

# NUMBERS

We know that when we count we start 1,2 .... . But there are other numbers like 0, negative numbers and decimals. All these types of numbers are categorized in different groups like counting numbers, integers, real numbers, whole numbers and rational and irrational numbers according to their properties. all this have been covered in this chapter

## Base Ten Numeration

Numbers are represented by symbols called numerals. For example, numeral for the number ten is 10. Numeral for the number hundred is 110 and so on.

The symbols which represent numbers are called digits. For example the number 521 has three (3) digits which are 5, 2 and 1. There are only ten digits which are used to represent any number. These digits are 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9.

### The Place Value in each Digit in Base Ten Numeration

*Identify the place value in each digit in base ten numeration*

When we write a number, for example 521, each digit has a different value called place value. The 1 on the right means 1 ones which can be written as  $1 \times 1$ , the next number which is 2 means 2 tens which can be written as  $2 \times 10$  and the last number which is 5 means 5 hundreds which can be written as  $5 \times 100$ . Therefore the number 521 was found by adding the numbers  $5 \times 100 + 2 \times 10 + 1 \times 1 = 521$ .

Note that when writing numbers in words, if there is zero between numbers we use word 'and'

### Example 1

Write the following numbers in words:

1. 7 008
2. 99 827 213
3. 59 000

**Solution**

- a.  $7\ 008 =$  Seven thousand and eight.
- b.  $99\ 827\ 213 =$  Ninety nine millions eight hundred twenty seven thousand two hundred thirteen.
- c.  $59\ 000 =$  Fifty nine thousand.

**Example 2**

Write the numbers bellow in expanded form.

1. 732.
2. 1 205.

**Solution**

- a.  $732 = 7 \times 100 + 3 \times 10 + 2 \times 1$
- b.  $1\ 205 = 1 \times 1000 + 2 \times 100 + 0 \times 10 + 5 \times 1$

**Example 3**

Write in numerals for each of the following:

1.  $9 \times 100 + 8 \times 10 + 0 \times 1$
2. Nine hundred fifty five thousand and five.

**Solution**

- a.  $9 \times 100 + 8 \times 10 + 0 \times 1 = 980$
- b. Nine hundred fifty five thousand and five = 955 005.

**Example 4**

For each of the following numbers write the place value of the digit in brackets.

1. 89 705 361 (8)

2. 57 341 (7)

### Solution

a. 8 is in the place value of ten millions.

Billions	Hundred millions	Ten millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
									1
								1	0
							1	0	0
						1	0	0	0
				1	0	0	0	0	0
			1	0	0	0	0	0	0
		1	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0

b. 7 is in the place value of thousands.

### Numbers in Base Ten Numeration

*Read numbers in base ten numeration*

Base Ten Numeration is a system of writing numbers using ten symbols i.e. 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. Base Ten Numeration is also called decimal system of Numeration.

## Numbers in Base Ten Numeration up to One Billion

*Write numbers in base ten numeration up to one billion*

Consider the table below showing place values of numbers up to one Billion.

If you are given numerals for a number having more than three digits, you have to write it by grouping the digits into groups of three digits from right. For example 7892939 is written as 7 892 939.

When we are writing numbers in words we consider their place values. For example; if we are told to write 725 in words, we first need to know the place value of each digit. Starting from right side 5 is in the place value of ones, 2 is in the place value of tens and seven is in the place value of hundreds. Therefore our numeral will be read as seven hundred twenty five.

## Numbers in Daily Life

*Apply numbers in daily life*

Numbers play an important role in our lives. Almost all the things we do involve numbers and Mathematics. Whether we like it or not, our life revolves in numbers since the day we were born. There are numerous numbers directly or indirectly connected to our lives.

