

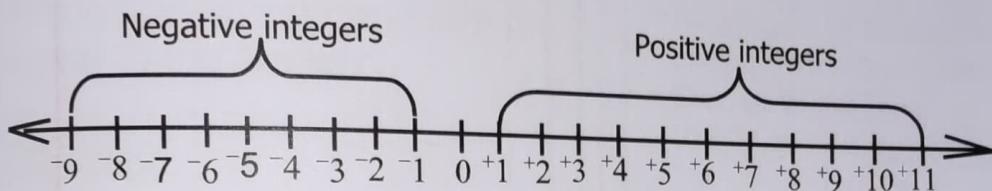
**INTEGERS.**

Integers are made up of negative numbers, zero and positive numbers.

**NOTE.**

- ✓ A set of positive integers are,  $\{+1, +2, +3, +4, +5, \dots\}$
- ✓ A set of negative integers are,  $\{-1, -2, -3, -4, -5, \dots\}$
- ✓ Zero (0) is neither positive nor negative.

- ❖ Integers on a number line are always arranged in ascending order as shown below.



### **OPPOSITES / ADDITIVE INVERSES**

- ✓ Every negative integer has its inverse or positive. The opposite of any negative integer is its corresponding positive integer.
- ✓ Zero doesn't have the positive or negative.
- ✓ When any integer is added to its inverse, the result is zero (0).

Examples.

3. Work out the inverse of  $+3$ .

Let the inverse of  $+3$  be  $k$

$$\begin{aligned} k + (+3) &= 0 \\ k + 3 &= 0 \\ k + 3 - 3 &= 0 - 3 \\ k &= -3 \end{aligned}$$

4. What is the additive inverse of  $-13$ ?

Let the inverse of  $-13$  be  $n$

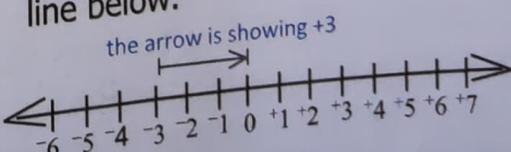
$$\begin{aligned} n + (-13) &= 0 \\ n - 13 &= 0 \\ n - 13 + 13 &= 0 + 13 \\ n &= +13 \end{aligned}$$

1. Work out the inverse of  $-3m$ .

Let the inverse of  $-3m$  be  $b$

$$\begin{aligned} b + (-3m) &= 0 \\ b - 3m &= 0 \\ b - 3m + 3m &= 0 + 3m \\ b &= +3m \end{aligned}$$

2. Work out the additive inverse of the integer shown on the number line below.



Let the inverse of  $+3$  be  $p$

$$\begin{aligned} p + (+3) &= 0 \\ p + 3 &= 0 \\ p + 3 - 3 &= 0 - 3 \\ p &= -3 \end{aligned}$$

### Activity.

Write the additive inverse of the following.

1.  $-8$

2.  $-10$

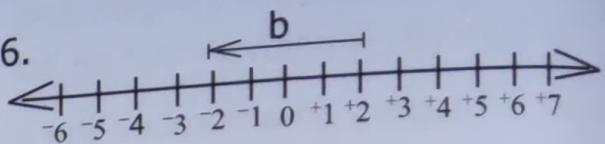
3.  $-100$

4.  $+200$

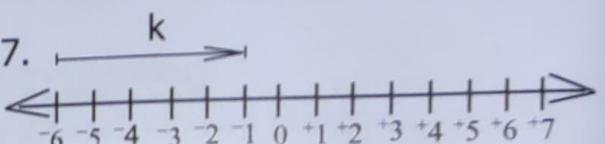
5.  $+4n$

Work out the additive inverse of the integers represented on the number lines below.

6.

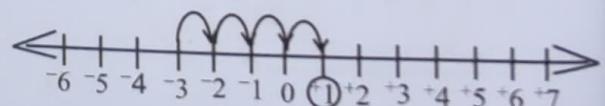


7.



