6) \times 7 = 7 \times (-6)$.

   Multiplication is commutative for integers.

3. **Associative Property :** If a, b and c are three integers, then $a \times (b \times c) = (a \times b) \times c$.

   Example : $7 \times \{(-4) \times (-2)\} = 7 \times 8 = 56$

   and $\{7 \times (-4)\} \times (-2) = (-28) \times (-2) = 56$

   Hence, $7 \times \{(-4) \times (-2)\} = \{7 \times (-4)\} \times (-2)$.

   The product of three integers does not depend upon the grouping of integers.

   Multiplication is associative for integers.

4. **Existence of Multiplicative Identity :** If a is any integer, then $a \times 1 = 1 \times a = a$.

Examples : (*i*) $12 \times 1 = 1 \times 12 = 12$

(*ii*) $(-5) \times 1 = 1 \times (-5) = -5$

1 is the ***multiplicative identity*** for integers.

5. **Property of Zero :** If a is any integer, then $a \times 0 = 0 \times a = 0$.

Examples : (*i*) $0 \times 6 = 6 \times 0 = 0$

(*ii*) $(-5) \times 0 = 0 \times (-5) = 0$

6. **Distributive Property :** If a, b and c are three integers, then $a \times (b + c) = (a \times b) + (a \times c)$.

This is called ***distributive property of multiplication over addition.***

Example : $(-4) \times \{(-5) + 3\} = (-4) \times (-2) = 8$

and $\{(-4) \times (-5)\} + \{(-4) \times 3\} = 20 + (-12) = 8$

Hence, $(-4) \times \{(-5) + 3\} = \{(-4) \times (-5)\} + \{(-4) \times 3\}$.

Distributivity of multiplication over subtraction is also true.

For any three integers a, b and c, $a \times (b - c) = (a \times b) - (a \times c)$.

Example : $(-8) \times (7 - 2) = -8 \times 5 = -40$

$[(-8) \times 7] - [(-8) \times 2] = -56 - (-16) = -56 + 16 = -40$

Hence, $(-8) \times (7 - 2) = [(-8) \times 7] - [(-8) \times 2]$.

Example 8 : Verify : $17 \times \{7 + (-3)\} = (17 \times 7) + \{17 \times (-3)\}$

Solution :

L.H.S. $= 17 \times \{7 + (-3)\}$

$= 17 \times 4 = 68$

R.H.S. $= (17 \times 7) + \{17 \times (-3)\}$

$= 119 + (-51) = 68$

Hence, $17 \times \{7 + (-3)\} = (17 \times 7) + \{17 \times (-3)\}$

Example 9 : Find the product, using suitable properties.

(*i*) $15 \times (-25) \times (-4) \times (-10)$ (*ii*) $625 \times (-35) + (-625) \times 65$

Solution : (*i*) $15 \times (-25) \times (-4) \times (-10)$

$= \{15 \times (-10)\} \times \{(-25) \times (-4)\}$

$= (-150) \times 100 = -15000$

(*ii*) $625 \times (-35) + (-625) \times 65$

$= 625 \times \{(-35) + (-65)\}$

$= 625 \times (-35 - 65)$

$= 625 \times (-100) = -62500$

Example 10 : Using distributive property, find

(*i*) 49×17 (*ii*) $(-26) \times (-41)$ (*iii*) $(-39) \times (-15) + (-1) \times 39$

Solution : (*i*) $49 \times 17 = (50 - 1) \times 17$

$= 50 \times 17 - 1 \times 17$

$= 850 - 17 = 833$

(ii) (– 26) × (– 41) = 26 × 41

= 26 × (40 + 1)

= 26 × 40 + 26 × 1

= 1040 + 26 = 1066

(iii) (– 39) × (– 15) + (– 1) × 39

= (– 39) × {(–15) + 1}

= (– 39) × (– 14)

= 39 × 14

= (40 – 1) × 14

= 40 × 14 – 1 × 14

= 560 – 14 = 546

ple 11 : Find each of the following products :

(i) 9 × (– 2) × (– 5) (ii) (– 4) × (– 6) + (– 3) × (– 1)

(iii) (– 11) × (– 12) × 10 (iv) (– 3) × (– 7) × (– 6)

ion : (i) 9 × (– 2) × (– 5) = 9 × {(– 2) × (– 5)} = 9 × 10 = 90

(ii) (– 4) × (– 6) + (– 3) × (– 1) = {(– 4) × (– 6)} + {(– 3) × (– 1)} = 24 + 3 = 27

(iii) (– 11) × (– 12) × 10 = {(– 11) × (– 12)} × 10

= (11 × 12) × 10

= 132 × 10 = 1320

(iv) (– 3) × (– 7) × (– 6) = {(– 3) × (– 7)} × (– 6)

= (3 × 7) × (– 6)

= 21 × (– 6) = – 126

nple 12 : If $a = -1$, $b = 1$, $c = 2$, verify that

(i) $a \times b = b \times a$ (ii) $a \times b \times c = b \times c \times a = c \times a \times b$

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

ution : (i) L.H.S. = $a \times b = (-1) \times 1 = -1$

R.H.S. = $b \times a = 1 \times (-1) = -1$

$\therefore a \times b = b \times a$

(ii) $a \times b \times c = (-1) \times 1 \times 2 = -2$

$b \times c \times a = 1 \times 2 \times (-1) = -2$

$c \times a \times b = 2 \times (-1) \times 1 = -2$

$\therefore a \times b \times c = b \times c \times a = c \times a \times b$

(iii) L.H.S. = $a \times (b + c) = (-1) \times (1 + 2)$

$= (-1) \times 3 = -3$

R.H.S. = $a \times b + a \times c = (-1) \times 1 + (-1) \times 2$

$= -1 + (-2) = -3$

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

Puzzle

A man wanted to get into his work building. But he had forgotten his codes. However he did remember five clues. The fifth digit plus the third digit equals 14. The fourth digit is one more than the second digit. The first digit is one less than twice the second digit. The second digit plus the third digit equals ten. The sum of all five digits is 30.

What are the five digits and in what order?

Example 13 : If an operation '*' is defined as $x * y = (x + y) \times x$, evaluate

(i) $1 * 2$ (ii) $(-3) * (-2)$ (iii) $(-5) * 3$

Solution : Given that $x * y = (x + y) \times x$

(i) $1 * 2 = (1 + 2) \times 1 = 3 \times 1 = 3$

(ii) $(-3) * (-2) = \{-3 + (-2)\} \times (-3)$
$= \{-5\} \times (-3) = 15$

(iii) $(-5) * 3 = (-5 + 3) \times (-5)$
$= (-2) \times (-5) = 10$

EXERCISE 1.2

Use Cordova Smart Class Software on the smart board in class to do Exercise.

1. Find each of the following products :
   (i) $6 \times (-12)$ (ii) $(-1) \times (-5) \times (-7) \times (-2)$ (iii) $6 \times (-5) \times (-5) \times (-2)$
   (iv) $0 \times 192 \times (-32)$ (v) $20 \times (-123) \times (-5)$ (vi) $(-12) \times (-5) \times 12$
2. Find the value of
   (i) $3276 \times 3 - 3276 \times 2$ (ii) $8964 \times 1 + 99 \times 8964$ (iii) $2314 \times 9 + 2314$
3. Verify the following :
   (i) $23 \times \{7 + (-2)\} = 23 \times 7 + 23 \times (-2)$
   (ii) $(-18) \times [(-3) + (-5)] = [(-18) \times (-3)] + [(-18) \times (-5)]$
4. Determine the integer whose product with '–1' is
   (i) 23 (ii) – 47 (iii) 0
5. Using convenient grouping, evaluate :
   (i) $(-5) \times 19 \times (-60)$ (ii) $25 \times 31 \times (-4)$
   (iii) $97 \times 25 \times (-2) \times (-4)$ (iv) $(-2) \times 4896 \times (-5)$
6. If $a = 3$, $b = -2$, $c = -1$, verify that :
   (i) $b \times (a + c) = b \times a + b \times c$ (ii) $b \times c \times a = a \times b \times c = c \times a \times b$
   (iii) $b \times c = c \times b$
7. If an operation '*' be defined as $a * b = a \times b - (a + b)$, evaluate :
   (i) $2 * 5$ (ii) $(-4) * (-6)$ (iii) $13 * (-6)$ (iv) $-7 * 5$

DIVISION OF INTEGERS

Division is inverse operation of multiplication.

Since $3 \times 6 = 18$

therefore, $18 \div 3 = 6$, $18 \div 6 = 3$

Similarly, $(-7) \times (-6) = 42$ therefore, $42 \div (-7) = -6$, $42 \div (-6) = -7$

Also, $(-8) \times 4 = (-32)$ therefore, $(-32) \div 4 = -8$, $(-32) \div (-8) = 4$

When we divide a negative integer by a positive integer, we divide them as natural numbers and put a minus sign before the quotient. We, thus, get a negative integer.

When we divide a positive integer by a negative integer, we divide them as natural numbers and put a minus sign before the quotient.

When we divide a negative integ
sign before the quotient.
Rule 1 : *If two integers are of like si*
to the quotient.
Examples : (i) $12 \div 4 = 3$
Rule 2 : *If two integers are of un*
assigned to the quotient.
Examples : (i) $(-26) \div 2 = -$

Properties of Division of I

1. If a and b are integers, the
   Examples : (i) $(-14) \div$
   (ii) $(-15) \div$
   (iii) $(-7) \div$
   (iv) $(13) \div 3$
   Integers are not closed u
2. If a is an integer such th
   Examples : $(-9) \div 1 =$
3. For any non-zero intege
   Examples : $0 \div 6 = 0$, (
4. If a is an integer, then a
5. Division is not commut
   Example : $4 \div (-2) \neq (-$

Example 14 : Find the quo
(i) $(-63) \div$

Solution : (i) $\frac{(-63)}{(-9)}$
(ii) $\frac{1078}{(-11)}$
(iii) $\frac{-12096}{576}$

Example 15 : Simplify :
(i) $\{(-24)$

Solution : (i) $\{(-$
(ii) (-42)
(iii) $(-3$

Example 16 : What sho

Solution : Here,
Now,
⇒
Hence, (

When we divide a negative integer by a negative integer, we divide them as natural numbers and put a plus sign before the quotient.

Rule 1 : *If two integers are of like signs, then the absolute values of two integers are divided and positive sign is assigned to the quotient.*

Examples : (*i*) $12 \div 4 = 3$ (*ii*) $(-42) \div (-7) = 42 \div 7 = 6$

Rule 2 : *If two integers are of unlike signs, then the absolute values of two integers are divided and negative sign is assigned to the quotient.*

Examples : (*i*) $(-26) \div 2 = -13$ (*ii*) $24 \div (-6) = -4$

Properties of Division of Integers

1. If a and b are integers, then $a \div b$ is not necessarily an integer.

   Examples : (*i*) $(-14) \div 2 = -7$, which is an integer.

   (*ii*) $(-15) \div (-3) = 5$, which is an integer.

   (*iii*) $(-7) \div 2$ is not an integer.

   (*iv*) $(13) \div 3$ is not an integer.

   Integers are not closed under division.

2. If a is an integer such that $a \neq 0$, then $a \div a = 1$ and $a \div 1 = a$.

   Examples : $(-9) \div 1 = (-9)$, $(-8) \div (-8) = 1$

3. For any non-zero integer a, $0 \div a = 0$.

   Examples : $0 \div 6 = 0$, $0 \div (-6) = 0$

4. If a is an integer, then $a \div 0$ is not defined.

5. Division is not commutative for integers.

   Example : $4 \div (-2) \neq (-2) \div 4$

Example 14 : Find the quotient :

(*i*) $(-63) \div (-9)$ (*ii*) $1078 \div (-11)$ (*iii*) $(-12096) \div 576$

Solution : (*i*) $\dfrac{(-63)}{(-9)} = \dfrac{63}{9} = 7$

(*ii*) $\dfrac{1078}{(-11)} = -\left(\dfrac{1078}{11}\right) = -98$

(*iii*) $\dfrac{-12096}{576} = -\left(\dfrac{12096}{576}\right) = -21$

Example 15 : Simplify :

(*i*) $\{(-24) \div (-6)\} + 5$ (*ii*) $(-42) \div \{(-8) + (-6)\}$ (*iii*) $(-32) \div \{(-12) + 8\}$

Solution : (*i*) $\{(-24) \div (-6)\} + 5 = 4 + 5 = 9$

(*ii*) $(-42) \div \{(-8) + (-6)\} = -42 \div (-14) = 42 \div 14 = 3$

(*iii*) $(-32) \div \{(-12) + 8\} = -32 \div (-4) = 32 \div 4 = 8$

Example 16 : What should be divided by -8 to get 36?

