1 Integers

Learning Outcomes

After studying this chapter, you will be able to:

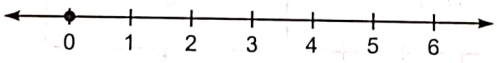
- understand multiplication and division of integers.
- evolve rules and strategies to multiply two integers by using patterns and generalising the rules to multiply a positive integer by a negative integer, a negative integer by a positive integer and two negative integers.
  - Understand methods and algorithms to divide two integers by using patterns.
  - Learn properties of integers (including identities for addition and multiplication—commutative, associative and distributive.)
- solve problems based on real life situations involving integers.

Warm-up

Revise quickly what you have learnt in Class 6.

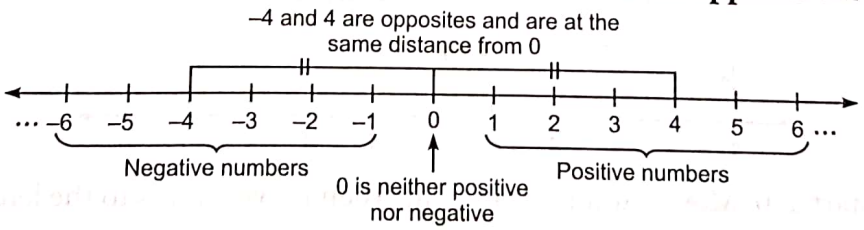
- **Opposites.** Examples of opposites in real life situations are up and down; hot and cold, winning and losing. When an aeroplane is ascending, we say it is changing altitude in a positive direction and when it is descending, it is changing altitude in a negative direction.

  When **graphing** whole numbers on a number line, you use '*to the right*' as the **positive direction** and '*to the left*' as the **negative direction.**



  You use *positive numbers* for distances in the positive direction and *negative numbers* for distances in the negative direction.

  On a number line, **opposites are the same distance from 0—but in opposite direction.**



- **Absolute Value.** The distance 4 units on either side is called the **absolute value** and is indicated by the symbol | |. Thus, we have absolute value of 4 = | 4 | and of –4 = | –4 |. Both |4| and | –4 | are equal to 4. Absolute value of a number is always positive. It can never be negative.

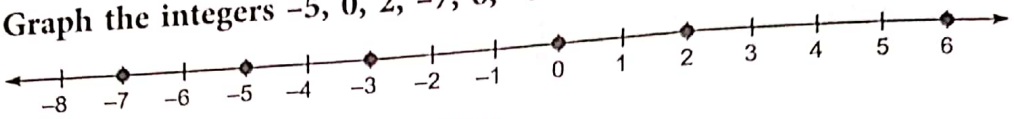
  Integers. *The integers are the set of whole numbers and their opposites.*

  By using integers, you can express elevations above, below and at sea level. Sea level has 0 elevation.

GRAPHING INTEGERS ON A NUMBER LINE

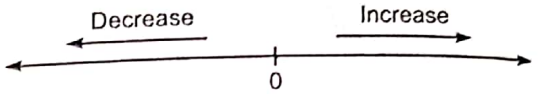
Example 1 Graph the integers –5, 0, 2, –7, 6, –3.

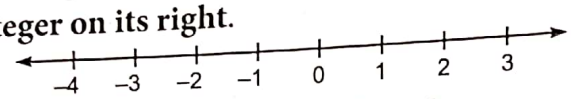
Solution



COMPARING AND ORDERING INTEGERS

You can compare and order the integers by imaging their position on the number line. Integers increase in value as you move to the right along a number line. They decrease in value as you move to the left. Thus, **an integer is greater than another integer on its left or we may say that an integer is less than another integer on its right.**





2 is to the right of – 1 so 2 > –1.

– 3 is to the left of 0 so –3 < 0.

> **Note !**
> The greatest negative integer is –1. The least positive integer is 1. Zero is neither positive nor negative

Example 2 **Compare the integers using '>' and '<'.**

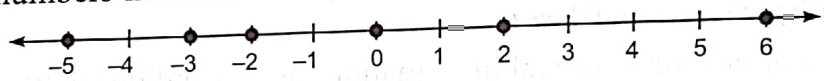
(a) –7, 10 **(b) 29, – 63** **(c) –8, –15**

Solution

(a) –7 < 10 (b) 29 > –63 (c) –8 > –15

Example 3 **Order the integers –3, 6, –5, 2, –2 and 0 from the least to the greatest.**

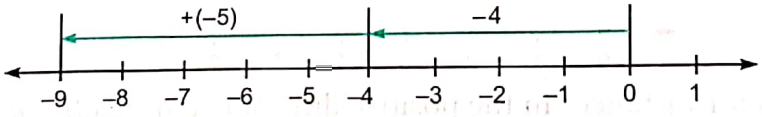
Solution The numbers in order from the least to the greatest are –5, –3, –2, 0, 2, 6.



