2 Multiplication and Division of Integers

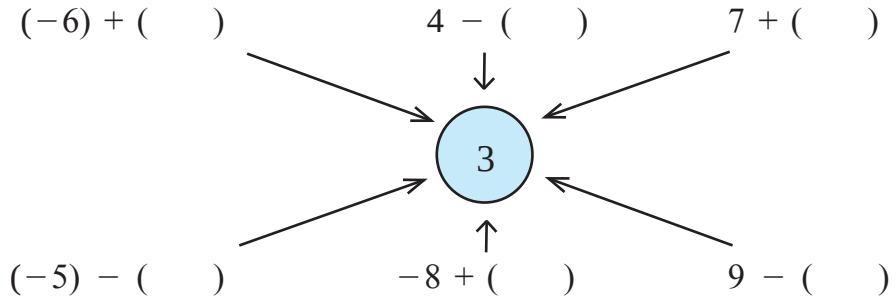
Let's recall.

- In the previous class, we have learnt to add and subtract integers. Using those methods, fill in the blanks below.

(1) $5 + 7 =$ ☐ (2) $10 + (-5) =$ ☐ (3) $-4 + 3 =$ ☐

(4) $(-7) + (-2) =$ ☐ (5) $(+8) - (+3) =$ ☐ (6) $(+8) - (-3) =$ ☐

- Write a number in each bracket to obtain the answer '3' in each operation.



Let's learn. Multiplication of Integers

Mayuri's bicycle got punctured on the way back from school and she did not have enough money to get it repaired. Sushant, Snehal and Kalpana lent her five rupees each. Thus she borrowed 15 rupees altogether and got the bicycle repaired. We show borrowed money, or a debt, using the '−' (minus) sign. That is, Mayuri had a debt of 15 rupees or Mayuri had −15 rupees.

We see here that $(-5) + (-5) + (-5) = -15$

Hence note that $(-5) \times 3 = 3 \times (-5) = -15$

Of course, Mayuri paid back her debt the next day.

We have learnt the multiplication and division of whole numbers. We have even made tables to carry out the multiplication. Now let us learn to multiply integers i.e. multiplication of numbers in the set that includes negative numbers, positive numbers and zero.

$(-3) + (-3) + (-3) + (-3)$ This addition is the addition of (-3) taken 4 times. It equals -12. It can be written as $(-3) \times 4 = -12$.

Similarly, $(-5) \times 6 = -30$, $(-7) \times 2 = -14$, $8 \times (-7) = -56$

Now, let us make the table of (-4).

$(-4) \times 0 = 0$
$(-4) \times 1 = -4$
$(-4) \times 2 = -8$
$(-4) \times 3 = -12$

Observe the pattern here. As the multiplier of (-4) increases by 1, the product is reduced by 4.

Keeping the same pattern, if we extend the table upwards, decreasing the multiplier, this is what we will get.

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

As the multiplier of (-4) decreases by one unit, the product increases by 4.

The table for (-5) is given below. Complete the tables of (-6) and (-7).

$(-5) \times (-3) = 15$	$(-6) \times (-3) =$ ☐	$(-7) \times (-3) =$ ☐
$(-5) \times (-2) = 10$	$(-6) \times (-2) =$ ☐	$(-7) \times (-2) =$ ☐
$(-5) \times (-1) = 5$	$(-6) \times (-1) =$ ☐	$(-7) \times (-1) =$ ☐
$(-5) \times 0 = 0$	$(-6) \times 0 =$ ☐	$(-7) \times 0 =$ ☐
$(-5) \times 1 = -5$	$(-6) \times 1 =$ ☐	$(-7) \times 1 =$ ☐
$(-5) \times 2 = -10$	$(-6) \times 2 =$ ☐	$(-7) \times 2 =$ ☐
$(-5) \times 3 = -15$	$(-6) \times 3 =$ ☐	$(-7) \times 3 =$ ☐
$(-5) \times 4 = -20$	$(-6) \times 4 =$ ☐	$(-7) \times 4 =$ ☐

Now I know!

• The product of two positive (+ve) integers is a positive (+ve) integer.	(+ve number) × (+ve number) = (+ve number)
• The product of one positive (+ve) and one negative (−ve) integer is a negative integer.	(+ve number) × (−ve number) = (−ve number)
• The product of two negative (−ve) integers is a positive (+ve) integer.	(−ve number) × (+ve number) = (−ve number)
	(−ve number) × (−ve number) = (+ve number)

Practice Set 8

⊙ Multiply.

(i) $(-5) \times (-7)$ (ii) $(-9) \times (6)$ (iii) $(9) \times (-4)$ (iv) $(8) \times (-7)$

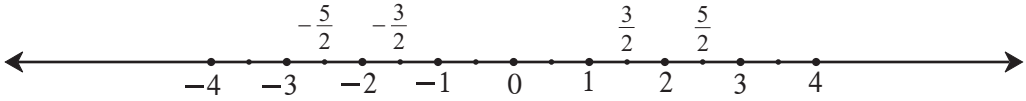
(v) $(-124) \times (-1)$ (vi) $(-12) \times (-7)$ (vii) $(-63) \times (-7)$ (viii) $(-7) \times (15)$

Let's learn. Division of Integers

We have learnt how to divide one positive integer by another. We also know that the quotient of such a division may be an integer or a fraction.