Solution : Here, quotient = 36, divisor = -8

Now, Integer $\div (-8) = 36$

$\Rightarrow$ Integer $= 36 \times (-8) = -288$

Hence, (-288) should be divided by (-8) to get 36.

Example 17 : Verify that $a \div (b + c) \neq (a \div b) + (a \div c)$ for $a = 12, b = -4, c = 2$.

Solution : L.H.S. $= a \div (b + c) = 12 \div \{(-4) + 2\}$

$= 12 \div (-2) = -6$

R.H.S. $= (a \div b) + (a \div c) = \{12 \div (-4)\} + (12 \div 2)$

$= -3 + 6 = 3$

Thus, $a \div (b + c) \neq (a \div b) + (a \div c)$.

Example 18 : Write five pairs of integers (a, b) such that $a \div b = -3$.

Solution : Five pairs of integers (a, b) such that $a \div b = -3$ are as follows :

$(-6, 2)$ because $-6 \div 2 = -3$

$(-12, 4)$ because $-12 \div 4 = -3$

$(12, -4)$ because $12 \div (-4) = -3$

$(9, -3)$ because $9 \div (-3) = -3$

$(-9, 3)$ because $-9 \div 3 = -3$

EXERCISE 1.3

Use **Cordova Smart Class Software** on the **smart board** in class to do Exercise.

1. Find the quotient :
   (*i*) $45 \div (-9)$ (*ii*) $(-243) \div 9$ (*iii*) $(-5525) \div (-221)$
   (*iv*) $1728 \div (-12)$ (*v*) $729 \div 9$ (*vi*) $(-133) \div (-19)$
2. Simplify :
   (*i*) $[(-49) \div 7] \div (-7)$ (*ii*) $[(-11) + (-5)] \div [3 + (-1)]$
   (*iii*) $(45 \div 9) - [(-36) \div 9]$ (*iv*) $[(-56) \div (-8)] + [(-7) \div 7)]$
3. If $a = 24, b = 8, c = 4$, verify that $a \div (b + c) \neq (a \div b) + (a \div c)$.
4. Write four pairs of integers (a, b) such that $a \div b = -4$.
5. Give three examples to prove that, if p and q are two integers, then $p \div q$ is not necessarily an integer.

Word Problems

Example 19 : In a class test containing 10 questions, 4 marks are given for every correct answer and (-2) marks are given for every incorrect answer.

(*i*) Naresh attempts all questions but only 8 of his answers are correct. What is his total score?

(*ii*) Umesh also attempts all questions but gets only 6 answers correct. What is his total score?

Solution : (*i*) Correct answers = 8

Marks given for 1 correct answer = 4

Marks given for 8 correct answers = $8 \times 4 = 32$

Marks given for 1 incorrect answer = -2

Marks given for 2 incorrect answers = $2 \times (-2) = -4$

Total score of Naresh = $32 + (-4) = 28$

(*ii*) Marks given for 1 correct answer = 4

Marks given for 6 correct answers = 6 × 4 = 24

Marks given for 1 incorrect answer = – 2

Marks given for 4 incorrect answers = 4 × (–2) = – 8

Total score of Umesh = 24 + (– 8) = 16

Example 20 : The product of two integers is – 182. If one of the integers is 13, find the other integer.

Solution : Product of two integers = – 182

One integer = 13

∴ Other integer = (– 182) ÷ 13 = $\frac{-182}{13}$ = – 14

Thus, the other integer is – 14.

Example 21 : Find an integer which when multiplied by 3 and then divided by 2 becomes (– 18).

Solution : Integer multiplied by 3 and then divided by 2 is – 18.

⇒ Integer multiplied by $\frac{3}{2}$ = – 18

⇒ $\text{Integer} \times \frac{3}{2} = -18$

⇒ $\text{Integer} = \frac{(-18)\times 2}{3}$

$= \frac{-36}{3} = -12$

Thus, the required integer is (– 12).

Example 22 : The temperature at 12 noon was 10°C above zero. If it decreases at the rate of 2°C per hour until midnight, at what time would the temperature be 8°C below zero? What would be the temperature at midnight?

Solution : Initial temperature *i.e.*, at 12 noon = 10°C

Change in temperature per hour = – 2°C

Temperature at 1:00 p.m. = 10°C + (– 2°C) = 8°C

Temperature at 2:00 p.m. = 8°C + (– 2°C) = 6°C

Temperature at 3:00 p.m. = 6°C + (– 2°C) = 4°C

Temperature at 4:00 p.m. = 4°C + (– 2°C) = 2°C

Temperature at 5:00 p.m. = 2°C + (– 2°C) = 0°C

Temperature at 6:00 p.m. = 0°C + (– 2°C) = – 2°C

Temperature at 7:00 p.m. = – 2°C + (– 2°C) = – 4°C

Temperature at 8:00 p.m. = – 4°C + (– 2°C) = – 6°C

Temperature at 9:00 p.m. = – 6°C + (– 2°C) = – 8°C

Therefore, the temperature will be 8°C below zero at 9:00 p.m.

Now, change in temperature in 12 hours = – 2°C × 12 = – 24°C

At midnight, the temperature will be 10°C + (– 24)°C = – 14°C

Therefore, the temperature at midnight will be 14°C below zero.

Example 23 : An elevator descends into a mine shaft at the rate of 6 m/min. If the descent starts from above the ground level, how long will it take to reach – 350 m?

Solution : Distance descended is denoted by a negative integer.

Initial height = + 10 m

Final depth = – 350 m

Total distance to be descended by the elevator = (– 350) – (+ 10) = – 360 m

Time taken by the elevator to descend – 6 m is 1 min.

Time taken by the elevator to descend – 360 m is (– 360) ÷ (– 6)

= 60 minutes = 1 hour

Thus, the elevator will take 1 hour to reach – 350 m.

EXERCISE 1.4

Use **Cordova Smart Class Software** on the **smart board** in class to do Exercise.

1. The product of two integers is 270. One of the integers is (– 18). Find the other integer.
2. Find an integer which when multiplied by 4 and then divided by 9 becomes (– 28).
3. If the quotient obtained on dividing an integer by – 9 is – 8, find the integer.
4. A shopkeeper earns a profit of ₹ 1 on selling one pen and suffers a loss of 30 paise on selling one pe... In a particular month, he incurs a loss of ₹ 5. In that month, he sold 40 pens. How many pencils di... sell in that period?
5. An elevator descends into a mine shaft at the rate of 6 metres per minute. If the descent starts f... 20 m above the ground level, how long will it take to reach – 340 m?
6. By what number should – 324 be divided to obtain – 18?
7. A cement company earns a profit of ₹8 per bag of white cement sold and a loss of ₹5 per bag of g... cement sold.
   (i) The company sells 3000 bags of white cement and 5000 bags of grey cement in a month. Wha... its profit or loss?
   (ii) What is the number of white cement bags it must sell to have neither profit nor loss, if the num... of grey cement bags sold is 6400?

FACTS TO REMEMBER

- The numbers ... –5, –4, –3, –2, –1, 0, 1, 2, 3, 4, 5, ... are integers.
- 0 is an integer which is neither positive nor negative.
- '0' is less than every positive integer and greater than every negative integer.
- The absolute value of an integer is its numerical value regardless of its sign.
- To add two integers of like signs, we add their absolute values and put the common sign with the sum...
- To add a positive and a negative integer, we find the difference between their absolute values and put the sign of the integer with the greater absolute value to it.
- To subtract one integer from the other integer, add its additive inverse to the other.
- – *a* and *a* are additive inverse or negatives of each other.
- The product of two integers with like signs is equal to the product of their absolute values with positive sign...
- The product of two integers with unlike signs is equal to the product of their absolute values with negative sign...
- The quotient of two negative or two positive integers is always positive.
- The quotient of one positive and one negative integer is always negative.

H...

1. If Δ is an operation such that f...
   $a \Delta b = a \times b - 2 \times a \times b + b \times$ ...
2. A railway engine starts shunti... It reverses and travels 1250 m ... it comes to rest. How far is th...

Exercise 1.1

1. (i) – 56 (ii) – 455 (iii) 173
2. (i) – 88 (ii) – 7 (iii) 135
3. – 246 4. 368 5. – 122
9. (i) 8 (ii) 56 10. (i) 5...

Exercise 1.2

1. (i) – 72 (ii) 70 (iii) – 300 (iv) 0
2. (i) 3276 (ii) 896400 (iii) 23140
4. (i) – 23 (ii) 47 (iii) 0
5. (i) 5700 (ii) – 3100 (iii) 19400
7. (i) 3 (ii) 34 (iii) – 85 (iv) – 3...

HOTS QUESTIONS

1. If Δ is an operation such that for integers a and b, we have
   $a \Delta b = a \times b - 2 \times a \times b + b \times b (-a) \times b + b \times b$ then find $(-7) \Delta (-1)$.
2. A railway engine starts shunting wagons by first going 1000 m north of railway station.
   It reverses and travels 1250 m south and then it again moves 600 m north. Finally moving 800 m south, it comes to rest. How far is the engine from the station and in which direction?

ANSWERS

Exercise 1.1

1. (*i*) – 56 (*ii*) – 455 (*iii*) 173
2. (*i*) – 88 (*ii*) – 7 (*iii*) 135

3. – 246 4. 368 5. – 122 6. 321 7. 15

9. (*i*) 8 (*ii*) 56 10. (*i*) 50 (*ii*) – 49

Exercise 1.2

1. (*i*) – 72 (*ii*) 70 (*iii*) – 300 (*iv*) 0 (*v*) 12300 (*vi*) 720
2. (*i*) 3276 (*ii*) 896400 (*iii*) 23140

4. (*i*) – 23 (*ii*) 47 (*iii*) 0
5. (*i*) 5700 (*ii*) – 3100 (*iii*) 19400 (*iv*) 48960

7. (*i*) 3 (*ii*) 34 (*iii*) – 85 (*iv*) – 33

Exercise 1.3

1. (*i*) – 5 (*ii*) – 27 (*iii*) 25 (*iv*) – 144 (*v*) 81 (*vi*) 7
2. (*i*) 1 (*ii*) – 8 (*iii*) 9 (*iv*) 6

4. (8, – 2), (–8, 2), (12, – 3), (– 12, 3)
5. $\frac{3}{5}, \frac{1}{3}, -\frac{4}{7}$

Exercise 1.4

1. – 15 2. – 63 3. 72 4. 150

5. 1 hour 6. 18

7. (*i*) loss of ₹ 1000 (*ii*) 4000

HOTS

1. – 13 2. 450 m south

MATHS LAB ACTIVITY

Objective : *To prove multiplication of integers is commutative.*

Activity : Complete the following table :

S. No.	Statement–1	Statement–2	Inference
1.	$2 \times (-4) = -8$	$(-4) \times 2 = -8$	$2 \times (-4) = (-4) \times 2$
2.	$6 \times (-5) =$	$(-5) \times 6 =$	
3.	$(-7) \times 6 =$	$6 \times (-7) =$	
4.	$(-9) \times (-8) =$	$(-8) \times (-9) =$	
5.	$(-6) \times (-9) =$	$(-9) \times (-6) =$	
6.	$11 \times 7 =$	$7 \times 11 =$	
7.	$(-13) \times 0 =$	$0 \times (-13) =$	
8.	$(-8) \times 1 =$	$1 \times (-8) =$	

(*i*) What do you observe from the above table?

....

....

....

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(*ii*) Is $a \times (-b) = (-b) \times a$?

Give examples to support your answer.

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NC

Example 1 : In an objective every correct ar Mention the wa

Solution : Marks that stu

∴ Minimum

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Case I : By g

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Case II : By

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Hence, to

Example 2 : Water lev in differ previous 80 cm. F he can

NCERT Exemplar Problems

ample 1 : In an objective type test containing 25 questions, a student is to be awarded +5 marks for every correct answer, –5 for every incorrect answer and zero for not writing any answer. Mention the ways of scoring 110 marks by a student.

lution : Marks that student has got = 110

∴ Minimum correct responses must be $= \frac{110}{5} = 22$

There are two cases in which student can score 110.