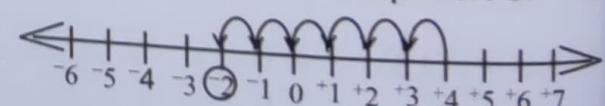
Additional Example.

1. What integer is four steps to the right of  $-3$ ?



$\therefore +1$  is the integer.

2. What integer is 6 steps left of  $+4$ ?



$\therefore -2$  is the integer.

## Ordering of integers.

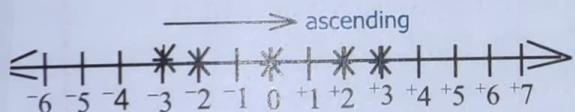
Integers can be written in either Ascending or Descending order.

Ascending order is the way of writing numbers starting from the smallest to the largest.

Descending order is the way of writing numbers starting with the largest to the smallest.

### Examples.

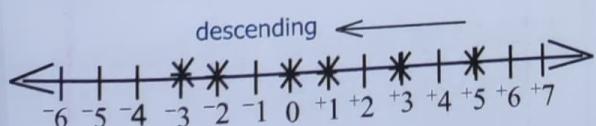
1. Arrange  $-2, +3, -3, +2$  and 0 in ascending order.



Ascending order

$\{-3, -2, 0, +2, +3\}$

- Arrange  $0, +3, +1, -2, -3$ , and  $-5$  in descending order.



Descending order

$\{+5, +3, +1, 0, -2, -3\}$

### Meaning of the symbols below

< is for less than

> is for greater than

$\leq$  is for less than or equal to

$\geq$  is for greater than or equal to

= is for equal to

## Important to note.



❖ All integers to the left of Zero (0) are Negative and they reduce in magnitude the more you extend to the left. i.e  $-99$  is less than  $-1$  or  $-1$  is far bigger than  $-99$ .

❖ All integers to the right of Zero (0) are Positive integers and increase as they go to the right. i.e.  $1$  is smaller than  $9$  or  $+9$  is bigger than  $+1$ .

❖ Zero is neither positive nor negative.

❖ is a positive arrow on a number line.

❖ is a negative arrow on a number line.

### Activity.

1. Use  $<$ ,  $>$  or  $=$  to complete the statements below.

$$+3 \quad \underline{\hspace{1cm}} \quad -3$$

$$-5 \quad \underline{\hspace{1cm}} \quad +3$$

$$-10 \quad \underline{\hspace{1cm}} \quad -2$$

$$-100 \quad \underline{\hspace{1cm}} \quad 0$$

2. Use True or False to complete.

(i) Any integer to the left of Zero is negative, \_\_\_\_\_

(ii) Any integer on a number line is positive, \_\_\_\_\_

(iii) Any integer without a sign is a negative integer \_\_\_\_\_

What integer is 6 steps left of  $+2$ ?

What integer is 8 groups right of  $-4$ ?

Arrange the following integers as instructed.

(i)  $+4, -4, 0, 5, -1, 3$  in ascending order.

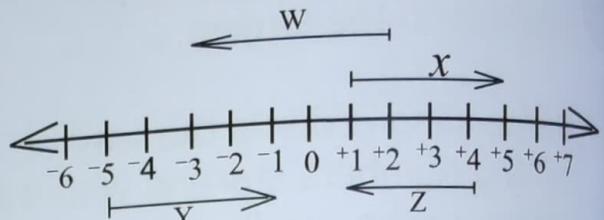
(ii)  $-2, -3, -4$ , and  $0$  in descending order

(iii)  $0, 1, 6, -4, -6$  in ascending order.

## Stating values of arrows on a Number line.

Example.

1. State the



As easy as shading!!

Just count the steps jumped as record but basing on the direction of the arrow given.