The following are some uses of numbers in our daily life:

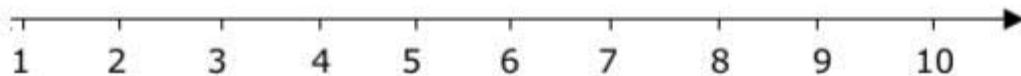
1. Calling a member of a family or a friend using mobile phone.
2. Calculating your daily budget for your food, transportation, and other expenses.
3. Cooking, or anything that involves the idea of proportion and percentage.
4. Weighing fruits, vegetables, meat, chicken, and others in market.
5. Using elevators to go places or floors in the building.
6. Looking at the price of discounted items in a shopping mall.
7. Looking for the number of people who liked your post on Facebook.
8. Switching the channels of your favorite TV shows.
9. Telling time you spent on work or school.

10. Computing the interest you gained on your business.

## Natural and Whole Number

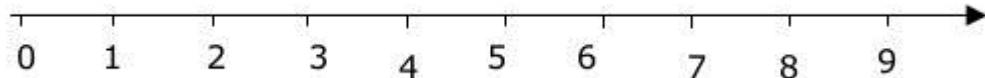
Natural numbers are counting numbers. Counting always starts with 1 and continues with 2, 3 ... (dots means numbers continue with no end). Therefore Natural or counting numbers starts from 1 and continue to infinite (no end).

Natural numbers are denoted by **N**. natural numbers can be represented on a horizontal line called number line as shown above:



The other group of numbers starts from zero and it is called whole numbers denoted by **W**.

We can represent whole numbers on a number line as shown above:



## The Difference between Natural and Whole Numbers

*Distinguish between natural and whole numbers*

Natural numbers are either used to count one to one objects or represent the position of an object in a sequence. They start from one and go on to infinity. This is why they are sometimes referred to as counting numbers. The only whole number that cannot be classified as a natural number is 0. Counting numbers can further be classified into perfect numbers, composite numbers, co-prime/ relatively prime numbers, prime numbers, even and odd numbers.

## Even ,Odd, and Prime Numbers

*Identify even ,odd, and prime numbers*

**Even numbers** are those numbers which are divisible by 2. In other words we can say that any natural number which can be divided by 2 is an even number. For example 2, 4, 6, 8, 10, 12, ... are even numbers since they are divisible by 2.

**Odd numbers** are those numbers which are not divisible by 2. In other words we can say that any natural number when divided by 2 and remains 1 including 1 are called odd numbers. Example 1, 3, 5, 7, 9, 11, 13, 15, ... are called odd numbers.

**Prime numbers** are those numbers which are divisible by one and itself excluding one or any natural number which is divisible by one and itself except one. For example 2, 3, 5, 7, 11, 13, 17, ... are called prime numbers.

## Odd and Prime Numbers on Numbers Lines

*Show even , odd and prime numbers on number lines*

Odd and Prime Numbers

### Prime and Odd Numbers

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

## Operations with Whole Numbers

We have four operations which are: addition (+), subtraction (-), multiplication ( X) and division (÷).

### Addition of Whole Numbers

*Add whole numbers*

When adding numbers we add the corresponding digits in their corresponding place values and we start adding from the right side i.e. from the place value of ones to the next.

We can add numbers horizontally or vertically.

### Horizontal addition

#### Example 5

1.  $972 + 18 =$

2.  $23\ 750 + 250 =$

#### Solution

1.  $972 + 18 = 990$

2.  $23\ 750 + 250 = 24\ 000$

### Vertical addition

#### Example 6

i. 
$$\begin{array}{r} 2\ 378\ 943 \\ +\ 72\ 812 \\ \hline \end{array}$$

ii. 
$$\begin{array}{r} 7\ 250 \\ +\ 2\ 352\ 890 \\ \hline \end{array}$$

### Solution

i. 
$$\begin{array}{r} 2\ 378\ 943 \\ +\ 72\ 812 \\ \hline 2\ 451\ 755 \end{array}$$

ii. 
$$\begin{array}{r} 7\ 250 \\ +\ 2\ 352\ 890 \\ \hline 2\ 360\ 140 \end{array}$$

## Subtraction of Whole Numbers

### *Subtract whole numbers*

Subtraction is denoted by the sign (-). It is sometimes called **minus**. Subtraction is the opposite of addition. Subtraction also means reduce a number from certain number and the answer that is obtained is called **difference**.

