

Multiplication

What is Multiplication?

Multiplication is the repeated addition of a number. If we multiply m by n , that means m is repeatedly added to itself for n times. The symbol for multiplication is '×'.

For instance, 8 multiplied by 4 is equal to 32. How? Adding 8, 4 times to itself, we get;

$$8 + 8 + 8 + 8 = 32$$

Therefore, we can write,

$$8 \times 4 = 32$$

Multiplication and Division Relationship

Multiplication and division, are inverse operations of each other. If we say, a multiplied by b is equal to c , then c divided by b results in a . Mathematically, it can be represented as:

- $a \times b = c$
- $c \div b = a$

For example,

- $4 \times 5 = 20$ [4 multiplied by 5 results in 20]
- $20 \div 5 = 4$ [20 divided by 5 returns back 4]

Multiplication and Division Rules

For every mathematical computation, we need to follow the rules. Thus even to multiply and divide the numbers, there are some rules which we need to follow.

Rule 1: Order of operations

The order of operations for multiplication does not matter. It means if we arrange the number in a different order while multiplying them, then the result will be the same.

Examples are:

$$3 \times 4 = 12$$

$$4 \times 3 = 12$$

In the above example, we can see, even if we have swapped the position of 3 and 4, the product of the two integers is equal to 12.

But this rule is not applicable for division. Let us take another example.

$$12 \div 3 = 4$$

$$3 \div 12 \neq 4 \text{ (it is equal to 0.25)}$$

Thus, we cannot change the order of numbers in division method.

Rule 2: Multiplying and Dividing by Positive Numbers

If any real number is multiplied or divided by the positive real number, then the sign of the resulting number does not change.

Examples are:

$$2 \times 3 = 6$$

$$-2 \times 3 = -6$$

Since, 2 and 3 both are positive integers, therefore the product of 2 and 3 is also positive. But the product of -2 and 3 is a negative number.

$$4 \div 2 = 2$$

$$-4 \div 2 = -2$$

Since, 4 and 2 both are positive, therefore, 4 divided by 2 is also a positive number. But -4 divided by 2 is a negative number.

Thus, we can conclude that:

$$(+) \times (+) = (+)$$

$$(+) \div (+) = (+)$$

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

$$(-) \div (+) = (-)$$

Rule 3: Multiplying and Dividing by Negative Numbers

Multiplication and division of any real number by a negative number will change the sign of the resulting number. Examples are given below.

1. Multiply 5 by -2.

$$5 \times -2 = -10$$

2. Multiply -5 by -2.

$$-5 \times -2 = 10$$

3. Divide 10 by 2.

$$10 \div -2 = -5$$

$$-10 \div -2 = 5$$

Thus we can conclude that:

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

$$(+) \div (-) = (-)$$

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

$$(-) \div (-) = (+)$$

Summary of Multiplication and Division Rules

Multiplication rules	Division rules
<ul style="list-style-type: none">$(+) \times (+) = (+)$	<ul style="list-style-type: none">$(+) \div (+) = (+)$

- | | |
|--------------------------|------------------------|
| • $(-) \times (-) = (+)$ | • $(-) \div (-) = (+)$ |
| • $(+) \times (-) = (-)$ | • $(+) \div (-) = (-)$ |
| • $(-) \times (+) = (-)$ | • $(-) \div (+) = (-)$ |

Multiplication and Division of Integers

Integers are those values that are not fractions and can be negative, positive or zero. The integers can be easily represented on a number line. Thus, the arithmetic calculations on integers can be done in a simple manner.

Multiplying and dividing any integer with a whole number, or a fraction or an integer itself is given below with examples.

- $3 \times 9 = 27$ (Integer \times Whole number)
- $2 \times \frac{1}{4} = \frac{1}{2}$ (Integer \times Fraction)
- $2 \times -5 = -10$ (Integer \times Integer)

Multiplication and Division of Fractions

Here, we will learn how to multiply and divide fractions with examples.

A fraction is a part of a whole. For example, $\frac{1}{2}$ is a fraction that represents half of a whole number or any value. Here, the upper part is called the numerator and the lower part is called the denominator. Let us multiply and divide fractions with examples.

$$\frac{1}{4} \times \frac{1}{2} = (1 \times 1)/(4 \times 2) = \frac{1}{8}$$

$$\frac{1}{4} \div \frac{1}{2} = (1 \times 2)/(1 \times 4) = \frac{2}{4} = \frac{1}{2}$$

Multiplication and Division of Decimals

Decimals are numbers with a decimal point, (Eg: 2.35). They represent the fraction of something or some value, such as $\frac{1}{2} = 0.5$. A decimal notation or point differentiates an integer part from fractional part (e.g. $2.35 = 2 + \frac{7}{20}$).