Case I : By giving 22 correct responses.

Each response gives him 5 marks.

Hence, total marks = 22 × 5 = 110

No incorrect answer will give = – 5 × 0 = 0 marks

Unattempted three questions will give 3 × 0 = 0 marks

∴ Total marks = 110 + 0 + 0 = 110

Case II : By giving 23 correct responses.

Each response gives him 5 marks.

Hence, total marks = 23 × 5 = 115

Each incorrect response will give – 5 marks.

Hence, the marks obtained by 1 wrong answer = – 5 × 1 = – 5

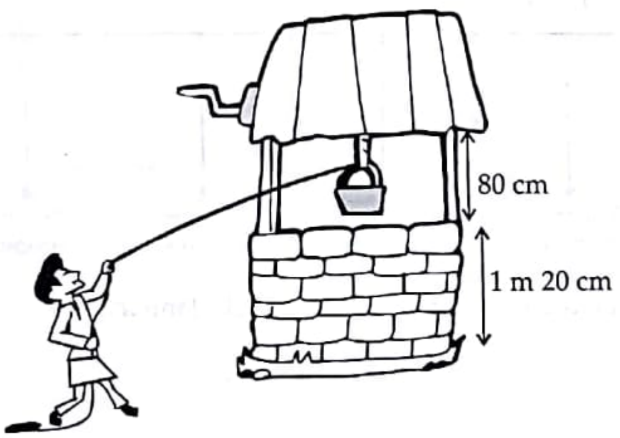
Unattempted question will give 0 marks

Hence, total marks = 115 + (– 5) + 0

= 115 – 5

= 110

Example 2 : Water level in a well was 20 m below ground level. During rainy season, rain water collected in different water tanks was drained into the well and the water level rises 5 m above the previous level. The wall of the well is 1 m 20 cm high and a pulley is fixed at a height of 80 cm. Raghu wants to draw water from the well. Find the minimum length of the rope that he can use.



Solution : We have,

[∵ It is below ground]

Initial water level in the well = – 20 m

Due to rain harvesting its level increases by 5 m.

New water level = – 20 m + 5 m = – 15 m

Wall of the well is 1 m 20 cm = 120 cm high and pulley is fixed at a height of 80 cm

Therefore, total height above ground level = Height of wall + Pulley

= 120 cm + 80 cm

= 200 cm = 2 m

Now, the minimum length of the rope that he can use to draw water from the well

= New water level + Height of wall + Height of pulley

= – (– 15 m) + 2 m = 17 m.

Example 3 : You have ₹ 500 in your savings account at the beginning of the month. The record shows all of your transactions during the month. How much money is in your account after these transactions?

Cheque no. Description	Date	Transaction	Payment	Deposit
384102	4/9	Jal Board	₹ 120	
275146	12/9	Deposit		₹ 200
384103	22/9	LIC India	₹ 240	
801351	29/9	Deposit		₹ 150

Solution : Cash deposited = ₹ 200 + ₹ 150 = ₹ 350

Hence, the total amount = previous balance + deposited amount

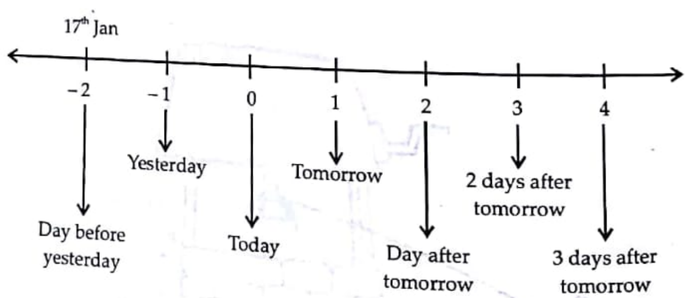
= ₹ 500 + ₹ 350 = ₹ 850

Payment done = ₹ 120 + ₹ 240 = ₹ 360

Net balance remaining after payment = ₹ 850 – ₹ 360 = ₹ 490

Example 4 : Taking today as zero on the number line, if the day before yesterday is 17 January, what is the date 3 days after tomorrow?

Solution :



Hence, the date 3 days after tomorrow is 23rd January.

2

Use Cor

FRACTIONS

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numerator and *b* is cal

Types of Fractions

(*i*) Proper fractior

called a prope

(*ii*) Improper frac

the fraction is

(*iii*) Like fraction

(*iv*) Unlike fracti

Example : $\frac{1}{2}$

(*v*) Unit fractior

Examples :

(*vi*) Mixed fracti

fraction. *Ex*

(*vii*) Decimal fra

Examples :

(*viii*) Equivalent

numerator

Examples :

2 Fractions

Use **Cordova Smart Class Software** on the **smart board** in class to learn about fractions.

FRACTIONS

The number of the form $\frac{a}{b}$, where $b \neq 0$ and a, b are whole numbers is called a **fraction**. Here, a is called the **numerator** and b is called the **denominator**.

Types of Fractions

(i) Proper fraction : If the numerator of a fraction is smaller than the denominator, then the fraction is called a **proper fraction**. *Examples :* $\frac{1}{3}, \frac{4}{5}, \frac{3}{7}$

(ii) Improper fraction : If the numerator of a fraction is greater than or equal to the denominator, then the fraction is called an **improper fraction**. *Examples :* $\frac{5}{3}, \frac{7}{2}, \frac{6}{5}$

(iii) Like fractions : Fractions with same denominator are called **like fractions**. *Example :* $\frac{2}{7}, \frac{3}{7}, \frac{5}{7}, \frac{6}{7}$

(iv) Unlike fractions : Fractions with different denominators are called **unlike fractions.**

Example : $\frac{1}{2}, \frac{5}{7}, \frac{4}{9}$

(v) Unit fractions : A fraction whose numerator is '1' is called a **unit fraction**.

Examples : $\frac{1}{3}, \frac{1}{5}, \frac{1}{7}, \frac{1}{9}$

(vi) Mixed fractions : A fraction having whole number along with proper fraction is known as a **mixed fraction**. *Examples :* $1\frac{2}{3}, 1\frac{4}{5}, 2\frac{2}{3}$

(vii) Decimal fractions : Fractions having denominators as 10, 100, 1000, are called **decimal fractions**.

Examples : $\frac{7}{10}, \frac{3}{100}, \frac{41}{1000}$

(viii) Equivalent fractions : A given fraction and the fraction obtained by multiplying (or dividing) its numerator and denominator by the same non-zero number are called **equivalent fractions**.

Examples : $\frac{2}{3}, \frac{4}{6}, \frac{6}{9}, \frac{8}{12}$ are equivalent fractions.

(*ix*) **Vulgar fractions :** A fraction whose denominator is a whole number other than 10, 100, 1000 is ca... a vulgar fraction. *Examples :* $\frac{7}{8}, \frac{3}{17}, \frac{19}{20}, \frac{23}{39}$

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

(*i*) $1\frac{4}{5}$ (*ii*) $3\frac{2}{7}$

Solution : (*i*) $1\frac{4}{5} = \frac{(1\times5)+4}{5} = \frac{5+4}{5} = \frac{9}{5}$

(*ii*) $3\frac{2}{7} = \frac{(3\times7)+2}{7} = \frac{21+2}{7} = \frac{23}{7}$

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

(*i*) $\frac{49}{5}$ (*ii*) $\frac{68}{9}$

Solution : (*i*) On dividing 49 by 5, we get 9 as the quotient and 4 as the remainder.

$\therefore \quad \frac{49}{5} = 9\frac{4}{5}$

$5)\overline{49}(9$, -45, 4

(*ii*) On dividing 68 by 9, we get 7 as the quotient and 5 as the remainder.

$\therefore \quad \frac{68}{9} = 7\frac{5}{9}$

$9)\overline{68}(7$, -63, 5

COMPARISON OF FRACTIONS

Rule 1 : *When the fractions have same denominator, the fraction with greater numerator is greater.*

Examples : $\frac{9}{11} > \frac{7}{11}, \frac{3}{8} > \frac{1}{8}, \frac{5}{7} > \frac{3}{7}$

Rule 2 : *When the fractions have same numerator, the fraction with greater denominator is smaller.*

Examples : $\frac{3}{7} < \frac{3}{5}, \frac{7}{11} < \frac{7}{9}, \frac{5}{14} < \frac{5}{12}$

Rule 3 : *When the fractions have different denominators and numerators, we multiply (or divide) the fractions and same non-zero number to make the denominators same and then apply Rule 1.*

Example 3 : Which is greater : $\frac{3}{5}$ or $\frac{7}{8}$?

Solution : L.C.M. of denominators 5 and 8 is 40.

$\therefore \quad \frac{3}{5} = \frac{3\times8}{5\times8} = \frac{24}{40}; \frac{7}{8} = \frac{7\times5}{8\times5} = \frac{35}{40}$

Now, $\frac{35}{40} > \frac{24}{40}$

Hence, $\frac{7}{8} > \frac{3}{5}$

Alternative Method : (Cross Multiplication Method)

$\frac{3}{5} \times \frac{7}{8}$

$3\times8 \quad 7\times5$

$24 \quad 35$

Since, $35 > 24$

therefore, $\frac{7}{8} > \frac{3}{5}$

Note : *In general, if $\frac{a}{b}$ and $\frac{c}{d}$ are two fractions, then*

(*i*) $\frac{a}{b} > \frac{c}{d} \Leftrightarrow ad > bc.$ (*ii*) $\frac{a}{b} = \frac{c}{d} \Leftrightarrow ad = bc.$ (*iii*) $\frac{a}{b} < \frac{c}{d} \Leftrightarrow ad < bc.$

Example 4 : Arrange the following fractions in ascending order :

$\frac{1}{3}, \frac{2}{5}, \frac{5}{6}, \frac{1}{15}$

Solution : L.C.M. of 3, 5, 6 and 15 = 3 × 5 × 2 = 30

3	3, 5, 6, 15
5	1, 5, 2, 5
	1, 1, 2, 1

Let us convert each of the given fractions into an equivalent fraction having 30 as its denominator.

$\frac{1}{3} = \frac{1\times10}{3\times10} = \frac{10}{30}; \frac{2}{5} = \frac{2\times6}{5\times6} = \frac{12}{30}$

$\frac{5}{6} = \frac{5\times5}{6\times5} = \frac{25}{30}; \frac{1}{15} = \frac{1\times2}{15\times2} = \frac{2}{30}$

Since the denominators are same, the fraction having the greater numerator is greater.

The fractions in ascending order are $\frac{2}{30}, \frac{10}{30}, \frac{12}{30}, \frac{25}{30}$ or, $\frac{1}{15}, \frac{1}{3}, \frac{2}{5}, \frac{5}{6}$

LOWEST TERMS OF A FRACTION

A fraction $\frac{a}{b}$ is said to be in lowest terms (irreducible) if H.C.F. of *a* and *b* is 1.

Any fraction may be reduced to lowest terms by dividing the numerator and denominator by their H.C.F.

Example 5 : Reduce the following fractions to their lowest terms :

(*i*) $\frac{78}{338}$ (*ii*) $\frac{105}{270}$

Solution : (*i*) H.C.F. of 78 and 338 is 26.

$78)\overline{338}(4$, -312, $26)\overline{78}(3$, -78, 0

$\therefore \quad \frac{78}{338} = \frac{78\div26}{338\div26} = \frac{3}{13}$

Hence, $\frac{78}{338}$ in its lowest terms is $\frac{3}{13}$.

(ii) H.C.F. of 105 and 270 is 15.

$\therefore \frac{105}{270} = \frac{105 \div 15}{270 \div 15} = \frac{7}{18}$

Hence, $\frac{105}{270}$ in its lowest terms is $\frac{7}{18}$.

EXERCISE 2.1

Use Cordova Smart Class Software on the smart board in class to do Exercise.