Subtraction is done in similar way like addition. We subtract the corresponding digits in their corresponding place value. For example;  $505 - 13$ . We first subtract ones, which are 5 and 3. Subtract 3 from 5 gives 2. Followed by tens which are 0 and 1. Subtract 1 from 0 is not possible. In order to make it easy, take 1 from 5 (hundreds). When 1 is added to 0 it has to be changed to be tens since it is added to a place of tens. So, when 1 comes into a place of tens it becomes 10. So add 10 to 0. We get 10. Now, subtract 1 from 10. We get 9. We are left with 4 in a place of hundreds since we took 1. There for our answer will be 492.

Note that similar manner will be used when subtracting.

### Example 7

a.  $89\ 237 - 2\ 275 =$

b.  $8\ 927\ 209$

- 997 100

\_\_\_\_\_

\_\_\_\_\_

### Solution

a.  $89\ 237 - 2\ 275 = 86\ 962$

b.  $8\ 927\ 209$

- 997 100

930 109

## Multiplication of Whole Numbers

### *Multiply whole numbers*

Multiplication means adding repeatedly depending on the times number given. For example; 25 6 means add 25, repeat adding 6 times i.e.  $25 + 25 + 25 + 25 + 25 + 25 = 150$ . The answer obtained after multiplying two or more numbers is called **product**. The number being multiplied is called a **multiplicand** while the number used in multiplying is called a **multiplier**. Referring our example, 25 is multiplicand and 6 is multiplier.

### Example 8

1.  $925 \times 35 =$

2.  $752\ 345$

$\times \quad 15$

\_\_\_\_\_

\_\_\_\_\_

### Solution

1.  $925 \times 35 = 32\ 375$

2.  $752\ 345$

$\times \quad 15$

752345

+3761725

11285175

## Division of Whole Numbers

### *Divide whole numbers*

Division is the same as subtraction. You subtract**divisor**(the number used to divide another number) from**dividend**(the number which is to be divided), we repeat subtracting divisor to the answer obtained until we get zero. The answer is how many times you repeat subtraction.

For example;  $27 \div 9$ , we take 27 we subtract 9, we get 18. Again we take 18 we subtract 9, we get 9. We take 9 we subtract 9 we get 0. We repeat subtraction three times. Therefore the answer is 3. The answer obtained is called**quotient**. Referring to our example; 27 is dividend, 9 is divisor

and 3 is quotient. If a number can't be divided exactly, what remains or left over is called **remainder**.

### Example 9

1.  $1\ 714\ 608 \div 18 =$

2.  $12)12\ 750$

### Solution

1)  $1\ 714\ 608 \times 18 = 95\ 256$

1062 rem 6  
2)  $12)12\ 750$   
$$\begin{array}{r} -12 \\ \hline 75 \\ -72 \\ \hline 24 \\ -6 \\ \hline \end{array}$$

## The Four Operations in Solving Word Problems

*Use the four operations in solving word problems*

Sometimes you may be given a question with mixed operations +, -, x and  $\div$ . We do multiplication and division first then addition and subtraction.

### Example 10

1.  $12 \div 4 + 3 \times 5$

2.  $14 \times 2 \div 7 - 3 + 6$

### Solution

1.  $12 \times 4 + 3 \times 5 = 3 + 15$  (do division and multiplication first) = 18

2.  $14 \times 2 \div 7 - 3 + 6 = 28 \div 7 - 3 + 6$  (multiply first) = 4 - 3 + 6 (then divide) = 10 - 3 (add then subtract) = 7

We may use brackets to separate  $x, \div, +$  and  $-$  if they are mixed in the same problem and use what is called BODMAS . BODMAS is the short form of the following:

B for Brackets O for Open D for Division M for Multiplication A for Addition and S for Subtraction

Therefore, with mixed operations, we first do the operation inside the brackets; we say that we open the brackets. Then we do division followed by multiplication, addition and lastly subtraction.