ADDING INTEGERS

Method 1. *Using the number line*

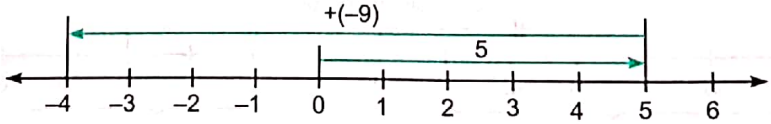
– 4 + (–5)



Start at 0. Move 4 units to the left. Then move 5 more units to the left.

So, – 4 + (–5) = – 9.

5 + (–9)



Start at 0. Move 5 units to the right. Then move 9 units to the left.

So, 5 + (–9) = –4.

Method 2. *Using absolute values*

If the signs are same,	If the signs are different,
find the sum of their absolute values. Use the same sign as that of the two integers.	find the difference of their absolute values. Use the sign of the integer with the greater absolute value.

ILLUSTRATIONS

(a) $5 + 7 = 12$ (b) $(-5) + (-7) = -12$ (c) $-5 + 7 = 2$

Think. The difference of 7 and 5 is 2. Sign of the greater absolute value ($7 > 5$) '+'. So use '+' sign.

(d) $5 + (-9) = -4$

Think. The difference of 9 and 5 is 4. Sign of the greater absolute value ($9 > 5$) is '–'. So use '–' sign.

SUBTRACTING INTEGERS

Addition and subtraction are inverse operations, they undo each other. So instead of subtracting a number, you can add its opposite.

Method.

1. *Change the subtraction sign to an addition sign.*
2. *Change the sign of the second number.*

Opposite of b is $-b$. $a - b = a + (-b)$	Opposite of $-b$ is b. $a - (-b) = a + b$
$3 - 5 = 3 + (-5)$	$3 - (-5) = 3 + 5$
$= -2$	$= 8$
$7 - 4 = 7 + (-4)$	$-4 - (-9) = -4 + 9$
$= 3$	$= 5$
Subtracting a positive integer is the same as adding a negative integer.	Subracting a negative integer is the same as adding a positive integer.

Additive Inverse. *A number and its opposite are called additive inverses of each other.* The sum of a number and its additive inverse is always zero.

Example 4 **Write a pair of integers whose**

(a) sum is a negative integer.
(b) sum is zero.
(c) difference gives a negative integer.
(d) difference is zero.
(e) difference gives an integer smaller than both the integers.
(f) difference gives an integer greater than both the integers.

Solution (a) $5 + (-9) = -4$ (b) $6 + (-6) = 0$ (c) $8 - 12 = -4$
(d) $7 - 7 = 0$ (e) $-5 - 7 = -12$ (f) $8 - (-7) = 15$

Self Practice 1A

1. Write each number as an integer in the following situations.

(a) Profit of ₹ 17,000 in the first year and a loss of ₹ 5,000 in the second year.
(b) Withdrawal of ₹ 800 from the bank
(c) 5 degrees above zero degree
(d) 2000 m above sea level
(e) 500 m below sea level
(f) Increase in weight by 5 kg
(g) Decrease in weight by 2 kg

2. **Graph each integer and its opposite on a number line.**
   (a) 7 (b) −5 (c) −1 (d) 4 (e) − 8
3. **Compare the integers. Use > or <.**
   (a) −10 ☐ −15 (b) − 29 ☐ −19 (c) − 20 ☐ 20
   (d) 7 ☐ −7 (e) − 8,700 ☐ − 8,000
4. **Use a number line to order the integers from the least to the greatest.**
   (a) −4, 3, −6, −7, 6 (b) −8, −10, −3, 0, −6
5. **Write the absolute value of each.**
   (a) | −27 | (b) | 18 | (c) | −509 | (d) | 306 |
6. **Compare. Write > or <, or = .**
   (a) 35 ☐ | 35 | (b) −19 ☐ | −27 | (c) − | −5 | ☐ | 5 |
   (d) | −200 | ☐ − 300 (e) | −25 | ☐ | 25 | (f) − | − 39 | ☐ − 35
7. **Write the opposite of**
   (a) | 45 | (b) | −50 | (c) − | −25 | (d) − | 18 |
8. The table shows the average temperature in Vostok, Antarctica, from March to October. List the months in order from coldest to warmest.