1. Write each of the following fractions into lowest terms :
   (i) $\frac{18}{48}$ (ii) $\frac{120}{168}$ (iii) $\frac{45}{180}$ (iv) $\frac{81}{108}$
2. Convert each of the following into a mixed fraction :
   (i) $\frac{16}{3}$ (ii) $\frac{32}{7}$ (iii) $\frac{243}{13}$ (iv) $\frac{441}{17}$
3. Arrange in descending order :
   (i) $\frac{5}{27}, \frac{4}{9}, \frac{7}{24}, \frac{5}{12}$ (ii) $\frac{3}{8}, \frac{5}{14}, \frac{3}{4}, \frac{5}{7}$
4. Arrange in ascending order :
   (i) $\frac{3}{4}, \frac{7}{12}, \frac{5}{6}, \frac{11}{12}$ (ii) $\frac{4}{5}, \frac{9}{14}, \frac{16}{35}, \frac{6}{10}$
5. Convert each of the following into an improper fraction :
   (i) $2\frac{3}{4}$ (ii) $3\frac{3}{10}$ (iii) $6\frac{2}{3}$ (iv) $2\frac{5}{6}$ (v) $6\frac{2}{3}$
6. Which of the following pairs of fractions are equivalent?
   (i) $\frac{9}{15}$ and $\frac{3}{5}$ (ii) $\frac{7}{21}$ and $\frac{3}{9}$ (iii) $\frac{6}{13}$ and $\frac{30}{52}$

ADDITION AND SUBTRACTION OF FRACTIONS

Rule 1 : *In order to add (or subtract) like fractions, we add (or subtract) their numerators and retain the common denominator.*

Example 6 : Simplify :

(i) $\frac{8}{15}+\frac{7}{15}$ (ii) $\frac{7}{8}-\frac{3}{8}$

Solution : (i) $\frac{8}{15}+\frac{7}{15} = \frac{8+7}{15} = \frac{15}{15} = 1$

(ii) $\frac{7}{8}-\frac{3}{8} = \frac{7-3}{8} = \frac{4}{8} = \frac{1}{2}$

Rule 2 : *Fractions with different denominators can be added (or subtracted) by changing the given fractions to equivalent fractions having same denominator.*

Example 7 : Simplify :

(i) $\frac{2}{9}+\frac{2}{3}$ (ii) $\frac{2}{3}+\frac{1}{8}$ (iii) $\frac{2}{3}-\frac{1}{4}$ (iv) $\frac{3}{4}-\frac{1}{10}$

Solution : (i) $\frac{2}{9}+\frac{2}{3} = \frac{2}{9}+\left(\frac{2\times3}{3\times3}\right) = \frac{2}{9}+\frac{6}{9} = \frac{2+6}{9} = \frac{8}{9}$

(ii) $\frac{2}{3}+\frac{1}{8} = \left(\frac{2\times8}{3\times8}\right)+\left(\frac{1\times3}{8\times3}\right) = \frac{16}{24}+\frac{3}{24} = \frac{16+3}{24} = \frac{19}{24}$

(iii) $\frac{2}{3}-\frac{1}{4} = \left(\frac{2\times4}{3\times4}\right)-\left(\frac{1\times3}{4\times3}\right) = \frac{8}{12}-\frac{3}{12} = \frac{8-3}{12} = \frac{5}{12}$

(iv) $\frac{3}{4}-\frac{1}{10} = \left(\frac{3\times5}{4\times5}\right)-\left(\frac{1\times2}{10\times2}\right) = \frac{15}{20}-\frac{2}{20} = \frac{15-2}{20} = \frac{13}{20}$

The addition and subtraction of fractions with different denominators can also be performed as follows :

(i) $\frac{7}{20}+\frac{13}{35}$

L.C.M. of denominators 20 and 35 is 140.

$\frac{7}{20}+\frac{13}{35} = \frac{7\times7+13\times4}{140} = \frac{49+52}{140} = \frac{101}{140}$ $\begin{bmatrix}140 \div 20 = 7 \text{ and } 7\times7 = 49\\ 140 \div 35 = 4 \text{ and } 13\times4 = 52\end{bmatrix}$

(ii) $\frac{8}{9}-\frac{7}{12}$

L.C.M. of denominators 9 and 12 is 36.

$\frac{8}{9}-\frac{7}{12} = \frac{8\times4-7\times3}{36} = \frac{32-21}{36} = \frac{11}{36}$ $\begin{bmatrix}36 \div 9 = 4 \text{ and } 8\times4 = 32\\ 36 \div 12 = 3 \text{ and } 7\times3 = 21\end{bmatrix}$

EXERCISE 2.2

Use Cordova Smart Class Software on the smart board in class to do Exercise.

1. Add :
   (i) $\frac{5}{9}+\frac{7}{9}$ (ii) $\frac{3}{5}+\frac{7}{4}$ (iii) $\frac{3}{4}+1$ (iv) $\frac{4}{7}+\frac{11}{14}$
2. Find the difference :
   (i) $\frac{5}{7}-\frac{3}{7}$ (ii) $\frac{11}{16}-\frac{7}{12}$ (iii) $\frac{7}{9}-\frac{2}{3}$ (iv) $\frac{15}{19}-\frac{12}{57}$
3. Find the sum :
   (i) $3\frac{1}{9}+1\frac{5}{6}$ (ii) $3\frac{1}{3}+5\frac{2}{7}$ (iii) $12\frac{3}{5}+1\frac{3}{5}$ (iv) $10\frac{1}{9}+6\frac{5}{12}$

4. Simplify :

(i) $3-\frac{7}{6}+\frac{11}{12}$ (ii) $4\frac{6}{7}-2\frac{2}{3}-\frac{20}{21}$ (iii) $5\frac{1}{6}-3\frac{1}{4}+2\frac{1}{3}$ (iv) $10\frac{3}{5}+2\frac{5}{6}-\ldots$

5. What should be added to $\frac{11}{48}$ to get $\frac{13}{16}$?

6. Which is greater : $\frac{2}{3}$ or $\frac{7}{9}$? By how much?

7. What should be added to $3\frac{1}{2}$ to get $8\frac{1}{4}$?

8. A rectangular field is $15\frac{2}{3}$ m long and $12\frac{4}{5}$ m wide. Find its perimeter.

9. The sum of two numbers is 7. If one of the numbers is $\frac{11}{7}$, find the other.

10. A piece of wire is of length $8\frac{1}{4}$ m. It is cut into two pieces. The length of one piece is $4\frac{3}{5}$ m. What is the length of the other piece?

11. The sides of a triangle are $\frac{7}{2}$ cm, $\frac{11}{4}$ cm and $\frac{16}{5}$ cm. Find its perimeter.

MULTIPLICATION OF FRACTIONS

To multiply two fractions, we multiply their numerators to get the numerator of the product and multiply their denominators to get the denominator of the product.

Thus, if $\frac{a}{b}$ and $\frac{c}{d}$ are two fractions, then $\frac{a}{b}\times\frac{c}{d}=\frac{a\times c}{b\times d}$.

i.e., Product of two fractions = $\frac{\text{Product of their numerators}}{\text{Product of their denominators}}$

Example 8 : Multiply and reduce the answer into lowest form :

(i) $5\times\frac{4}{9}$ (ii) $3\frac{1}{6}\times15$ (iii) $16\times\frac{3}{4}$ (iv) $7\times6\frac{1}{3}$

Solution : (i) $5\times\frac{4}{9}=\frac{5}{1}\times\frac{4}{9}=\frac{5\times4}{1\times9}=\frac{20}{9}=2\frac{2}{9}$

(ii) $3\frac{1}{6}\times15=\frac{19}{\cancel{6}_2}\times\cancel{15}^5=\frac{95}{2}=47\frac{1}{2}$

(iii) $16\times\frac{3}{4}=\frac{16}{1}\times\frac{3}{4}=\frac{16\times3}{1\times4}=\frac{48}{4}=12$

(iv) $7\times6\frac{1}{3}=7\times\frac{19}{3}=\frac{133}{3}=44\frac{1}{3}$

Example 9 : Simplify :

(i) $\frac{27}{4}\times\frac{8}{15}\times\frac{10}{3}$ (ii) $3\frac{3}{4}\times3\frac{4}{7}\times1\frac{2}{5}$

Solution : (i) $\frac{27}{4}\times\frac{8}{15}\times\frac{10}{3}=\frac{\cancel{27}^{\cancel{9}^3}\times\cancel{8}^2\times\cancel{10}^2}{_1\cancel{4}\times\cancel{15}_{\cancel{3}_1}\times\cancel{3}_1}=3\times2\times2=12$

(ii) $3\frac{3}{4}\times3\frac{4}{7}\times1\frac{2}{5}=\frac{15}{4}\times\frac{25}{7}\times\frac{7}{5}=\frac{15\times\cancel{25}^5\times\cancel{7}^1}{4\times\cancel{7}_1\times\cancel{5}_1}=\frac{15\times5}{4}=\frac{75}{4}=18\frac{3}{4}$

Fraction as an Operator 'of'

Observe the adjacent figures. [Fig. (*i*)]
These are two exactly similar squares.

Fig. (*i*)

Each shaded portion represents $\frac{1}{2}$ of a square *i.e.,* $\frac{1}{2}$ of 1.

Both the shaded portions together will represent $\frac{1}{2}$ of 2.

Fig. (*ii*)

If we combine the two shaded $\frac{1}{2}$ parts, it represents 1. [Fig. (*ii*)]

i.e., $\frac{1}{2}$ of 2 is 1

$\Rightarrow$ $\frac{1}{2}$ of 2 = 1

Also, $\frac{1}{2}\times2=1$

We see that 'of' represents multiplication.
Here are some examples using an operator 'of'

(i) $\frac{1}{2}$ of $4=\frac{1}{2}\times4=2$ (ii) $\frac{1}{2}$ of $5=\frac{1}{2}\times5=\frac{5}{2}$

Puzzle

My father owns a small rose garden. My sister Rita has a share of 3/5 of it and my sister Gita has twice as much as myself. What fraction of the rose garden belongs to me?

Example 10 : Find :

(i) $\frac{2}{3}$ of 81 (ii) $\frac{5}{7}$ of 98

Solution : (i) $\frac{2}{3}$ of $81=\frac{2}{3}$ of $\frac{81}{1}=\frac{2}{3}\times\frac{81}{1}=\frac{2}{_1\cancel{3}}\times\frac{\cancel{81}^{27}}{1}=2\times27=54$

(ii) $\frac{5}{7}$ of $98=\frac{5}{7}$ of $\frac{98}{1}$

$=\frac{5}{7}\times\frac{98}{1}=\frac{5\times\cancel{98}^{14}}{_1\cancel{7}\times1}=5\times14=70$

Example 11 : Find :

(i) $\frac{1}{4}$ of a rupee (ii) $\frac{3}{4}$ of a day (iii) $\frac{7}{25}$ of a kg

Solution : (i) We know that, 1 rupee = 100 paise

$$\frac{1}{4} \text{ of a rupee} = \frac{1}{4} \text{ of } 100 \text{ paise}$$

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

(ii) We know that, 1 day = 24 hours

$$\frac{3}{4} \text{ of a day} = \frac{3}{4} \text{ of } 24 \text{ hours}$$

$$= \left(\frac{3}{4} \times 24\right) \text{ hours} = \left(\frac{3 \times \cancel{24}^{6}}{{}_{1}\cancel{4}}\right) \text{ hours} = 18 \text{ hours}$$

(iii) We know that, 1 kg = 1000 grams

$$\frac{7}{25} \text{ of a kg} = \frac{7}{25} \text{ of } 1000 \text{ grams}$$

$$= \left(\frac{7}{25} \times 1000\right) \text{ grams}$$

$$= \left(\frac{7 \times \cancel{1000}^{40}}{{}_{1}\cancel{25}}\right) \text{ grams} = 280 \text{ grams}$$

Example 12 : Which is greater : $\frac{3}{4}$ of 36 or $\frac{4}{5}$ of 35?

Solution :

$$\frac{3}{4} \text{ of } 36 = \frac{3}{4} \times 36 = \frac{3 \times \cancel{36}^{9}}{{}_{1}\cancel{4}} = 27$$

$$\frac{4}{5} \text{ of } 35 = \frac{4}{5} \times 35 = \frac{4 \times \cancel{35}^{7}}{{}_{1}\cancel{5}} = 28$$

Clearly, $28 > 27$

Hence, $\frac{4}{5}$ of $35 > \frac{3}{4}$ of 36.

Value of the Products

We know that the product of two whole numbers is greater than each of the two whole numbers.