Example $6 \div 2 = \frac{6}{2} = 3$, $5 \div 3 = \frac{5}{3} = 1 + \frac{2}{3}$

On the number line, we can show negative integers on the left of the zero. We can show parts of integers also in the same way.



Here, the numbers $-\frac{5}{2}$, $-\frac{3}{2}$, $\frac{3}{2}$, $\frac{5}{2}$ are shown on the number line.

Note that $\left(-\frac{1}{2}, \frac{1}{2}\right)$, $\left(\frac{3}{2}, \frac{-3}{2}\right)$, $\left(\frac{-5}{2}, \frac{5}{2}\right)$ are mutually opposite numbers.

That is, $\frac{1}{2} + \frac{-1}{2} = 0$, $\frac{3}{2} + \frac{(-3)}{2} = 0$, $-\frac{5}{2} + \frac{5}{2} = 0$

Pairs of opposite numbers are also called pairs of additive inverse numbers. We have seen that $(-1) \times (-1) = 1$. If the two sides of this equation are divided by (-1) we get the equation $(-1) = \frac{1}{(-1)}$. Therefore, the quotient of the division $\frac{1}{(-1)}$ is (-1).

Hence, we see that $6 \times (-1) = 6 \times \frac{1}{(-1)} = \frac{6}{(-1)}$.

To divide any positive integer by a negative integer

$$\frac{7}{-2} = \frac{7\times1}{(-1)\times2} = 7 \times \frac{1}{(-1)} \times \frac{1}{2} = \frac{7}{1} \times (-1) \times \frac{1}{2} = \frac{(7)\times(-1)}{2} = \frac{-7}{2}$$

To divide any negative integer by a negative integer

$$\frac{-13}{-2} = \frac{(-1)\times13}{(-1)\times2} = \frac{(-1)}{(-1)} \times 13 \times \frac{1}{2} = (-1)\times\frac{(-1)}{1}\times\frac{13}{2} = 1\times\frac{13}{2} = \frac{13}{2}$$

Similarly, verify that $\frac{-25}{-4} = \frac{25}{4}$, $\frac{-18}{-2} = \frac{18}{2} = 9$ etc.

This explains the division of negative integers.

When one integer is divided by another non-zero integer, it is customary to write the denominator of the quotient as a positive integer.

Hence we write $\frac{7}{-2} = \frac{-7}{2}$, $\frac{-11}{-3} = \frac{11}{3}$

Now I know!

The rules of division of integers are like the rules of multiplication of integers.

- We cannot divide any number by zero.
- The quotient of two positive integers is a positive number.
- The quotient of two negative integers is a positive number.
- The quotient of a positive integer and a negative integer is always a negative number.

Practice Set 9

1. Solve :

   (i) (– 96) ÷ 16 (ii) 98 ÷ (– 28) (iii) (– 51) ÷ 68 (iv) 38 ÷ (– 57)

   (v) (– 85) ÷ 20 (vi) (–150) ÷ (– 25) (vii) 100 ÷ 60 (viii) 9 ÷ (– 54)

   (ix) 78 ÷ 65 (x) (– 5) ÷ (– 315)

2*. Write three divisions of integers such that the fractional form of each will be $\frac{24}{5}$.

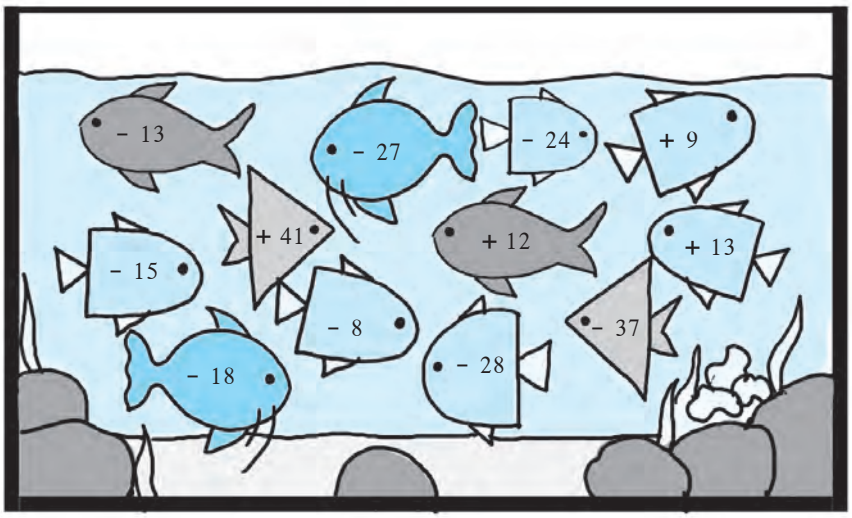
3*. Write three divisions of integers such that the fractional form of each will be $\frac{-5}{7}$.

4. The fish in the pond below, carry some numbers. Choose any 4 pairs and carry out four multiplications with those numbers. Now, choose four other pairs and carry out divisions with these numbers.

For example,

1. $(-13) \times (-15) = 195$

2. $(-24) \div 9 = \frac{-24}{9} = \frac{-8}{3}$



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