Month	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.
Temperature < 0° *F*	− 72	− 84	− 86	− 85	− 88	− 90	− 87	− 71

9. **Use number line to find each sum**
   (a) 6 + 2 (b) − 4 + (−3) (c) 8 + (−10) (d) − 4 + 7
10. **Find each sum.**
   (a) −15 + (− 7) (b) 13 + 27 (c) − 44 + 4 (d) 36 + (− 60)
   (e) − 94 + (−6) (f) 39 + (−9) (g) 50 − | −50 |
11. **Find each sum.**
   (a) −18 + 29 + (−11) (b) | −25 | + 9 = | −4 |
12. **Find each difference.**
   (a) 8 − 15 (b) −7 − (−12) (c) 3 − (−7) (d) 8 − (−15)
   (e) −8 − 12 (f) 9 − (−9) (g) 89 − (−11) (h) −129 − (−130)
13. If the deepest point in the sea is 11,600 m below sea level and the highest mountain top is 8,846 m above sea level, then the difference in their elevation is
   (a) 2,754 m (b) 20,446 m (c) 21,406 m (d) 2,952 m
14. The sum of two integers is 50. If one of them is −38, the other is
   (a) 88 (b) 12 (c) −88 (d) − 12
15. If p and q are two integers such that p is the predecessor of q, then $p - q$ is equal to
   (a) 1 (b) 0 (c) 2 (d) −1
16. Which sum is not negative?
   (a) −40 + (−30) (b) − 70 + 65 (c) − 63 + 82 (d) −49 + 0

PROPERTIES OF ADDITION

Just as with whole numbers, addition of integers has the following properties:

1. **Closure Property.** *The sum of two integers is always an integer.*
   For example, 7 + (−10) = −3, which is an integer.
2. **Commutative Property.** *The order of the addends in an addition does not matter.*
   If a and b are two integers, then $\boldsymbol{a + b = b + a}$.
   For example, − 8 + 10 = 10 + (− 8) = 2, −7 + (−6) = (−6) + (−7) = − 13

3. **Associative Property.** *The result of an addition is not affected if the order in which operations are performed is changed.*

Thus, to add –4, –3 and –7, we may work out in either of the following ways,

First group –3 and –7.

$$-4 + [(-3) + (-7)]$$
$$= -4 + (-10)$$
$$= -14$$

First group –4 and –3.

$$[(-4) + (-3)] + (-7)$$
$$= -7 + (-7)$$
$$= -14$$

In general, if a, b and c are any three integers then $\boldsymbol{a + (b + c) = (a + b) + c}$.

4. **Existence of Additive Identity.** *The identity element for addition is 0. Thus, for any integer a, we have* $\boldsymbol{a + 0 = 0 + a = a}$.

For example, $-89 + 0 = -89$, $75 + 0 = 75$

5. **Existence of Additive Inverse.** *For any integers, we have* $\boldsymbol{a + (-a) = (-a) + a = 0}$, *i.e., the sum of any integer and its additive inverse is always zero.*

For example, $-219 + 219 = 0$, $78 + (-78) = 0$

The additive inverse or the opposite of –219 is 219 and that of 78 is –78.

PROPERTIES OF SUBTRACTION

1. **Closure Property.** Unlike with whole numbers, subtraction of integers has the closure property, *i.e., if a and b are any integers, then (a – b) is always an integer.*
2. **Subtraction of integers is not commutative,** *i.e.*, if a and b are integers then $\boldsymbol{a - b \neq b - a}$.

For example, $7 - 11 = 7 + (-11) = -4$ and $11 - 7 = 11 + (-7) = 4$

$\therefore 7 - 11 \neq 11 - 7$.

3. **Subtraction of integers is not associative.**

For example, $(7 - 5) - 8 = 2 - 8 = 2 + (-8) = -6$

$7 - (5 - 8) = 7 - [5 + (-8)] = 7 - (-3) = 7 + (3) = 10$

Thus, $(7 - 5) - 8 \neq 7 - (5 - 8)$.

Self Practice 1B

Fill in the blanks and name the property used.