Examples: (i) $2 \times 3 = 6$, $6 > 2$ and $6 > 3$.

(ii) $3 \times 4 = 12$, $12 > 3$ and $12 > 4$.

Case I : *When two proper fractions are multiplied, the value of their product is less than each of the two fractions.*

Examples : (i) $\frac{1}{4} \times \frac{3}{5} = \frac{3}{20}$, $\frac{3}{20} < \frac{1}{4}$ and $\frac{3}{20} < \frac{3}{5}$ (ii) $\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$, $\frac{8}{15} < \frac{2}{3}$ and $\frac{8}{15} < \frac{4}{5}$

Case II : *When two improper fractions are multiplied, the value of their product is greater than each of the two fractions.*

Examples : (i) $\frac{3}{2} \times \frac{5}{4} = \frac{15}{8}$; $\frac{15}{8} > \frac{3}{2}$ and $\frac{15}{8} > \frac{5}{4}$ (ii) $\frac{5}{3} \times \frac{7}{2} = \frac{35}{6}$; $\frac{35}{6} > \frac{5}{3}$ and $\frac{35}{6} > \frac{7}{2}$

Case III : *When a proper fraction is multiplied by an improper fraction, the product obtained is less than the improper fraction but greater than the proper fraction.*

Examples : (i) $\frac{2}{3} \times \frac{7}{5} = \frac{14}{15}$; $\frac{14}{15} < \frac{7}{5}$ and $\frac{14}{15} > \frac{2}{3}$ (ii) $\frac{9}{2} \times \frac{3}{4} = \frac{27}{8}$; $\frac{27}{8} < \frac{9}{2}$ and $\frac{27}{8} > \frac{3}{4}$

Word Problems

Example 13 : Vishakha reads a book for $1\frac{4}{5}$ hours everyday. She reads the entire book in 10 days. How many hours in all does she take to read the book?

Solution : In one day, she reads for $1\frac{4}{5}$ hours $= \frac{9}{5}$ hours

In 10 days, she reads for $\frac{9}{{}_{1}\cancel{5}} \times \cancel{10}^{2}$ hours = 18 hours

Thus, she takes 18 hours to read the book.

Example 14 : Shikha's age is $\frac{2}{5}$ of the age of her eldest brother. If her brother's age is 35 years, then how old is Shikha?

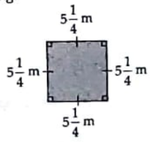
Solution : Shikha's age $= \frac{2}{5}$ of the age of her brother (given)

$= \frac{2}{5}$ of 35 years (Her brother's age = 35 years)

$= \left(\frac{2}{{}_{1}\cancel{5}} \times \cancel{35}^{7}\right)$ years = 14 years

Thus, Shikha is 14 years old.

Example 15 : Find the perimeter and area of a square field whose side is $5\frac{1}{4}$ m long.



Solution : Side of the square $= 5\frac{1}{4}$ m $= \frac{21}{4}$ m

Perimeter of the square = 4 × side

$= {}^{1}\cancel{4} \times \frac{21}{\cancel{4}_{1}}$ m = 21 m

Area of the square = side × side

$= \left(\frac{21}{4} \times \frac{21}{4}\right)$ sq. m $= \frac{441}{16}$ sq. m $= 27\frac{9}{16}$ sq. m

Hence, the perimeter of the square is 21 m and area is $27\frac{9}{16}$ sq. m.

Example 16 : Vinay covers $7\frac{1}{2}$ km in one hour. How much distance will he cover in $2\frac{4}{5}$ hours?

Solution : $7\frac{1}{2}$ km = $\frac{15}{2}$ km; $2\frac{4}{5}$ hours = $\frac{14}{5}$ hours

Distance covered in one hour = $\frac{15}{2}$ km

$\therefore$ Distance covered in $\frac{14}{5}$ hours = $\frac{\cancel{15}^{3}}{{}_{1}\cancel{2}} \times \frac{\cancel{14}^{7}}{{}_{1}\cancel{5}}$ km = 21 km

Hence, Vinay will cover 21 km in $2\frac{4}{5}$ hours.

EXERCISE 2.3

Use **Cordova Smart Class Software** on the **smart board** in class to do Exercise.

1. Multiply and reduce to lowest form :
   (i) $9 \times \frac{2}{5}$ (ii) $5 \times \frac{3}{7}$ (iii) $13 \times \frac{1}{4}$ (iv) $\frac{5}{3} \times$ [illegible]
2. Multiply and express as a mixed fraction :
   (i) $6 \times 2\frac{1}{9}$ (ii) $5\frac{1}{4} \times 6$ (iii) $2\frac{3}{5} \times 6$
3. Find :
   (i) $\frac{1}{2}$ of $3\frac{2}{9}$ (ii) $\frac{1}{3}$ of $\frac{15}{7}$ (iii) $\frac{1}{3}$ of $3\frac{2}{9}$
4. Multiply and reduce to lowest form (if possible) :
   (i) $\frac{3}{5} \times 2\frac{2}{5}$ (ii) $\frac{3}{5} \times \frac{5}{6}$ (iii) $\frac{1}{4} \times \frac{32}{3}$ (iv) $7\frac{3}{4} \times \frac{8}{5}$
5. Which is greater?
   (i) $\frac{2}{3}$ of $\frac{1}{5}$ or $\frac{3}{5}$ of $\frac{5}{6}$ (ii) $\frac{4}{5}$ of $\frac{5}{6}$ or $\frac{2}{3}$ of $\frac{4}{5}$
6. Find :
   (i) $\frac{3}{4}$ of a year (ii) $\frac{2}{5}$ of a rupee (iii) $\frac{1}{4}$ of an hour (iv) $\frac{11}{25}$ of a li[illegible]
7. Priyanka has 24 apples. $\frac{3}{4}$ of these are found to be rotten. Find the number of rotten apples.
8. A rectangular park is $21\frac{3}{7}$ m long and $12\frac{3}{5}$ m wide. What is the area of the park?
9. Apples are sold at ₹ $15\frac{3}{4}$ per kg. Find the cost of $6\frac{1}{2}$ kg of apples.
10. Rohit covers $2\frac{2}{5}$ km in one hour. How much distance will he cover in $3\frac{1}{3}$ hours?

11. There are 48 students in a class and $\frac{2}{3}$ of them are boys. How many girls are there in the class?
12. A car runs 18 km in 1 litre of petrol. How much distance will it cover in $3\frac{1}{3}$ litres of petrol?
13. Varad reads $\frac{1}{4}$ part of a book in one hour. How much part of the book will he read in $3\frac{1}{2}$ hours?
14. A book contains 320 pages. Vishal reads $\frac{3}{5}$ of the book. How many pages are left to be read?
15. A tin contains 21 kg of sugar. If $\frac{2}{3}$ of it has been consumed, how much sugar is left in the tin?

MULTIPLICATIVE INVERSE (RECIPROCAL) OF A FRACTION

If we multiply 3 by $\frac{1}{3}$ *i.e.,* $3 \times \frac{1}{3}$, we get 1.

Similarly, $\frac{2}{3}$ has to be multiplied by $\frac{3}{2}$ to get 1.

Thus, $\frac{1}{3}$ is the reciprocal of 3 and 3 is the reciprocal of $\frac{1}{3}$.

Similarly, $\frac{2}{3}$ is the reciprocal of $\frac{3}{2}$ and $\frac{3}{2}$ is the reciprocal of $\frac{2}{3}$.

Thus, if the product of two fractions is 1, then each fraction is the **reciprocal or multiplicative inverse** of the other.

Clearly, the reciprocal of a non-zero fraction $\frac{a}{b}$ is the fraction $\frac{b}{a}$.

Example 17 : Find the reciprocal of :

(i) $\frac{2}{9}$ (ii) $\frac{3}{8}$ (iii) $\frac{4}{3}$

Solution : (i) The reciprocal of $\frac{2}{9}$ is $\frac{1}{\frac{2}{9}} = \frac{9}{2}$.

(ii) The reciprocal of $\frac{3}{8}$ is $\frac{1}{\frac{3}{8}} = \frac{8}{3}$.

(iii) The reciprocal of $\frac{4}{3}$ is $\frac{1}{\frac{4}{3}} = \frac{3}{4}$.

DIVISION OF FRACTIONS

We know that, division is the inverse of multiplication.

If we divide 6 by 3, then we get $6 \div 3 = 6 \times \frac{1}{3} = 2$

Similarly, $\frac{4}{5} \div \frac{2}{3} = \frac{4}{5} \times \left(\frac{1}{2/3}\right) = \frac{\cancel{4}^{2}}{5} \times \frac{3}{\cancel{2}_{1}} = \frac{6}{5}$ (quotient)

Thus, we observe that if we divide a fraction by another fraction, the quotient is the product of first fraction and reciprocal of second fraction.

Thus, $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$

Example 18 : Divide :

(i) $\frac{7}{9}$ by $\frac{2}{3}$ (ii) 35 by $\frac{7}{5}$ (iii) 49 by $2\frac{3}{7}$ (iv) $\frac{13}{5}$ by 11

Solution : (i) $\frac{7}{9} \div \frac{2}{3} = \frac{7}{9} \times \frac{3}{2}$ (Reciprocal of $\frac{2}{3}$ is $\frac{3}{2}$)

$= \frac{7}{\cancel{9}_3} \times \frac{\cancel{3}^1}{2} = \frac{7}{6} = 1\frac{1}{6}$

(ii) $35 \div \frac{7}{5} = \frac{35}{1} \div \frac{7}{5} = \frac{35}{1} \times \frac{5}{7}$ (Reciprocal of $\frac{7}{5}$ is $\frac{5}{7}$)

$= \frac{\cancel{35}^5}{1} \times \frac{5}{\cancel{7}_1} = 25$

(iii) $49 \div 2\frac{3}{7} = \frac{49}{1} \div \frac{17}{7}$

$= \frac{49}{1} \times \frac{7}{17}$ (Reciprocal of $\frac{17}{7}$ is $\frac{7}{17}$)

$= \frac{343}{17} = 20\frac{3}{17}$

(iv) $\frac{13}{5} \div 11 = \frac{13}{5} \times \frac{1}{11} = \frac{13}{55}$ (Reciprocal of 11 is $\frac{1}{11}$)

Example 19 : Simplify :

(i) $48 \div \frac{8}{9}$ (ii) $45 \div 2\frac{3}{5}$ (iii) $\frac{4}{5} \div \frac{2}{3}$

(iv) $\frac{25}{32} \div \frac{5}{8}$ (v) $\frac{5}{9} \div 2\frac{7}{9}$

Solution : (i) $48 \div \frac{8}{9} = \frac{48}{1} \div \frac{8}{9} = \frac{\cancel{48}^6}{1} \times \frac{9}{_1\cancel{8}} = 54$ (Reciprocal of $\frac{8}{9}$ is $\frac{9}{8}$)

(ii) $45 \div 2\frac{3}{5} = \frac{45}{1} \div \frac{13}{5} = \frac{45}{1} \times \frac{5}{13} = \frac{225}{13} = 17\frac{4}{13}$ (Reciprocal of $\frac{13}{5}$ is $\frac{5}{13}$)

(iii) $\frac{4}{5} \div \frac{2}{3} = \frac{4}{5} \times \frac{3}{2} = \frac{\cancel{4}^2}{5} \times \frac{3}{\cancel{2}_1} = \frac{6}{5} = 1\frac{1}{5}$ (Reciprocal of $\frac{2}{3}$ is $\frac{3}{2}$)

(iv) $\frac{25}{32} \div \frac{5}{8} = \frac{25}{32} \times \frac{8}{5} = \frac{\cancel{25}^5}{\cancel{32}_4} \times \frac{\cancel{8}^1}{\cancel{5}_1} = \frac{5}{4} = 1\frac{1}{4}$ (Reciprocal of $\frac{5}{8}$ is $\frac{8}{5}$)

(v) $\frac{5}{9} \div 2\frac{7}{9} = \frac{5}{9} \div \frac{25}{9} = \frac{\cancel{5}^1}{\cancel{9}_1} \times \frac{\cancel{9}^1}{\cancel{25}_5} = \frac{1}{5}$ (Reciprocal of $\frac{25}{9}$ is $\frac{9}{25}$)

Example 20 : Divide :

(i) $2\frac{2}{9} \div \frac{25}{27}$ (ii) $3\frac{1}{3} \div 2\frac{1}{6}$ (iii) $2\frac{2}{9} \div 1\frac{2}{3}$ (iv) $2\frac{2}{3} \div 1\frac{5}{9}$

Solution : (i) $2\frac{2}{9} \div \frac{25}{27} = \frac{20}{9} \div \frac{25}{27} = \frac{\cancel{20}^4}{_1\cancel{9}} \times \frac{\cancel{27}^3}{\cancel{25}_5} = \frac{12}{5} = 2\frac{2}{5}$

(ii) $3\frac{1}{3} \div 2\frac{1}{6} = \frac{10}{3} \div \frac{13}{6} = \frac{10}{_1\cancel{3}} \times \frac{\cancel{6}^2}{13} = \frac{20}{13} = 1\frac{7}{13}$

(iii) $2\frac{2}{9} \div 1\frac{2}{3} = \frac{20}{9} \div \frac{5}{3} = \frac{^4\cancel{20}}{_3\cancel{9}} \times \frac{^1\cancel{3}}{_1\cancel{5}} = \frac{4}{3} = 1\frac{1}{3}$

(iv) $2\frac{2}{3} \div 1\frac{5}{9} = \frac{8}{3} \div \frac{14}{9} = \frac{\cancel{8}^4}{_1\cancel{3}} \times \frac{\cancel{9}^3}{\cancel{14}_7} = \frac{12}{7} = 1\frac{5}{7}$

Example 21 : The product of two numbers is $1\frac{1}{5}$. If one of the numbers is $\frac{4}{5}$, find the other number.