### Example 11

$$1. (78 \div 3 + 4) \div (2 \times 3) - 2$$

$$2. 4 + 3 - (5 - 3) + 8 \div (9 - 7)$$

#### Solution

$$1. (78 \div 3 + 4) \div (2 \times 3) - 2$$

$$=30 \div 6 - 2 \text{ (first do the operations inside the brackets)}$$

$$=5 - 2 \text{ (do division)}$$

$$=3$$

$$2. 4 + 3 - (5 - 3) + 8 \div (9 - 7)$$

$$=4 + 3 - 2 + 8 \div 2 \text{ (do the operations inside the brackets first)}$$

$$=4 + 3 - 2 + 4 \text{ (do division)}$$

$$=11 - 2 \text{ (do addition and then subtraction)}$$

$$=9$$

## Word problems on whole numbers

### Example 12

In a school library there are 6 shelves each with 30 books. How many books are there?

Solution

Each shelf has 30 books

6 shelves have  $30 \times 6 = 180$  books.

Therefore, there are 180 books.

### Example 13

Juma's mother has a garden with Tomatoes, Cabbages and Water Lemons. There are 4 rows of

Tomato each with 30 in it. 6 rows of Cabbages with 25 in each and 3 rows of Water Lemo

Solution

There are 30 Tomatoes in each row

4 rows will have  $30 \times 4 = 120$  Tomatoes

Each row has 25 Cabbages

6 rows have  $25 \times 6 = 150$  Cabbages

Each row has 15 Water Lemons

3 rows have  $15 \times 3 = 45$  Water Lemons

In total there  $120 + 150 + 45 = 315$  plants.

Therefore in Juma's mother garden there are 315 plants.

### Example 14

A school shop collects sh 90 000 from customers each day. If sh 380 000 from the collection of 6 days was used to buy books. How much money was left?

Each day the collection is sh 90 000

6 days collection is  $sh 90\,000 \times 6 = sh 540\,000$

The money left will be = Total collection – Money used

=  $sh 540\,000 - sh 380\,000 = sh 160\,000$

Therefore the money left was sh 160 000

## Exercise 1

1. For each of the following numbers write the place value of a digit in a bracket.

a. 899 482 (4)

b. 1 940 (0)

c. 9 123 476

2. Write the numerals for each of the following problems.

a. Ten thousand and fifty one.

b. Nine hundred thirty millions one hundred twenty five thousand three hundred seventy four.

c.  $6 \times 100 + 1 \times 10 + 7 \times 1$

d.  $5 \times 10\,000 + 4 \times 1\,000 + 2 \times 100 + 7 \times 10 + 8 \times 1$

3. Write the following numerals in words

a. 952 817

b. 98 802 750

4. Write down even, odd and prime numbers between 90 and 100.

5. Compute:

a.  $25\,940 + 72\,115 - 5\,750 =$

b.  $892 \times 12 =$

c.  $14\,670 \div 15 =$

6. Calculate:  $(75 \div 3) + 7 - 14 + (13 \times 2) =$

7. There are 23 streams at Mamboleo primary school. If each stream has 60 pupils except 4 streams which they have 75 pupils each. How many pupils are there at Mamboleo primary school?

8. Hamis uses 200 shillings every day for transport. How much money will he use for 35 days?

## Factors And Multiples Of Numbers

### Factors of a Number

*Find factors of a number*

Consider two numbers 5 and 6, when we multiply these numbers i.e.  $5 \times 6$  the answer is 30. The numbers 5 and 6 are called factors or divisors of 30 and number 30 is called a multiple of 5 and 6. Therefore factors are the divisors of a number.

#### Example 15

Find all factors of 12

Note that, when listing the factors we don't repeat any of it.

Write 12 as a product of two numbers

$$\begin{aligned}12 &= 1 \times 12 \\&= 2 \times 6 \\&= 3 \times 4 \\&= 4 \times 3 \\&= 6 \times 2 \\&= 12 \times 1\end{aligned}$$

Therefore, the factors of 12 are 1, 2, 3, 4, 6, 12.

