

CHAPTER - INTEGERS (PART-II)Multiplication of Integers

Rule ① To find the product of two integers with unlike signs, we find the product of the values regardless of their signs and give a minus sign to the product.

E.g. →

• $6 \times (-5)$	• $35 \times (-18)$
= $-(30)$	= -630
• $(-7) \times 9$	• $(-42) \times 20$
= -63	= -840

Rule ② To find the product of two integers with the same sign, we find the product of their values regardless of their signs and give a plus sign to the product.

E.g. →

• $12 \times 16 = 192$	• $(-8) \times (-14) = (8 \times 14) = 112$
• $(-25) \times (-10)$	• $(-70) \times (-31)$
= (25×10)	= (70×31)
= 250	= 2170

Properties of Multiplication of Integers

① Closure Property for Multiplication
The product of two integers is always an integer.

E.g. → $(-8) \times 7 = -56$, which is an integer.

- ② Commutative Law for Multiplication
for any two integers a and b , we have
 $(a \times b) = (b \times a)$

E.g. \rightarrow $5 \times (-8) = -40$
 $\& (-8) \times 5 = -40$
 $\Rightarrow 5 \times (-8) = (-8) \times 5$

- ③ Associative Law for Multiplication
for any two integers a and b , we have
 $(a \times b) \times c = a \times (b \times c)$

E.g. \rightarrow $\{3 \times (-5)\} \times (-8) = (-15) \times (-8)$
 $= 120$

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

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

- ④ Distributive Law of Multiplication over Addition.

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

E.g. \rightarrow $5 \times \{(-6) + (-8)\} = 5 \times \{-14\}$
 $= -70$

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

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

⑤

EXISTENCE OF MULTIPLICATIVE
IDENTITY: for every integer a , we have
 $(a \times 1) = (1 \times a) = a$
1 is called the multiplicative identity

for integers.

E.g. → • $12 \times 1 = 12$

• $-16 \times 1 = -16$

⑥ Existence of Multiplicative Inverse:
Multiplicative inverse of a nonzero integer a is the number $\left(\frac{1}{a}\right)$ as

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

E.g. → Multiplicative inverse of 6 is $\frac{1}{6}$

Multiplicative inverse of $-\frac{2}{3}$ is $-\frac{3}{2}$

⑦ Property of Zero

for every integer a , we have

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

E.g. → • $0 \times -8 = 0$

• $2 \times 0 = 0$

IMPORTANT RESULTS

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

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

• $(-a) \times (-a) \times (-a) \times \dots \times (-a)$ n times = $-a^n$, when n is odd.

- $(-a) \times (-a) \times (-a) \times \dots$ n times $= a^n$, when n is even.
- $(-1) \times (-1) \times (-1) \times \dots$ n times $= -1$, when n is odd.
- $(-1) \times (-1) \times (-1) \times \dots$ n times $= 1$, when n is even.

EXAMPLES

① Simplify:

(a) $8 \times (-15) + 8 \times 6$
 $\therefore a \times b + a \times c = a(b+c)$
 $\therefore = 8 \{ (-15) + 6 \}$
 $= 8 \{ -9 \}$
 $= -72$

(b) $(-18) \times 7 + (-18) \times (-4)$
 $\therefore a \times b + a \times c = a(b+c)$
 $\therefore = (-18) \{ 7 + (-4) \}$
 $= (-18) \{ 7 - 4 \}$
 $= (-18) \times 3$
 $= -54$

② Evaluate:

(a) $(-1) \times (-2) \times (-3) \times (-4) \times (-5)$
 Number of negative integers in the given product is odd

Q. 5

\therefore their product is negative.
 $\therefore (-1) \times (-2) \times (-3) \times (-4) \times (-5)$
 $= -120$

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

Number of negative integers in the given product is even.

\therefore their product is positive.

Hence, $(-3) \times (-5) \times (-2) \times (-4)$
 $= 256$

(c) $(-2) \times (-2) \times \dots$ 9 times

Number of negative integers in the given product is odd.

\therefore their product is negative.

Hence, $(-2) \times (-2) \dots$ 9 times.
 $= -2^9$
 $= -512$

- (3) A shop keeper gains ₹1 on each pen & loses 40 paise on each pencil. He sells 45 pens and some pencils losing ₹5 in all. How many pencils does he sell?

Solution Suppose he sells x pencils.

Total gain on pens = ₹45

Total loss on pencils = ₹ $\frac{40x}{100} = \frac{₹2x}{5}$

$\therefore \frac{45 - 2x}{5} = -5$

$\Rightarrow \frac{2x}{5} = 45 + 5$

$$\Rightarrow \frac{2x}{5} = 50$$

$$\Rightarrow x = \frac{50 \times 5}{2} = 125$$

Hence, the number of pencils sold is 125.

EXERCISE

① Multiply:

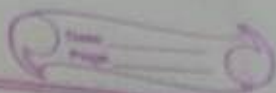
- (a) 16 by 9 (b) 18 by -6 (c) 36 by -11
- (d) -28 by 14 (e) -53 by 18 (f) -35 by 0
- (g) 0 by -23 (h) -16 by -12 (i) -105 by -8
- (j) -36 by -50 (k) -28 by -1 (l) 25 by -11

② Find the product of -

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

③ Find the product of -

- (a) $(-4) \times (-5) \times (-8) \times (-10)$
- (b) $(-6) \times (-5) \times (-7) \times (-2) \times (-3)$
- (c) $(-60) \times (-10) \times (-5) \times (-1)$
- (d) $(-30) \times (-20) \times (-5)$
- (e) $(-3) \times (-3) \times \dots \times (-3)$ 6 times
- (f) $(-5) \times (-5) \times \dots \times (-5)$ 5 times
- (g) $(-1) \times (-1) \times (-1) \times \dots \times (-1)$ 200 times
- (h) $(-1) \times (-1) \times \dots \times (-1)$ 171 times.



④ Simplify:

- (a) $(-8) \times 9 + (-8) \times 7$ (b) $9 \times (-13) + 9 \times (-7)$
 (c) $20 \times (-16) + 20 \times 14$ (d) $(-16) \times (-15) + (-16) \times (-5)$
 (e) $(-11) \times (-15) + (-11) \times (-25)$ (f) $10 \times (-12) + 5 \times (-12)$
 (g) $(-16) \times (-8) + (-4) \times (-8)$ (h) $(-26) \times 72 + (-26) \times 28$

⑤ What will be the sign of the product, if we multiply —

- (a) 90 negative integers and 9 positive integers
 (b) 103 negative integers and 65 positive integers

⑥ A certain freezing process requires that room temperatures be lowered from 40°C at the rate of 5°C per hour. What will be the room temperature 12 hours after the process begins.

⑦ In a class test containing 10 questions, 5 marks are awarded for every correct answer & (-2) marks are awarded for every incorrect answer and 0 for each questions not attempted.

- (a) Ravi gets 4 correct & 6 incorrect answers. What is his score?
 (b) Raju gets 5 correct and 5 incorrect answers. What is his score?
 (c) Heena gets 2 correct and 5 incorrect answers. What is his score?