Solution : Let the other number be x.

$\therefore \quad x \times \frac{4}{5} = 1\frac{1}{5}$

$\Rightarrow \quad x \times \frac{4}{5} = \frac{6}{5}$

$\Rightarrow \quad x = \frac{6}{5} \div \frac{4}{5}$

$\Rightarrow \quad x = \frac{^3\cancel{6}}{_1\cancel{5}} \times \frac{\cancel{5}^1}{_2\cancel{4}} = \frac{3}{2} = 1\frac{1}{2}$

Thus, the other number is $1\frac{1}{2}$.

Example 22 : What number should be multiplied with $\frac{25}{32}$ to get the product $\frac{5}{8}$?

Solution : Let the required number be x.

$\therefore \quad x \times \frac{25}{32} = \frac{5}{8}$

$\Rightarrow \quad x = \frac{5}{8} \div \frac{25}{32}$

$\Rightarrow \quad x = \frac{^1\cancel{5}}{_1\cancel{8}} \times \frac{\cancel{32}^4}{\cancel{25}_5}$

$\Rightarrow \quad x = \frac{4}{5}$

Thus, the required number is $\frac{4}{5}$.

Example 23 : If the cost of 17 m of cloth is ₹ $77\frac{5}{7}$, find its cost per metre.

Solution : Cost of 17 m of cloth = ₹ $77\frac{5}{7}$ = ₹ $\frac{544}{7}$

∴ Cost of 1 m of cloth = ₹ $\left(\frac{544}{7} \div 17\right)$

= ₹ $\left(\frac{\cancel{544}^{32}}{7} \times \frac{1}{{}_1\cancel{17}}\right)$

= ₹ $\frac{32}{7}$ = ₹ $4\frac{4}{7}$

Hence, the cost of cloth is ₹ $4\frac{4}{7}$ per metre.

EXERCISE 2.4

Use Cordova Smart Class Software on the smart board in class to do Exercise.

1. Divide :

   (i) $\frac{14}{9}$ by 7 (ii) $\frac{15}{27}$ by 5 (iii) $\frac{18}{25}$ by $\frac{3}{50}$ (iv) 24 by $\frac{8}{3}$

2. Evaluate :

   (i) $3\frac{3}{5} \div 2\frac{2}{5}$ (ii) $1\frac{7}{104} \div \frac{11}{13}$ (iii) $40 \div 6\frac{2}{9}$ (iv) $6\frac{2}{5} \div 8$

3. Write down the reciprocal of each of the following fractions :

   (i) $\frac{1}{13}$ (ii) $12\frac{2}{5}$ (iii) 9 (iv) $\frac{6}{7}$

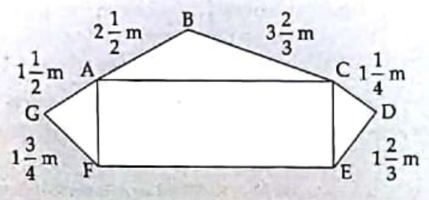
4. The cost of $4\frac{1}{4}$ kg of sugar is ₹68. Find the cost of 1 kg of sugar.
5. The product of a fraction and the sum of $2\frac{3}{4}$ and $3\frac{1}{2}$ is 5. Find the fraction.
6. Find a number such that its two-fifths is 12.
7. The product of two numbers is $\frac{16}{9}$. If one of the numbers is $\frac{5}{2}$, find the other number.
8. A rope of length $3\frac{3}{5}$ m has been divided into six pieces of equal length. What is the length of each piece?
9. If the cost of a notebook is ₹ $6\frac{1}{3}$, how many notebooks can be purchased for ₹ $126\frac{2}{3}$?
10. By what number should $10\frac{2}{3}$ be divided to obtain 20?
11. Find a number such that its two-thirds is equal to $\frac{5}{4}$.

FACTS TO REMEMBER

- The numbers of the form $\frac{a}{b}$, where a and b are whole numbers and $b \neq 0$ are called fractions. Here, a is called the numerator and b is called the denominator of the fraction.
- A fraction whose numerator is less than the denominator is called a proper fraction.
- A fraction whose numerator is more than or equal to the denominator is called an improper fraction.
- A combination of whole number and a proper fraction is called a mixed fraction.
- The reciprocal of a fraction is obtained by interchanging the numerator and denominator of the fraction.
- Sum of like fractions = $\frac{\text{Sum of their numerators}}{\text{Common denominator}}$
- Difference of like fractions = $\frac{\text{Difference of their numerators}}{\text{Common denominator}}$
- For adding or subtracting unlike fractions, convert them into equivalent like fractions and then add or subtract.
- If $\frac{a}{b}$ and $\frac{c}{d}$ are two fractions, then $\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}$.
- To divide a fraction by another fraction, multiply the first fraction by the reciprocal of the second fraction. Thus, $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$.

HOTS QUESTIONS

1. The perimeter of the given figure is 18 m and the area of rectangular part ACEF is $8\frac{1}{2}$ m². Find the length and breadth of the rectangular part.



2. Find the fraction which is as much greater than $\frac{4}{7}$ as it is less than $\frac{5}{6}$.

ANSWERS

Exercise 2.1

1. (i) $\frac{3}{8}$ (ii) $\frac{5}{7}$ (iii) $\frac{1}{4}$ (iv) $\frac{3}{4}$
2. (i) $5\frac{1}{3}$ (ii) $4\frac{4}{7}$ (iii) $16\frac{9}{13}$ (iv) $25\frac{16}{17}$
3. (i) $\frac{4}{9}, \frac{5}{12}, \frac{7}{24}, \frac{5}{27}$ (ii) $\frac{3}{4}, \frac{5}{7}, \frac{3}{8}, \frac{5}{14}$
4. (i) $\frac{7}{12}, \frac{3}{4}, \frac{5}{6}, \frac{11}{12}$ (ii) $\frac{16}{35}, \frac{6}{10}, \frac{9}{14}, \frac{4}{5}$
5. (i) $2\frac{3}{4}$ (ii) $3\frac{3}{10}$ (iii) $6\frac{2}{3}$ (iv) $2\frac{5}{6}$ (v) $6\frac{2}{5}$
6. (i) Yes (ii) Yes (iii) No

Exercise 2.2

1. (i) $1\frac{1}{3}$ (ii) $2\frac{7}{20}$ (iii) $1\frac{3}{4}$ (iv) $1\frac{5}{14}$
2. (i) $\frac{2}{7}$ (ii) $\frac{5}{48}$ (iii) $\frac{1}{9}$ (iv) $\frac{11}{19}$
3. (i) $4\frac{17}{18}$ (ii) $8\frac{13}{21}$ (iii) $14\frac{1}{5}$ (iv) $16\frac{19}{36}$
4. (i) $2\frac{3}{4}$ (ii) $1\frac{5}{21}$ (iii) $4\frac{1}{4}$ (iv) $7\frac{5}{6}$
5. $\frac{7}{12}$ 6. $\frac{7}{9}, \frac{1}{9}$ 7. $4\frac{3}{4}$ 8. $56\frac{14}{15}$ m
9. $5\frac{3}{7}$ 10. $3\frac{13}{20}$ m 11. $9\frac{9}{20}$ cm

Exercise 2.3

1. (i) $3\frac{3}{5}$ (ii) $2\frac{1}{7}$ (iii) $3\frac{1}{4}$ (iv) 45
2. (i) $12\frac{2}{3}$ (ii) $31\frac{1}{2}$ (iii) $15\frac{3}{5}$
3. (i) $1\frac{11}{18}$ (ii) $\frac{5}{7}$ (iii) $1\frac{2}{27}$
4. (i) $1\frac{11}{25}$ (ii) $\frac{1}{2}$ (iii) $2\frac{2}{3}$ (iv) $12\frac{2}{5}$
5. (i) $\frac{3}{5}$ of $\frac{5}{6}$ (ii) $\frac{4}{5}$ of $\frac{5}{6}$
6. (i) 9 months (ii) 40 paise (iii) 15 minutes (iv) 440 g
7. 18 8. 270 sq. m 9. ₹ $102\frac{3}{8}$ 10. 8 km
11. 16 girls 12. 60 km 13. $\frac{7}{8}$ 14. 128 pages
15. 7 kg

Exercise 2.4

1. (i) $\frac{2}{9}$ (ii) $\frac{1}{9}$ (iii) 12 (iv) 9
2. (i) $1\frac{1}{2}$ (ii) $1\frac{23}{88}$ (iii) $6\frac{3}{7}$ (iv) $\frac{4}{5}$
3. (i) 13 (ii) $\frac{5}{62}$ (iii) $\frac{1}{9}$ (iv) $1\frac{1}{6}$
4. ₹ 16 5. $\frac{4}{5}$ 6. 30 7. $\frac{32}{45}$
8. $\frac{3}{5}$ m 9. 20 10. $\frac{8}{15}$ 11. $1\frac{7}{8}$

HOTS

1. $5\frac{2}{3}$m, $1\frac{1}{2}$m 2. $\frac{59}{84}$

3 Decimals

Use Cordova Smart Class Software on the smart board in class to learn about decimals.

DECIMALS

Decimals are fractions whose denominators are 10, 100, 1000, etc.

For example : $\frac{2}{10}, \frac{6}{100}, \frac{7}{1000}$, are all decimal fractions and can be written as 0.2, 0.06 and 0.007 respectively.

The numbers written in decimal form are called **decimal numbers**.

The number of digits contained in the decimal part of a decimal number is known as number of **decimal places**.

Example : 3.456 has 3 decimal places.

Like and Unlike Decimals

Decimal fractions having same number of decimal places are known as **like decimals**.

Examples : 5.17, 19.25, 216.42 are like decimals.

Decimal fractions having different number of decimal places are known as **unlike decimals.**

Examples : 12.5, 13.72, 18.564 are unlike decimals.

Comparison of Decimals

To compare decimal fractions, we follow the given steps :

Step 1 : Convert the given decimals into like decimals.

Step 2 : Compare whole number parts. The decimal number with greater whole number part will be greater.

Step 3 : If the whole number parts are equal, compare the digits at the tenths place. The decimal number with the greater digit at the tenths place will be greater.

Step 4 : If the tenths digits are same, proceed for hundredths digits. The decimal number having greater digit at hundredths place will be greater and so on.

Example 1 : Which is greater : 15.4 or 15.36?

Solution : Converting the given decimals into like decimals, we get 15.40 and 15.36.
As the whole number parts of both decimals are same, so comparing the tenths place, we get, 15.4 > 15.36

Example 2 : Write the following decimals in ascending order :
2.53, 2.0532, 4.505, 4.0503, 4.3502

Solution : Converting the given decimals into like decimals, we get
2.5300, 2.0532, 4.5050, 4.0503, 4.3502.