Note that, when listing the factors we don't repeat any of it.

### Multiples of a Number

*Find multiples of a number*

Multiples of a number are the products of a number. For example multiples of 4 are 4, 8, 12, 16, 20, 24, ... This means multiply 4 by 1, 2, 3, 4, 5, 6, ...

#### Example 16

Example

List all multiples of 6 between 30 and 45.

### Solution

The multiples of 6 are:  $6 \times 1 = 6$ ;  $6 \times 2 = 12$ ;  $6 \times 3 = 18$ ;  $6 \times 4 = 24$ ;  $6 \times 5 = 30$ ;  $6 \times 6 = 36$ ;  $6 \times 7 = 42$ ;  $6 \times 8 = 48$  and so on.

Therefore, multiples of 6 between 30 and 45 are 36 and 42.

### Factors to Find the Greatest Common Factors(GCF) of Numbers

*Use factors to find the greatest common factors(GCF) of numbers*

Greatest Common Factor is sometimes called Highest Common Factor. Its short form is (GCF) or (HCF) respectively. The Greatest Common Factor is the largest common divisor of two or more numbers given.

For example if you are told to find the GCF of 15 and 25. First, list all factors or divisors of 15 and that of 25. Thus, factors of 15 are 1, 3, 5, 15 factors of 25 are 1, 5, 25

The common factors are 1 and 5. Therefore the GCF is 5.

### Example 17

Example1

Find the HCF of 72 and 120.

### Solution

We have to list factors of our numbers:

Factors of 72 are 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72

Factors of 120 are 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120

The common factors are 1, 2, 3, 4, 6, 8, 12, 24.

Therefore the HCF of 72 and 120 is 24.

Another method which can be used to find the GCF or HCF is prime factorization method.

### Example 18

### Example

Find the HCF of 36 and 48.

### Solution

We have to find prime factors of 36 and 48 first

$$\begin{array}{r} 2) \underline{36} \\ 2) \underline{18} \\ 3) \underline{9} \\ 3) \underline{3} \\ 1 \end{array} \qquad \begin{array}{r} 2) \underline{48} \\ 2) \underline{24} \\ 2) \underline{12} \\ 2) \underline{6} \\ 3) \underline{3} \\ 1 \end{array}$$

thus,  $36 = 2 \times 2 \times 3 \times 3$ .

$48 = 2 \times 2 \times 2 \times 2 \times 3$ .

After writing the numbers as a product of their prime factors, take only the common prime factors (prime factors appeared to all numbers). In our example the common factors are  $2 \times 2 \times 3$ . Therefore the HCF of 36 and 48 is 12.

## Lowest Common Multiple (LCM)

Lowest Common Multiple is also called Least Common Multiple and its short form is LCM. For example: multiples of 5 are 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, ... multiples of 3 are 3, 9, 15, 18, 21, 24, 27, 30, 33, ....

When you look carefully at these multiples of 5 and 3 you notes that 15 had appeared to both. This multiple which appear to both is called a common multiple. If there are more than one common multiples which appeared the smaller common multiple is what is called Lowest Common Multiple.

### Example 19

Find the common multiples and then show the Lowest Common Multiple of the numbers 4, 6 and 8.

Solution

Multiples of 4 are 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, ...

Multiples of 6 are 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, ...

Multiples of 8 are 8, 16, 24, 32, 40, 48, 56, 64, 72, ...

The common multiples of 4, 6 and 8 are 24, 48, ...

Therefore the Lowest Common Multiple of 4, 6, and 8 is 24.

We can find the Lowest Common Multiple (LCM) of numbers by writing the numbers as a product of their prime factors. The method is called prime factorization.

### Example 20

Find the LCM of 24 and 36 by prime factorization method.