1. $5 + (-3) = (-3) +$ ___
2. $37 + 0 =$ ___
3. $(-18) + 0 =$ ___
4. $-25 +$ ___ $= 0$
5. $0 +$ ___ $= -68$
6. $27 -$ ___ $= 27$
7. $24 + [(-15 + 2)] = [24 +$ ___ $] + 2$
8. $(59 + 11) + (-30) =$ ___ $+ [11 + (-30)]$
9. $-9 + [17 + (-4)] = (-9 + 17) +$ ___
10. Predecessor of -12 is ___

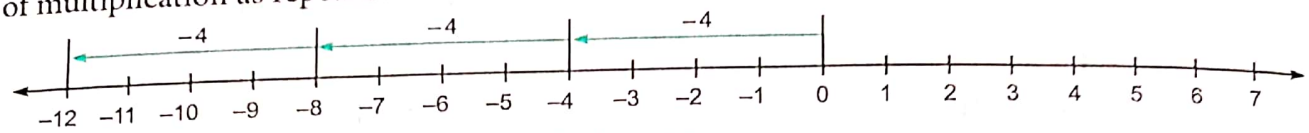
MULTIPLICATION OF INTEGERS

You already know how to multiply positive integers. That is just like multiplying whole numbers. Thus, $7 \times 3 = 21$, $25 \times 18 = 450$. Here we take up cases of multiplication of two integers having different signs and of two negative integers.

Multiplication of Integers Having Different Signs

Let us find the product $3 \times (-4)$.

Think of multiplication as repeated addition. Thus, 3×-4 can be shown on a number line as under:



$3 \times (-4)$ is three 'minus fours' $= -(4) + (-4) + (-4) = -12$

How to find a product such as -4×3?

By commutative property, you can change the order of the factors without changing the product.

$3 \times (-4) = (-4) \times 3$

Since $3 \times (-4) = -12$, therefore, $-4 \times 3 = -12$.

So, you have the following rule.

The product of two integers having opposite signs is negative.

positive × negative = negative

\+ × − = −

Example 5 **Multiply 7 by −8.**

Solution $7 \times (-8) = -(7 \times 8) = -56$

Example 6 **Multiply −15 by 9.**

Solution $-15 \times 9 = -(15 \times 9) = -135.$

Multiplying two Negative Integers

Let us investigate what should be the product of −2 and −6. Consider the following pattern.

These factors are decreasing by 1 →

$3 \times -6 = -18$ ← These products are increasing by 6

$2 \times -6 = -12$ (+6)

$1 \times -6 = -6$ (+6)

$0 \times -6 = 0$ (+6)

$-1 \times -6 = ?$

$-2 \times -6 = ?$

For the pattern to continue, you have the following

$-1 \times -6 = 6$

$-2 \times -6 = 12$

Many other such examples can be taken. They all lead us to the conclusion:

The product of two negative integers is positive.

− × − = +

Negative, Negative, Positive

Example 7 **Multiply −6 by −90.**

Solution $-6 \times -90 = 6 \times 90 = 540.$

Example 8

Solution

Multiply −5, 6 and −7.

You can multiply any two numbers first. It is your choice.

$(-5 \times 6) \times -7$	or	$-5 \times (6 \times -7)$	*Associativity*
$= -30 \times (-7)$		$= -5 \times (-42)$	
$= 210$		$= 210$	

Self Practice 1C

1. **Determine whether the product is positive or negative.**

(a) 2×5	(b) -2×5	(c) 2×-5	(d) -2×-5
(e) -25×-16	(f) -80×14	(g) -803×-17	(h) $38 \times (-11)$

2. **Find each product.**

(a) 8×5	(b) $6 \times (-7)$	(c) -6×9	(d) -9×10
(e) $9 \times (-8)$	(f) $4 \times (-15)$	(g) -23×5	(h) -12×7

3. (a) -7×-8 (b) -9×-10 (c) -15×-4 (d) -19×5
   (e) -12×-12 (f) 23×-30 (g) -16×-12 (h) -50×-50

4. (a) $2 \times 5 \times 6$ (b) $8 \times -6 \times -7$ (c) $-9 \times -5 \times -2$ (d) $-4 \times -6 \times -10$
   (e) $-5 \times 4 \times -9$ (f) $-2 \times 3 \times -4 \times -5$ (g) $-1 \times -2 \times 3 \times -4$ (h) $-1 \times -1 \times -1 \times -1$

DIVIDING INTEGERS

Multiplication and division are inverse operations. You can use this relationship to discover how to divide integers.

If $5 \times 7 = 35$, then $\overbrace{35 \div 7 = 5}^{\text{Both positive}}$

If $5 \times (-7) = -35$, then $\underbrace{-35 \div (-7) = 5}_{\text{Both negative}}$

→ Positive quotients

If two integers have the same sign, their quotient is positive.

Now let us consider the case when signs are different.