Clearly,

2.0532 < 2.5300 < 4.0503 < 4.3502 < 4.5050

Hence, the given decimals in ascending order are

2.0532, 2.53, 4.0503, 4.3502, 4.505.

Decimals as Fractions

We convert the given decimal into an equivalent fraction with the denominator 10, 100 or 1000 depending on the number of decimal places after removing the decimal point from the numerator.

Example 3 : Express each of the following as a fraction :

(*i*) 0.05 (*ii*) 0.75 (*iii*) 2.064 (*iv*) 2.75

Solution : (*i*) $0.05 = \frac{5}{100} = \frac{1}{20}$

(*ii*) $0.75 = \frac{75}{100} = \frac{3}{4}$

(*iii*) $2.064 = \frac{2064}{1000} = \frac{258}{125}$

(*iv*) $2.75 = \frac{275}{100} = \frac{11}{4}$

Fractions as Decimals

Step 1 : Convert the given fraction into an equivalent fraction with denominator 10, 100 or 1000.

Step 2 : Put the decimal point before the number in the numerator as many digits as number of zeros in the denominator.

Step 3 : If the number of digits in the numerator are not equal to the number of zeros in the denominator then add zeros to the left of the number to make it equal.

Step 4 : In case of mixed fractions, keep the whole number as the integral part and proceed as in Step 1, 2 and 3.

Example 4 : Express the following fractions as decimals :

(*i*) $\frac{6}{10}$ (*ii*) $\frac{8}{100}$ (*iii*) $7\frac{1}{4}$ (*iv*) $12\frac{1}{8}$

Solution : (*i*) $\frac{6}{10} = 0.6$ (Inserting the decimal point one place to the left)

(*ii*) $\frac{8}{100} = 0.08$ (Inserting the decimal point two places to the left)

(*iii*) $7\frac{1}{4} = 7 + \frac{1}{4} = 7 + \frac{25}{4 \times 25}$

$= 7 + \frac{25}{100} = 7 + 0.25 = 7.25$ (Inserting the decimal point two places to the left)

(*iv*) $12\frac{1}{8} = 12 + \frac{1}{8}$

$= 12 + \frac{1 \times 125}{8 \times 125} = 12 + \frac{125}{1000}$

$= 12 + 0.125 = 12.125$ (Inserting the decimal point three places to the left)

Addition and Subtraction of Decimals

In order to add or subtract decimals, we use the following steps :

Step 1 : Convert the given decimals into like decimals.

Step 2 : Arrange the numbers one under the other in columns such that their decimal points are in the same column.

Step 3 : Add or subtract as we do in case of numbers.

Step 4 : Decimal point is placed in the same place as the numbers above it.

Example 5 : Add the following decimals :

(*i*) 8.6 + 15.123 (*ii*) 0.33 + 33.014 (*iii*) 5.46 + 2.374 + 12.8

Solution : (*i*) Converting the given decimals into like decimals, and adding.

8.6 + 15.123 = 8.600 + 15.123

= 23.723

$$\begin{array}{r} 8.600 \\ +\,15.123 \\ \hline 23.723 \\ \hline \end{array}$$

(*ii*) Converting the given decimals into like decimals, and adding.

0.33 + 33.014 = 0.330 + 33.014

= 33.344

$$\begin{array}{r} 0.330 \\ +\,33.014 \\ \hline 33.344 \\ \hline \end{array}$$

(*iii*) Converting the given decimals into like decimals, and adding.

5.46 + 2.374 + 12.8 = 5.460 + 2.374 + 12.800

= 20.634

$$\begin{array}{r} 5.460 \\ +\,2.374 \\ +\,12.800 \\ \hline 20.634 \\ \hline \end{array}$$

Example 6 : Subtract :

(*i*) 3.72 from 8.47 (*ii*) 16.92 from 24.08

(*iii*) 27.4 from 40.056 (*iv*) 6.354 from 10

Solution :

(*i*) $$\begin{array}{r} 8.47 \\ -\,3.72 \\ \hline 4.75 \\ \hline \end{array}$$

(*ii*) $$\begin{array}{r} 24.08 \\ -\,16.92 \\ \hline 7.16 \\ \hline \end{array}$$

(*iii*) $$\begin{array}{r} 40.056 \\ -\,27.400 \\ \hline 12.656 \\ \hline \end{array}$$

(*iv*) $$\begin{array}{r} 10.000 \\ -\,6.354 \\ \hline 3.646 \\ \hline \end{array}$$

Remember : *Adding zeros after the last digit of the decimal part of any decimal number does not change the value of the decimal.*

EXERCISE 3.1

Use Cordova Smart Class Software on the smart board in class to do Exercise.

1. Convert each of the following decimals into a fraction in lowest form :

(*i*) 0.8 (*ii*) 2.25 (*iii*) 17.5

(*iv*) 0.0375 (*v*) 0.524

2. Write each of the following as a decimal :

(*i*) $\frac{29}{10}$ (*ii*) $15\frac{1}{8}$ (*iii*) $234\frac{1}{25}$ (*iv*) $18 + \frac{3}{10} + \frac{4}{1000}$

3. Add :
   (i) 4.56, 0.8 and 32.5   (ii) 0.05 and 0.004   (iii) 13.225 and 9.25
   (iv) 14.44, 6.234 and 18
4. Subtract :
   (i) 8.752 – 4.9   (ii) 23.8 – 0.25   (iii) 100 – 36.48
   (iv) 8.5 – 2.785
5. Simplify :
   (i) 68.5 – 21.45 + 26.2 – 13.46   (ii) 6.6 + 23.8 – 0.99   (iii) 34.26 – 15.029 + 3.04
   (iv) 6 – 2.5307 + 3.1
6. Arrange the following decimals in ascending order :
   (i) 4.6, 0.22, 24.13, 20.05   (ii) 0.52, 36.28, 2.05, 3.5

MULTIPLICATION OF DECIMALS

Multiplication of a Decimal by 10, 100, 1000

Rules : 1. *On multiplying a decimal by 10, the decimal point is shifted to the right by one place.*
2. *On multiplying a decimal by 100, the decimal point is shifted to the right by two places.*
3. *On multiplying a decimal by 1000, the decimal point is shifted to the right by three places.*

Example 7 : Find the product :
(i) 7.24 × 10   (ii) 7.24 × 100   (iii) 7.24 × 1000
(iv) 25.46 × 10   (v) 127.354 × 10

Solution : (i) 7.24 × 10 = 72.4 (Decimal point shifts one place to the right)
(ii) 7.24 × 100 = 724 (Decimal point shifts two places to the right)
(iii) 7.24 × 1000 = 7.240 × 1000 = 7240 (Decimal point shifts three places to the right)
(iv) 25.46 × 10 = 254.6 (Decimal point shifts one place to the right)
(v) 127.354 × 10 = 1273.54 (Decimal point shifts one place to the right)

Multiplication of a Decimal by a Whole Number

To carry multiplication of a decimal by a whole number, we follow the following steps :

Step 1 : Multiply the given decimal without the decimal point by the given whole number.

Step 2 : Mark the decimal point in the product to have as many places of decimal as there are in the given decimal.

Example 8 : Multiply :
(i) 4.25 × 12   (ii) 0.203 × 16   (iii) 0.67 × 15   (iv) 0.0361 × 18
(v) 0.0008 × 9

Solution :
(i) 425 × 12 = 5100 (First multiplying without decimal point)
4.25 × 12 = 51.00 = 51 (Put the decimal point after two digits)
(ii) 203 × 16 = 3248 (First multiplying without decimal point)
0.203 × 16 = 3.248 (Put the decimal point after three digits)
(iii) 67 × 15 = 1005 (First multiplying without decimal point)
∴ 0.67 × 15 = 10.05 (Put the decimal point after two digits)
(iv) 361 × 18 = 6498 (First multiplying without decimal point)
∴ 0.0361 × 18 = 0.6498 (Put the decimal point after four digits)
(v) 8 × 9 = 72 (First multiplying without decimal point)
∴ 0.0008 × 9 = 0.0072 (Put the decimal point after four digits)

Multiplication of a Decimal by a Decimal

We follow the following steps for multiplying a decimal by a decimal.

Step 1 : Multiply the two decimals without the decimal point.

Step 2 : Mark the decimal point in the product in such a way that the number of decimal places in the product is equal to the sum of the number of decimal places of the given decimals.

Example 9 : Multiply : 62.48 × 5.9

Solution : First, we multiply two decimals without the decimal point.

6248 × 59 = 368632

```
   6248
   × 59
  -----
  56232
+312400
 ------
 368632
```

62.48 (2 decimal places) × 5.9 (1 decimal place) = 368.632 (2 + 1 = 3 decimal places)

Hence, 62.48 × 5.9 = 368.632

Example 10 : Multiply : 0.032 × 0.416

Solution : First we multiply 32 by 416.

We have, 32 × 416 = 13312

```
   416
  × 32
 -----
   832
+12480
 -----
 13312
```

0.032 (3 decimal places) × 0.416 (3 decimal places) = 0.013312 (3 + 3 = 6 decimal places)

Hence, 0.032 × 0.416 = 0.013312

Example 11 : Multiply 0.0243 by 0.0526.

Solution : First, we multiply 243 by 526.

```
    243
  × 526
 ------
   1458
+  4860
+121500
 ------
 127818
```

∴ 243 × 526 = 127818

0.0243 (4 decimal places) × 0.0526 (4 decimal places) = 0.00127818 (4 + 4 = 8 decimal places)

Hence, 0.0243 × 0.0526 = 0.00127818

Example 12 : Find the product : $0.457 \times 26.8 \times 23$

Solution : First, we find the product $457 \times 268 \times 23$

$457 \times 268 \times 23 = 457 \times (268 \times 23) = 457 \times 6164 = 2816948$

$$\begin{array}{r} 268 \\ \times 23 \\ \hline 804 \\ +5360 \\ \hline 6164 \\ \hline \end{array} \qquad \begin{array}{r} 6164 \\ \times 457 \\ \hline 43148 \\ +308200 \\ +2465600 \\ \hline 2816948 \\ \hline \end{array}$$

$$\underbrace{0.457}_{3\text{ decimal places}} \times \underbrace{26.8}_{1\text{ decimal place}} \times 23 = \underbrace{281.6948}_{3+1=4\text{ decimal places}}$$

Hence, $0.457 \times 26.8 \times 23 = 281.6948$

EXERCISE 3.2

Use Cordova Smart Class Software on the smart board in class to do Exercise.

1. Evaluate :
   (i) 2.6×10 (ii) 234.05×10 (iii) 352.4×100
   (iv) 3.57×100 (v) 0.09×1000 (vi) 0.06×1000
2. Evaluate :
   (i) 0.6×6 (ii) 6.23×5 (iii) 25.2×7
   (iv) 351.06×4 (v) 3×0.55
3. Evaluate :
   (i) 6.2×0.2 (ii) 0.4×302.5 (iii) 0.3×0.03
   (iv) 20.05×2.05 (v) 14.3×0.12 (vi) 101.01×0.01
4. Find the area of a square field of side 5.8 cm.
5. If 1 m of cloth costs ₹ 158.50, what is the cost of 4.5 m of cloth?
6. Find the area of a rectangle whose length is 18.60 m and breadth is 7.05 m.
7. Find the product :
   (i) $1.2 \times 1.2 \times 0.012$ (ii) $3.2 \times 1.5 \times 2.5$ (iii) $33.3 \times 3.3 \times 0.33$

DIVISION OF DECIMALS

Division by 10,100 and 1000

Consider $23.5 \div 10 = \frac{235}{10} \times \frac{1}{10} = \frac{235}{100} = 2.35$

Similarly, $23.5 \div 100 = \frac{235}{10} \times \frac{1}{100} = \frac{235}{1000} = 0.235$

Also, $23.5 \div 1000 = \frac{235}{10} \times \frac{1}{1000} = \frac{235}{10000} = 0.0235$

Thus, *while dividing a decimal number by 10, 100 or 1000, the digits of the number and the quotient are same but the decimal point in the quotient shifts to the left by as many places as there are zeros in the denominator.*

Hence, $3.25 \div 10 = 0.325$; $3.25 \div 100 = 0.0325$ and $3.25 \div 1000 = 0.00325$.