Solution

Let us find prime factors of each number by dividing the numbers by their prime factors.

$$\begin{array}{r} 2) \underline{24} \\ 2) \underline{12} \\ 2) \underline{6} \\ 3) \underline{3} \\ \quad 1 \end{array} \qquad \begin{array}{r} 2) \underline{36} \\ 2) \underline{18} \\ 3) \underline{9} \\ 3) \underline{3} \\ \quad 1 \end{array}$$

Thus,  $24 = 2 \times 2 \times 2 \times 3$ .

$36 = 2 \times 2 \times 3 \times 3$ .

Now take the prime factors which appear to both numbers i.e.  $2 \times 2 \times 3$  (we take without repeating). We are left with 2 which is a multiple of 24 and 3 which is a multiple of 36. We have also to multiply these prime factors left i.e.  $2 \times 2 \times 2 \times 3 \times 3$ . This gives 72. Therefore the LCM of 24 and 36 is  $2 \times 2 \times 2 \times 3 \times 3 = 72$ .

## Integers

### Integers

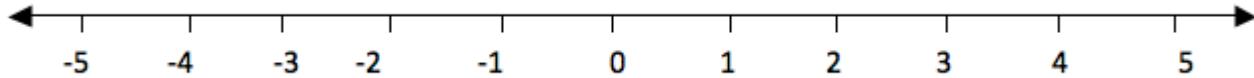
*Identify integers*

Consider a number line below



The numbers from 0 to the right are called positive numbers and the numbers from 0 to the left with minus (-) sign are called negative numbers. Therefore all numbers with positive (+) or negative (-) sign are called integers and they are denoted by  $\mathbb{Z}$ . Numbers with positive sign are written without showing the positive sign. For example  $+1, +2, +3, \dots$  they are written simply as  $1, 2, 3, \dots$ . But negative numbers must carry negative sign (-). Therefore integers are all positive and negative numbers including zero (0). Zero is neither positive nor negative number. It is neutral.

The numbers from zero to the right increases their values as the increase. While the numbers from zero to the left decrease their values as they increase. Consider a number line below.



If you take the numbers 2 and 3, 3 is to the right of 2, so 3 is greater than 2. We use the symbol ' $>$ ' to show that the number is greater than i. e.  $3 > 2$  (three is greater than two). And since 2 is to the left of 3, we say that 2 is smaller than 3 i.e.  $2 < 3$ .

Consider numbers to the left of 0. For example if you take  $-5$  and  $-3$ .  $-5$  is to the left of  $-3$ , therefore  $-5$  is smaller than  $-3$ .  $-3$  is to the right of  $-5$ , therefore  $-3$  is greater than  $-5$ .

Generally, the number which is to the right of the other number is greater than the number which is to the left of it.

If two numbers are not equal to each other, we use the symbol ‘ $\neq$ ’ to show that the two numbers are not equal. The not equal to ‘ $\neq$ ’ is the opposite of is equal to ‘ $=$ ’.

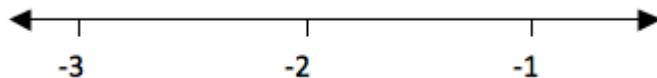
### Example 21

Represent the following integers  $Z$  on a number line

- 0 is greater than  $Z$  and  $Z$  is greater than -4
- 2 is less than  $Z$  and  $Z$  is less than or equal to 1.

Solution

a. 0 is greater than  $Z$  means the integers to the left of zero and  $Z$  is greater than -4 means integers to the left of -4. These numbers are -1, -2 and -3. Consider number line below



b. -2 is less than  $Z$  means integers to the right of -2 and  $Z$  is less than or equal to 1 means integers to the left of 1 including 1. These integers are -1, 0 and 1. Consider the number line below



### Example 22

Put the signs ‘is greater than’ ( $>$ ), ‘is less than’ ( $<$ ), ‘is equal to’ ( $=$ ) to make a true statement.

a. -4	<input type="text"/>	-5	d. 78	<input type="text"/>	78
b. 7	<input type="text"/>	7	e. -25	<input type="text"/>	-37
c. -32	<input type="text"/>	-3	f. 20	<input type="text"/>	5