If $-5 \times 6 = -30$, then $\overbrace{-30 \div 6 = -5}^{\text{Different signs}}$

If $-5 \times -6 = 30$, then $\underbrace{30 \div (-6)}_{\text{Different signs}} = -5$

→ Negative quotients

If two integers have different signs, their quotient is negative.

Example 9

Solution

Divide −15 by −3.

$\underbrace{-15 \div (-3)}_{\text{Same sign}} = +(15 \div 3) = 5$ *Positive quotient*

Example 10 Divide:

(a) 28 by − 4 (b) −36 by 6

Solution

(a) $28 \div (-4) = -(28 \div 4)$

different signs $= -7$ *(negative quotient)*

(b) $-36 \div 6 = -(36 \div 6) = -6$.

Example 11 Simplify:

(a) $-81 \div 9 + (-16)$ (b) $-84 \div (-7) \times 8$

Solution

(a) $-81 \div 9 + (-16)$ *Perform division.* $-81 \div 9 = -9$

$= -9 + (-16)$ *Sum of two negative integers is negative.*

$= -25$

(b) $-84 \div (-7) \times 8$

$= 12 \times 8$ *Perform division.* $-84 \div (-7) = +(84 \div 7) = 12$

$= 96$

Self Practice 1D

1. **Determine whether each quotient is positive or negative.**
   (a) $18 \div 9$ (b) $-32 \div 4$ (c) $45 \div (-9)$ (d) $-65 \div (-13)$
   (e) $-62 \div 7$ (f) $28 \div (-7)$ (g) $-56 \div (-8)$ (h) $-91 \div (-7)$
2. **Divide and find each quotient.**
   (a) $38 \div 2$ (b) $-6 \div 3$ (c) $-16 \div 8$ (d) $36 \div -4$
   (e) $49 \div (-7)$ (f) $-70 \div 14$ (g) $-100 \div 10$ (h) $80 \div (-16)$
3. **Divide and find each quotient.**
   (a) $-8 \div (-4)$ (b) $-63 \div (-9)$ (c) $128 \div (-16)$ (d) $-52 \div (-13)$
   (e) $-27 \div 3$ (f) $84 \div (-14)$ (g) $-126 \div (-18)$ (h) $-400 \div (-16)$
4. **Evaluate:**
   (a) $10 + (-40) \div 8$ (b) $-7 \times 15 \div (-5)$ (c) $-72 \div (-9) \times 5$ (d) $20 + (7) \times 8 \div (-2)$

PROPERTIES OF MULTIPLICATION AND DIVISION

Properties of Multiplication

1. **Closure Property.** *The product of two integers is always an integer.*
   For example, $3 \times 5 = 15$ which is an integer
   $-3 \times 5 = -15$ which is an integer,
   $-7 \times -6 = 42$ which is an integer.
2. **Commutative Property.** *The order of multiplicands in a multiplication sum does not matter. For any integers* ***a*** *and* ***b****, we have* $(a \times b) = (b \times a)$.
   For example, $7 \times (-9) = -63$ and $(-9) \times 7 = -63$. $\therefore 7 \times (-9) = (-9) \times 7$.
   $-6 \times (-4) = 24$ and $(-4) \times (-6) = 24$. $\therefore -6 \times (-4) = (-4) \times (-6)$.
3. **Associative Property.** *The product remains unchanged if the order in which multiplication of three or more numbers is performed is changed.*

For example, the product of $3 \times 4 \times -5$ will be same whether 3×4 is performed first or 4×-5 is performed first.

$(3 \times 4) \times -5 = 12 \times -5 = -60$, Also, $3 \times (4 \times -5) = 3 \times (-20) = -60$.

$\therefore (3 \times 4) \times -5 = 3 \times (4 \times -5)$.

In general, if a, b, c are any three integers, $(a \times b) \times c = a \times (b \times c)$

4. **Existence of Multiplicative Identity.** *The identity element for multiplication of integers is 1.*

For example, $27 \times 1 = 27$, $(-18) \times 1 = -18$, $1 \times (-27) = -27$

For every integer a, we have $(a \times 1) = (1 \times a) = a$.

5. **Existence of Multiplicative Inverse.** As with whole numbers if $a \neq 0$ is any integer, then $\frac{1}{a}$ is its multiplicative inverse, because $a \times \frac{1}{a} = \frac{1}{a} \times a = 1$.

For example, multiplicative inverse of 8 is $\frac{1}{8}$ and that of -8 is $-\frac{1}{8}$.

6. **Property of Zero.** *Any integer multiplied by 0 gives 0.* Thus, $a \times 0 = 0 \times a = 0$.
7. **Distributive Property.** *The product of a number with the sum of two numbers is the same as the sum of the product of each of the numbers with the multiplier.*

Thus, for any integers a, b, c, we have $a \times (b + c) = a \times b + a \times c$.