Division of a Decimal Number by a Whole Number

In order to divide a decimal number by a whole number, we follow the following steps :

Step 1 : Perform the division by considering the dividend a whole number.

Step 2 : When the division of whole number part of the dividend is complete, put the decimal point in the quotient and proceed with the division.

Step 3 : If the last remainder is non-zero, insert as many zeros on the right of decimal part of the dividend as needed to make the last remainder zero.

The following examples will illustrate the procedure.

Example 13 : Divide : (i) 62.64 by 12 (ii) 0.672 by 14

Solution :

(i)
$$\begin{array}{r} 5.22 \\ 12\overline{)62.64} \\ -60 \\ \hline 26 \\ -24 \\ \hline 24 \\ -24 \\ \hline 0 \end{array}$$

$\therefore 62.64 \div 12 = 5.22$

(ii)
$$\begin{array}{r} 0.048 \\ 14\overline{)0.672} \\ -0 \\ \hline 67 \\ -56 \\ \hline 112 \\ -112 \\ \hline 0 \end{array}$$

$\therefore 0.672 \div 14 = 0.048$

Example 14 : Divide : (i) 9.27 by 15 (ii) 113.44 by 8

Solution :

(i)
$$\begin{array}{r} 0.618 \\ 15\overline{)9.270} \\ -0 \\ \hline 92 \\ -90 \\ \hline 27 \\ -15 \\ \hline 120 \\ -120 \\ \hline 0 \end{array}$$

$\therefore 9.27 \div 15 = 0.618$

(ii)
$$\begin{array}{r} 14.18 \\ 8\overline{)113.44} \\ -8 \\ \hline 33 \\ -32 \\ \hline 14 \\ -8 \\ \hline 64 \\ -64 \\ \hline 0 \end{array}$$

$\therefore 113.44 \div 8 = 14.18$

Example 15 : Divide : (i) 0.5306 by 5 (ii) 0.7682 by 16

Solution :

(i)
$$\begin{array}{r} 0.10612 \\ 5\overline{)0.53060} \\ -0 \\ \hline 5 \\ -5 \\ \hline 30 \\ -30 \\ \hline 6 \\ -5 \\ \hline 10 \\ -10 \\ \hline 0 \end{array}$$

$\therefore 0.5306 \div 5 = 0.10612$

(ii)
$$\begin{array}{r} 0.0480125 \\ 16\overline{)0.7682000} \\ -0 \\ \hline 76 \\ -64 \\ \hline 128 \\ -128 \\ \hline 20 \\ -16 \\ \hline 40 \\ -32 \\ \hline 80 \\ -80 \\ \hline 0 \end{array}$$

$\therefore 0.7682 \div 16 = 0.0480125$

Division of a Decimal Number by a Decimal Number

The steps followed for division are as follows :

Step 1 : Multiply the divisor and dividend by 10, 100 or 1000 etc. so that the divisor becomes a whole number.

Step 2 : Then use the same steps for division of a decimal number by a whole number.

Let us take some examples to understand it further.

Example 16 : Divide :

(*i*) 30.94 by 0.7 (*ii*) 76.5 by 0.15 (*iii*) 2.73 by 1.3 (*iv*) 37.8 by 1.4

Solution : (*i*) $\frac{30.94}{0.7} = \frac{30.94 \times 10}{0.7 \times 10} = \frac{309.4}{7}$

$$\begin{array}{r} 44.2 \\ 7\overline{)309.4} \\ -28 \\ \hline 29 \\ -28 \\ \hline 14 \\ -14 \\ \hline 0 \end{array}$$

$\therefore$ 30.94 ÷ 0.7 = **44.2**

(*ii*) $\frac{76.5}{0.15} = \frac{76.5 \times 100}{0.15 \times 100} = \frac{7650}{15}$

$$\begin{array}{r} 510 \\ 15\overline{)7650} \\ -75 \\ \hline 15 \\ -15 \\ \hline 0 \end{array}$$

$\therefore$ 76.5 ÷ 0.15 = 510

(*iii*) $\frac{2.73}{1.3} = \frac{2.73 \times 10}{1.3 \times 10} = \frac{27.3}{13}$

$$\begin{array}{r} 2.1 \\ 13\overline{)27.3} \\ -26 \\ \hline 13 \\ -13 \\ \hline 0 \end{array}$$

$\therefore$ 2.73 ÷ 1.3 = 2.1

(*iv*) $\frac{37.8}{1.4} = \frac{37.8 \times 10}{1.4 \times 10} = \frac{378}{14}$

$$\begin{array}{r} 27 \\ 14\overline{)378} \\ -28 \\ \hline 98 \\ -98 \\ \hline 0 \end{array}$$

$\therefore$ 37.8 ÷ 1.4 = 27

Example 17 : Divide : (*i*) 1.001 by 14 (*ii*) 0.768 by 16

Solution : (*i*)

$$\begin{array}{r} 0.0715 \\ 14\overline{)1.0010} \\ -0 \\ \hline 100 \\ -98 \\ \hline 21 \\ -14 \\ \hline 70 \\ -70 \\ \hline 0 \end{array}$$

$\therefore$ 1.001 ÷ 14 = 0.0715

(*ii*)

$$\begin{array}{r} 0.048 \\ 16\overline{)0.768} \\ -0 \\ \hline 76 \\ -64 \\ \hline 128 \\ -128 \\ \hline 0 \end{array}$$

$\therefore$ 0.768 ÷ 16 = 0.048

Example 18 : Divide 26.313 by 1.75.

Solution : $26.313 \div 1.75 = \frac{26.313}{1.75} = \frac{26.313 \times 100}{1.75 \times 100} = \frac{2631.3}{175}$

$$\begin{array}{r} 15.036 \\ 175\overline{)2631.30} \\ -175 \\ \hline 881 \\ -875 \\ \hline 630 \\ -525 \\ \hline 1050 \\ -1050 \\ \hline 0 \end{array}$$

Hence, 26.313 ÷ 1.75 = 15.036

Example 19 : Divide 3.411 by 37.5.

Solution : $3.411 \div 37.5 = \frac{3.411}{37.5} = \frac{3.411 \times 10}{37.5 \times 10} = \frac{34.11}{375}$

$$\begin{array}{r} 0.09096 \\ 375\overline{)34.11000} \\ -0 \\ \hline 3411 \\ -3375 \\ \hline 3600 \\ -3375 \\ \hline 2250 \\ -2250 \\ \hline 0 \end{array}$$

Hence, 3.411 ÷ 37.5 = 0.09096

Example 20 : The area of a rectangle of breadth 2.6 m is 19.50 sq. m. Find the length of the rectangle.

Solution : Area of rectangle = 19.50 sq. m

Breadth of rectangle = 2.6 m

Length of rectangle = $\frac{\text{Area}}{\text{Breadth}}$

$= \frac{19.50}{2.6} \text{ m} = \frac{19.50 \times 10}{2.6 \times 10} \text{ m} = \frac{195}{26} \text{ m} = 7.5 \text{ m}$

$$\begin{array}{r} 7.5 \\ 26\overline{)195.0} \\ -182 \\ \hline 130 \\ -130 \\ \hline 0 \end{array}$$

Hence, length of the rectangle is 7.5 m.

Example 21 : The product of two decimals is 3.392. If one of them is 1.6, find the other.

Solution : Product of two decimals = 3.392

One decimal number = 1.6

Other decimal number = $\frac{\text{Product of two decimals}}{\text{One decimal number}}$

$= \frac{3.392}{1.6}$

$= \frac{3.392 \times 10}{1.6 \times 10}$

$= \frac{33.92}{16} = 2.12$

$$\begin{array}{r} 2.12 \\ 16\overline{)33.92} \\ -32 \\ \hline 19 \\ -16 \\ \hline 32 \\ -32 \\ \hline 0 \end{array}$$

Hence, the other decimal number is 2.12.

EXERCISE 3.3

Use Cordova Smart Class Software on the smart board in class to do Exercise.

1. Divide :
   (i) 2.5 by 10 (ii) 2.5 by 100 (iii) 2.5 by 1000
   (iv) 3.69 by 10 (v) 3.79 by 100 (vi) 233.7 by 100
2. Divide :
   (i) 25.5 by 0.5 (ii) 20.4 by 6 (iii) 27 by 0.03
   (iv) 89.1 by 3.3 (v) 2.73 by 1.3 (vi) 0.5 by 0.05
3. Divide :
   (i) 12.98 by 4 (ii) 36 by 0.4 (iii) 30.94 by 7
   (iv) 7.75 by 25 (v) 24.66 by 12 (vi) 6.2 by 248
4. Find :
   (i) $12 \div 8$ (ii) $24 \div 25$ (iii) $135 \div 2$
   (iv) $796 \div 3184$ (v) $6 \div 125$ (vi) $17 \div 40$
5. The cost of 15 notebooks is ₹ 142.50. Find the cost of one such notebook.
6. The total weight of certain bags of rice is 650.16 kg. If each bag weighs 10.32 kg, find the number of bags.
7. The product of two decimals is 32.396. If one of the decimals is 5.2, find the other.

FACTS TO REMEMBER

- The fractions whose denominators are 10, 100, 1000 are known as decimal fractions.
- A decimal has two parts–the whole-number part (integral part) and the decimal part.
- Decimals having the same number of decimal places are called like decimals, otherwise they are called unlike decimals.
- By annexing zeros after the last digit of the decimal part of any decimal number does not alter the value of the decimal number *e.g.*, 0.1 = 0.10 = 0.100, 0.2 = 0.20 = 0.200.
- Unlike decimals can be converted into like decimals by annexing requisite number of zeros at the end of the decimal part.
- While multiplying two decimal numbers, first multiply them as whole numbers. Put the decimal point in the product in such a way that the number of decimal places in the product is equal to the sum of the decimal places in the given decimals.
- To multiply a decimal number by 10, 100 or 1000, shift the decimal point to the right by one, two or three places respectively.
- To divide a decimal number by a whole number, we first divide them as whole numbers. Then, we place the decimal point in the quotient as in the decimal number.
- To divide a decimal number by 10, 100 or 1000, shift the decimal point to the left by one, two or three places respectively.
- While dividing a decimal by a decimal, convert the divisor into a whole number by multiplying the dividend and the divisor by 10, 100 or 1000 etc. and then divide the new dividend by the whole number obtained.

HOTS QUESTIONS

If $x = 2.24$, then what is the value of $\frac{3x}{2x - 0.48}$?

ANSWERS

Exercise 3.1

1. (i) $\frac{4}{5}$ (ii) $\frac{9}{4}$ (iii) $\frac{35}{2}$ (iv) $\frac{3}{80}$ (v) $\frac{131}{250}$
2. (i) 2.9 (ii) 15.125 (iii) 234.04 (iv) 18.304
3. (i) 37.86 (ii) 0.054 (iii) 22.475 (iv) 38.674
4. (i) 3.852 (ii) 23.55 (iii) 63.52 (iv) 5.715
5. (i) 59.79 (ii) 29.41 (iii) 22.271 (iv) 6.5693
6. (i) 0.22, 4.6, 20.05, 24.13 (ii) 0.52, 2.05, 3.5, 36.28

Exercise 3.2

1. (i) 26 (ii) 2340.5 (iii) 35240 (iv) 357 (v) 90 (vi) 60
2. (i) 3.6 (ii) 31.15 (iii) 176.4 (iv) 1404.24 (v) 1.65
3. (i) 1.24 (ii) 121 (iii) 0.009 (iv) 41.1025 (v) 1.716 (vi) 1.0101
4. 33.64 sq. cm 5. ₹ 713.25 6. 131.13 m^2
7. (i) 0.01728 (ii) 12 (iii) 36.2637

Exercise 3.3

1. (i) 0.25 (ii) 0.025 (iii) 0.0025 (iv) 0.369 (v) 0.0379 (vi) 2.337
2. (i) 51 (ii) 3.4 (iii) 900 (iv) 27 (v) 2.1 (vi) 10
3. (i) 3.245 (ii) 90 (iii) 4.42 (iv) 0.31 (v) 2.055 (vi) 0.025
4. (i) 1.5 (ii) 0.96 (iii) 67.5 (iv) 0.25 (v) 0.048 (vi) 0.425
5. ₹ 9.50 6. 63 7. 6.23

HOTS : 1.68