### Solution

a.  $-4$    $-5$

-5

d.  $78$

$=$

78

b.  $7$    $7$

7

e.  $-25$

$>$

-37

c.  $-32$    $-3$

-3

f.  $20$    $5$

$>$

5

### Addition of Integers

Add integers

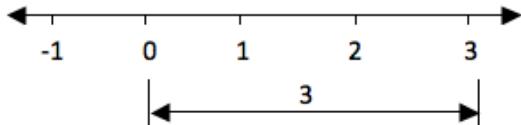
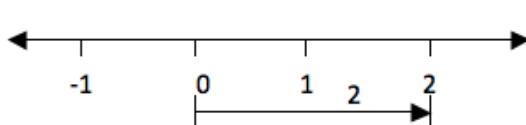
#### Example 23

$$2 + 3$$

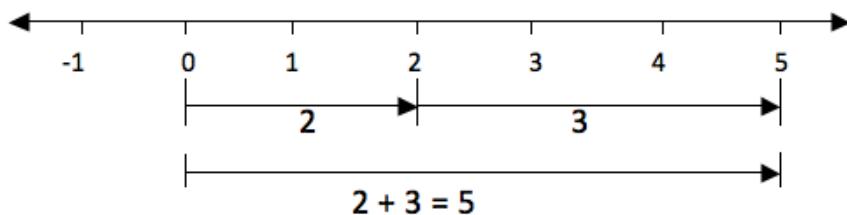
Show a picture of 2 and 3 on a number line.

#### Solution

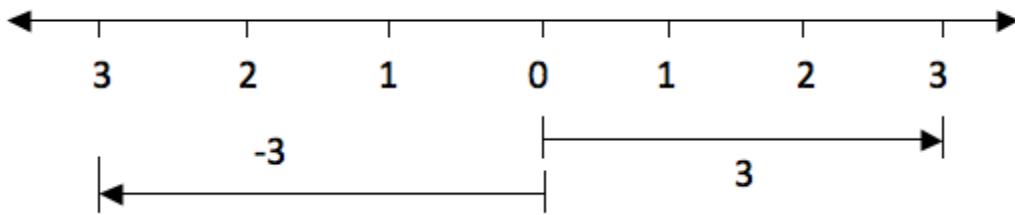
Show a picture of 2 and 3 on a number line.



Then add 2 and 3. It will appear as here below



When drawing integers on a number line, the arrows for the positive numbers goes to the right while the arrows for the negative numbers goes to the left. Consider an illustration bellow.

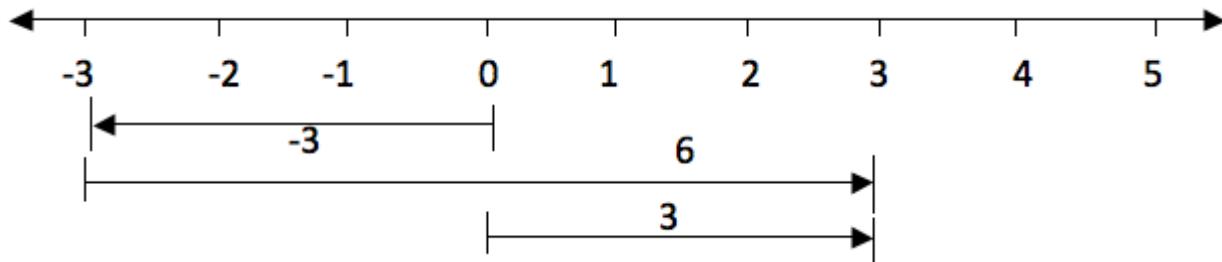


The distance from 0 to 3 is the same as the distance from 0 to -3, only the directions of their arrows differ. The arrow for positive 3 goes to the right while the arrow for the negative 3 goes to the left.