For example,

(a) $5 \times [7 + (-8)] = 5 \times 7 + 5 \times (-8)$

$= 35 + (-40) = -5$.

(b) $-7 \times [-4 + (-9)] = (-7) \times (-4) + (-7) \times (-9)$

$= 28 + 63 = 91$.

(c) $16 \times (-7) + 16 \times (-3) = 16[(-7) + (-3)]$

$= 16 \times (-10) = -160$.

Example 12 **Find the value of**

(a) $-817 \times (-59) + (-817) \times 39$ **(b) $3258 \times 99 - (-3258)$**

Solution

(a) $-817 \times (-59) + (-817) \times 39$

$= -817 \times (-59 + 39)$ *Distributive property of multiplication*

$= -817 \times (-20) = 16340$

(b) $3258 \times 99 - (-3258)$

$= 3258 \times 99 + 3258$

$= 3258 \times (99 + 1)$ *Distributive property*

$= 3258 \times 100 = 325800$

Properties of Division

1. The *closure, commutative, associative and distributive* properties **do not hold for division**, *i.e.*, for any integers a, b and c.
   (a) $a \div b$ is not necessarily an integer.
   (b) $a \div b \neq b \div a$ for all integers a and b.
   (c) $(a \div b) \div c \neq a \div (b \div c)$ for all integers a, b and c.
   (d) $a \div (b + c) \neq (a \div b) + (a \div c)$ for all integers a, b and c.

   For example,

   (a) $8 \div 3$ is not an integer. *not closed*

   (b) $-16 \div 4 = -4$ and $4 \div (-16) = -\frac{4}{16} = -\frac{1}{4}$

   So, $-16 \div 4 \neq 4 \div (-16)$ *not commutative*

   (c) $(40 \div 10) \div 2 = 4 \div 2 = 2$ and $40 \div (10 \div 2) = 40 \div 5 = 8$.

   So, $(40 \div 10) \div 2 \neq 40 \div (10 \div 2)$ *not associative*

   (d) $12 \div (-4 + 2) = 12 \div (-2) = -6$,

   $[12 \div (-4)] + (12 \div 2) = -3 + 6 = 3$

   $\therefore\ 12 \div (-4 + 2) \neq [12 \div (-4)] + (12 \div 2)$ *not distributive*

2. When any integer is divided by itself, the quotient is 1, *i.e.*, if a is any integer and $a \neq 0$, then $\boldsymbol{a \div a = 1}$.
3. 0 divided by any integer is 0 but division by 0 is not defined, *i.e.*, $0 \div a = 0$ and $a \div 0$ is meaningless, where $a \neq 0$ is any integer.
4. If any integer a is divided by 1, the quotient is the integer itself, *i.e.*, $\boldsymbol{a \div 1 = a}$.

Self Practice 1E

1. **Verify and name the property used.**
   (a) $18 \times (-15) = (-15) \times 18$
   (b) $15 \times [3 \times (-12)] = (15 \times 3) \times -12$
   (c) $20 \times [75 + (-15)] = 20 \times 75 + 20 \times (-15)$
   (d) $-12 \times [(-7) + 5] = (-12) \times (-7) + (-12) \times 5$
2. **Fill in the blanks.**
   (a) $28 \times$ ____ $= 28$
   (b) $-16 \times$ ____ $= 16$
   (c) $285 \times$ ____ $= 0$
   (d) $0 \div 63 =$ ____
   (e) $-95 \div$ ____ $= -1$
   (f) $-50 \times$ ____ $= 50$
3. **Evaluate by using suitable properties.**
   (a) $37 \times (-58) + (-58) \times (-27)$
   (b) $-45 \times (103)$
   (c) $4 \times 87 \times (-25)$
   (d) $19 \times (-25) \times (-4) \times (-8)$
   (e) $(-16) \times (-39)$
   (f) $(-68) \times (-19) + 68$

PROBLEMS BASED ON REAL LIFE SITUATIONS

Example 13 **A business had losses of ₹20 lakh, ₹25 lakh and ₹30 lakh and profit of ₹15 lakh and ₹28 lakh. How much was its overall profit or loss?**

Solution

Total loss = ₹ (20 lakh + 25 lakh + 30 lakh) = ₹ 75 lakh.

Total profit = ₹ (15 lakh + 28 lakh) = ₹ 43 lakh

Since, total loss > total profit, so, the business has incurred an overall loss.