Multiplication of Decimals

When a decimal is multiplied by any real number, then the position of the decimal point (.) changes.

For example: $0.33 \times 2 = 0.33 + 0.33 + 0.33$. Multiplication of decimal numbers is similar to the multiplication of whole numbers. Steps for multiplication of decimals are given below with an example.

Consider multiplication of two numbers, 2.32 and 3 for example.

Step 1: Take the count of the total number of places (digits) to the right of the decimal point in both numbers.

Here, in 2.32 there are two digits to the right of the decimal point and 3 is a whole number with no decimal point. Therefore, the total number of digits to the right of the decimal is 2.

Step 2: Now forget about the decimal point and just multiply the numbers without the decimal point.

$$\begin{array}{r} 232 \\ \times 3 \\ \hline 696 \end{array}$$

Step 3: After multiplication, put the decimal point in answer 2 places (step 1) from the right i.e. answer (2.32×3) will be 6.96.

Simply, just multiply the decimal numbers without decimal points and then give decimal point in the answer as many places same as the total number of places right to the decimal points in both numbers.

Multiplication of Decimal Numbers by 10, 100 and 1000

Multiplication and division of decimals by numbers that have powers of 10 is easier than that by a whole number. Rules for multiplication and division of decimal numbers by 10, 100 and 1000:

Multiplication and Division	Rules	Examples
Multiply by 10(10^1)	The number will move one place value to the left	$5.63 \times 10 = 56.3$
Multiply by 100 (10^2)	The number will move two places value to the left	$5.63 \times 100 = 563$
Multiply by 1000 (10^3)	The number will move three places value to the left	$5.63 \times 1000 = 5630$

Multiplication and Division Equations

The equations are the expression that includes integers, variables, equality signs and arithmetic operations. For example,

$$2a + 9 = 7$$

If we solve the above equation for a, then,

$$2a = 7 - 9$$

$$a = -2 \div 2 = -1$$

Solved Examples – Multiplication and Division

Q.1: Find the product of:

$$22 \times 11 = ?$$

$$3 \times 91 = ?$$

$$444 \times 3 = ?$$

$$1000 \times 8 = ?$$

Solution:

$$22 \times 11 = 242$$

$$3 \times 91 = 273$$

$$444 \times 3 = 1332$$

$$1000 \times 8 = 8000$$

Word Problems on Multiplication and Division

Q.1: There are 90 pencils in 1 box. How many pencils are there in 3 boxes?

Solution: Given, 1 box has 90 pencils.

So, in 3 boxes, number of pencils = $3 \times 90 = 270$

Therefore, there are total of 270 pencils in 3 boxes.

Q.2: Raju has 1615 candies stored in a box. If there are 85 such boxes, then how many candies are there in each box?

Solution: Total number of candies = 1615

Number of boxes = 85

Therefore, each box contains = $1615 \div 85$ candies
= 19 candies.

Practice Questions – Multiplication and Division

1. Fill in the blanks:

$$7 \times 9 = \underline{\quad}$$

$$83 \div 2 = \underline{\quad}$$

2. Find the value of:

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

$$\frac{5}{6} \times 12 = ?$$

$$16 \div \frac{4}{3} = ?$$

$$200 \div 40 = ?$$

3. Each toffee cost Rs. 2. If there are 120 toffees, then what is the total cost?

4. A school is planning a trip. There are 1729 students and each bus has 19 seats. How many buses are required to go for the trip?

To solve more problems on multiplication and division of decimals, download BYJU'S – The Learning App from Google Play Store and watch interactive videos.

Frequently Asked Questions on Multiplication and Division

What is the order of operations of multiplication and division?

As per the BODMAS rule, we divide first and then multiply, unless an expression is included in the bracket.

$$15 \div 3 \times 2 = 5 \times 2 = 10$$

$$15 \div (3 \times 2) = 15 \div 6 = 2.5$$

What do we get when we multiply an integer with an integer?

Multiplication of an integer with an integer result in an integer itself.

Integer \times Integer = Integer

How to multiply decimal by a fraction?

If we have a decimal and a fraction to multiply, then we can convert the decimal into a fraction and then multiply with another fraction.

$$0.5 \times \frac{1}{3}$$

$$0.5 = \frac{5}{10} = \frac{1}{2}$$

$$\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$$

Is multiplication and division applicable to all the real numbers?

We can multiply and divide all the real numbers such as whole numbers, natural numbers, integers, rational numbers, irrational numbers.