#### Example 24

$$-3 + 6$$

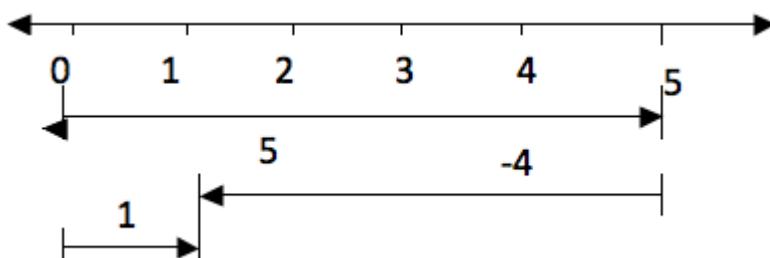
Solution



#### Subtraction of Integers

*Subtract integers*

Since subtraction is the opposite of addition, if for example you are given  $5-4$  is the same as  $5 + (-4)$ . So if we have to subtract 4 from 5 we can use a number line in the same way as we did in addition. Therefore  $5-4$  on a number line will be:



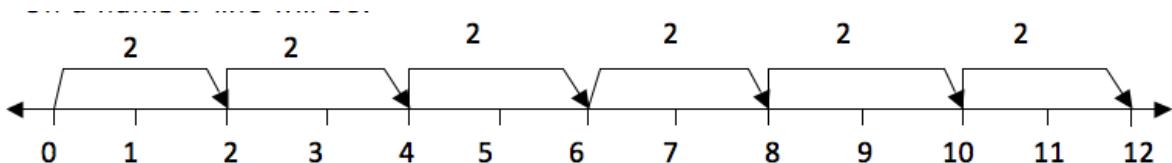
Take five steps from 0 to the right and then four steps to the left from 5. The result is 1.

## Multiplication of Integers

*Multiply integers*

### Example 25

$2 \times 6$  is the same as add 2 six times i.e.  $2 \times 6 = 2 + 2 + 2 + 2 + 2 + 2 = 12$ . On a number line will be:



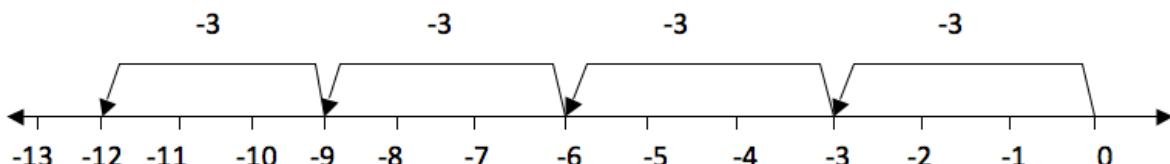
### Example 2

$$-3 \times 4$$

### Solution

$$-3 \times 4 = -3 + -3 + -3 + -3 = -12$$

On a number line will be:



Multiplication of a negative integer by a negative integer cannot be shown on a number line but the product of these two negative integers is a positive integer.

From the above examples we note that multiplication of two positive integers is a positive integer. And multiplication of a positive integer by a negative integer is a negative integer. In summary:

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

## Division of Integers

*Divide integers*

### Example 26

$6 \div 3$  is the same as saying that, which number when you multiply it by 3 you will get 6, that number is 2, so,  $6 \div 3 = 2$ .

Therefore division is the opposite of multiplication. From our example  $2 \times 3 = 6$  and  $6 \div 3 = 2$ . Thus multiplication and division are opposite to each other.

Dividing two integers which are both positive the quotient (answer) is a positive integer. If they are both negative also the quotient is positive. If one of the integer is positive and the other is negative then the quotient is negative. In summary:

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

## Mixed Operations on Integers

*Perform mixed operations on integers*

You may be given more than one operation on the same problem. Do multiplication and division first and then the rest of the signs. If there are brackets, we first open the brackets and then we do division followed by multiplication, addition and lastly subtraction. In short we call it BODMAS. The same as the one we did on operations on whole numbers.

### Example 27

$$9 \div 3 + 3 \times 2 - 1 =$$

Solution

$$9 \div 3 + 3 \times 2 - 1$$

$$= 3 + 6 - 1 \text{ (first divide and multiply)}$$

$$= 9 - 1$$

$$= 10$$