$\therefore$ Overall loss = ₹ 75 lakh − ₹ 43 lakh = ₹ 32 lakh.

Example 14 **A certain freezing process requires that room temperature is lowered from 40°C at the rate of 5°C every hour. What will be the room temperature 10 hours after the process begins?**

Solution

Given: Room temperature = 40°C

Temperature lowered in 1 hour = −5°C

∴ Temperature lowered in 10 hours = 10 × (−5°C) = −50°C

So, room temperature after 10 hours = 40°C + (−50°C) = −10°C.

Example 15 **In a class test, (+3) marks are given for every correct answer and (−2) marks are given for every incorrect answer and no mark for not attempting any question. Ankita scored 20 marks. If she got 12 correct answers, how many questions did she attempt incorrectly?**

Solution

Given: Marks for every correct answer = +3

Marks for every incorrect answer = −2

Total marks scored by Ankita = 20

Number of correct answers she gave = 12

∴ Marks scored for correct answers = 12 × 3 = 36.

Marks scored for incorrect answers = 20 − 36 = −16.

$$\therefore \text{ Number of incorrect questions } = \frac{\text{Marks scored for incorrect answers}}{\text{Marks for every incorrect answer}} = \frac{-16}{(-2)} = 8.$$

Thus, Ankita attempted 8 questions incorrectly.

Example 16 **An elevator descends into a mine shaft at the rate of 6 m/min. If the descent starts from 10 m above ground level, how long will it take to reach −350 m?**

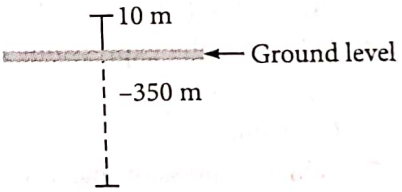
Solution

Starting position of the elevator = 10 m above ground level.

The elevator descends 350 m below the ground level.

∴ Total distance descended by the elevator

= 350 m + 10 m = 360 m



Given, rate of descent = 6 m/min

$$\therefore \text{ Time taken } = \frac{\text{Total distance}}{\text{Rate of descent}} = \frac{360}{6} = 60 \text{ minutes.}$$

Self Practice 1F

1. A submarine submerged at a depth of −15 m, dives 20 m more. What is the new depth of the submarine?
2. The temperature was −3°C in the morning and rose by 10°C by noon. What was the temperature at noon?
3. The day time temperature on Mercury can reach 430°C. The night time temperature can drop to −180°C. How much can the temperature change during one day?
4. The lowest point of the Japanese Trench in the Pacific Ocean is −10,372 m. The lowest point of the Puerto Rico Trench, in the Atlantic Ocean, is 1,172 m higher. What is the depth of the Puerto Rico Trench?

   (a) −9,200 m (b) 8,200 cm (c) −1,172 cm (d) −11,544 cm
5. A submarine at − 250 m dives to a depth of 6 times its initial depth. To what depth does the submarine dive?

   (a) −256 m (b) −244 m (c) −1,500 m (d) −5,000 cm

6. The temperature at 12 noon was 10°C above zero. If it decreases at the rate of 2°C/h until midnight, at what time would the temperature be 8°C below zero. What would be the temperature at midnight?
7. A multistorey building has 25 floors above the ground level, each of height 5 m. It also has 3 floors in the basement, each of height 5 m. A lift in the building moves at the rate of 1 m/s. If a man starts from 50 m above the ground, how long will it take him to reach the 2nd floor of basement?
8. At a target shooting stall in a fair, for every chance a person got he was paid ₹ 15 if he hit the target, and would have to pay ₹ 5 to the stall keeper for every shot he missed. How much money did Manish make if he shot a total of 25 times and missed 5 times.
9. A person earned ₹ 400 per day and out of this he spent ₹ 225 per day. Calculate his savings for the month of June.

Mental Maths

1. $(-5) \times (-4) =$ _____
2. $0 \div 398 =$ _____
3. $298 \div 1 =$ _____
4. $-28 \div 4 =$ _____
5. $-64 \div (-8) =$ _____
6. $2986 \times 0 =$ _____
7. $89 \div 89 =$ _____
8. $(-67) \div 67 =$ _____
9. $(-3) \times 5 \times (-2) =$ _____
10. $35 \div 7 \times 4 =$ _____

Multiple Choice Questions (MCQs)

1. $-20 \div 5$ is not the same as
   (a) $5 \div (-20)$ (b) $-(20 \div 5)$ (c) $20 \div (-5)$ (d) -4
2. Which of the following does not represent an integer?
   (a) $0 \div (-8)$ (b) $15 \div (-3)$ (c) $(-4) \times (-5)$ (d) $8 \div 3$
3. Which of the following is different from others?
   (a) $(-7) \times (-1)$ (b) $-49 \div (-7)$ (c) $27 \div 3 - 2$ (d) $28 \div (-4)$
4. Which of the expressions are equal to -30?
   (I) -5×6 (II) $-60 \div (-2)$ (III) -30×1 (IV) $-8 \times 3 - 6$
   (a) I only (b) I and II (c) I, III and IV (d) I, II, III, IV
5. Which expression has a value greater than the value of $-40 \div (-8)$?
   (a) $30 \div (-5)$ (b) $-80 \div 8$ (c) $-35 \div (-7)$ (d) $-54 \div (-9)$
6. The value of $80 \div 5 \times (-3)$ is
   (a) 65 (b) 95 (c) -48 (d) -19
7. The value $8 \div (-1)$ does not lie between
   (a) 0 and -10 (b) 0 and 10 (c) -1 and -10 (d) -5 and -9
8. $-69 \times (103)$ is not the same as
   (a) $-69 \times (100 + 3)$ (b) $(-69) \times 100 + (-69) \times 3$
   (c) $-69 \times 3 + 100$ (d) $(-60 - 9) \times 103$
9. $-56 \times (-99) + 56$ is equal to
   (a) 5600 (b) -5600 (c) 5544 (d) 5488
10. Which of the following is odd one?
    (a) $80 \div (-5)$ (b) $-48 \div 3$ (c) $112 \div 7$ (d) $(-8) \times 2$

11. Which of the following expressions has a different value?

(a) $(-3) \times 4 \times 5 \times (-8)$ (b) $3 \times (-4) \times (-5) \times 8$

(c) $3 \times (-4) \times 5 \times (-8)$ (d) $(-3) \times (-4) \times 5 \times (-8)$

12. Which of the following is the odd one out?

(a) $0 \div 816$ (b) $16 \div 1$ (c) 635×0 (d) $-36 \div 9 + 4$

Chapter Test

Concept Review

1. Fill in the blanks.

(a) The product of two negative integers has _____ sign.

(b) When zero is divided by any integer, the quotient is _____.

(c) When a negative integer is divided by a positive integer, the quotient has _____ sign.

(d) If a, b, c are any three integers, then $a(b + c)$ = _____.

(e) The identity element of multiplication and division is _____.

2. State true (T) or false (F).

(a) For any integer a, $a \div 0 = 0$. (b) For all integers a and b, $a \div b \neq b \div a$.

(c) When an integer is divided by itself, the quotient is 1. (d) $(-57) \div (-19) = -3$

(e) The product of two integers is −56. If one of the integers is 8, the other integer is 7.

3. Find the value of:

(a) $(-18) \times (-30)$ (b) $(-89) \times (-237) \times 0 \times 18$ (c) $-1728 \div 12$

(d) $-38970 \div (-1)$ (e) $(-1 \times -4 \times -4 \times -10 \times 5) \div 80 \times (-1)$

4. Insert > or < in the box to make a correct statement.

(a) $-49 \div 7 \square -96 \div 12$ (b) $-5 \times 15 \square 1800 \div (-25)$

(c) $27 - 81 \div 3 \square -8 \times 9 \div 3$ (d) $-110 \div (-2) \square -8 \times (-7)$

5. Bunty is playing a game with a regular die. If the number that turns up is even, he will gain four times the number that came up. If it is odd, he will lose 10 times the number that comes up. Bunty tosses the die 10 times in the game. What will be his final score?

He tosses: 6, 3, 1, 5, 4, 2, 6, 3, 2, 4 in the ten throws.

6. Evaluate:

(a) $(-187) \times (-35) + (-187) \times (-65)$ (b) $(-54) \div 9 \times (-7) \times (-1)$

7. $[-36 \div 9] \div (-2)$ is

(a) −2 (b) 2 (c) 4 (d) −4

8. If a and b are two integers, which of the following may not be an integer?

(a) $a + b$ (b) $a - b$ (c) $a \times b$ (d) $a \div b$

9. Which expression has a value smaller than $[-30 \div (-5)] \times (-10)$?

(a) -12×4 (b) $50 \div (-2)$ (c) $(-280) \div 4$

(d) $[(-30) \times (-6)] \div (-9)$

10. A 1-kilogram rock dropped into the ocean would take 37 minutes to reach −6,660 m. If the rock dropped steadily, how far would it fall in 1 minute?

(a) 167 m (b) −167 m (c) −180 m (d) 188 m