If the arrow is pointing to the left, we get a negative value but if it is pointing to the right, we get a positive value. No trick needed. So, basing on that explanation, the values for the above arrows shall be;

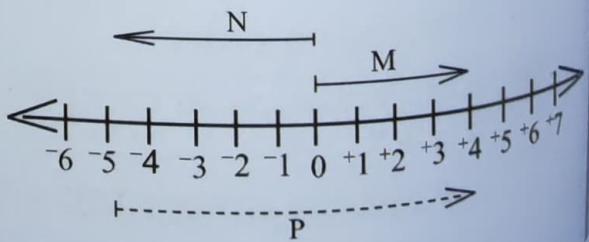
$$W = -5$$

$$Z = -3$$

$$Y = +4$$

$$\underline{X = +4}$$

2. Use the number line below to state the value of arrows M, N and P.



$$M = +4$$

$$N = -5$$

$$\underline{P = +9}$$

## ADDITION OF INTEGERS



Note Carefully!!

Similar signs give a plus (+) sign and differing signs give a minus (-) sign. i.e,

$$\begin{array}{ll} +(+)=+ & +(+) = +7 \\ -(-)=+ & -(-8) = +8 \\ +(-)=- & +(-3) = -3 \\ -(+)=- & -(+) = -7 \end{array}$$

### Examples.

1. Simplify:  $+6 + +4$

$$+6 + +4$$

$$+6 + (+4)$$

We put the 2<sup>nd</sup> integer in brackets as a sign of multiplication.

$$+6 + 4$$

After multiplying the + x + in brackets, we get a plus sign and the brackets disappear.

$$\underline{+10}$$

$$++++++ + +++ = +10$$

Work out:  $+3 + -7$

$$+3 + -7$$

$$+3 + (-7)$$

We put the 2<sup>nd</sup> integer in brackets as a sign of multiplication.

$$+3 - 7$$

After multiplying the + x - in brackets, we get a minus sign and the brackets disappear.

$$\underline{-4}$$

$$+++ + +--- = -4$$



Consider the +ves as cash and the -ves as a debt you owe and you have to pay. So, after paying all the 3 +ves you owe, you remained with a debt of 4 -ves as illustrated above

3. Simplify:  $-6 + -12$

$$-6 + -12$$

$$-6 + (-12)$$

$$-6 - 12$$

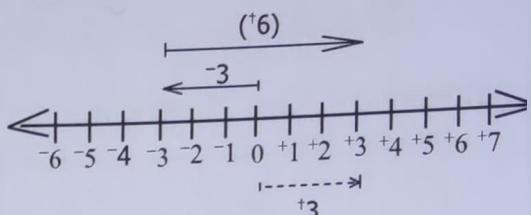
$$\underline{-18}$$

## Addition of integers on a Number line.

### Examples.

1. Use a number line to work out the following.

(i)  $-3 + +6$ .



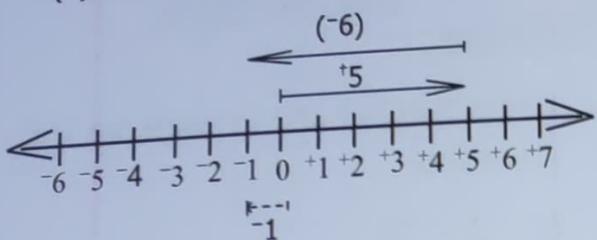
$$\underline{-3 + +6 = +3}$$



Read through the steps below carefully and let your teacher guide you for better understanding.

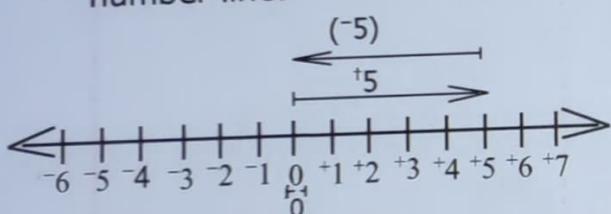
- ✓ We follow the order in which the integers have been given i.e. -3 first then the meaning of the plus sign and then the last integer +6.
- ✓ A negative arrow points to the left and the plus sign means that you have to start the second arrow immediately above the where the first arrow ended and if the second integer is positive, then we face to the right and if it is negative, then we point to the left.
- ✓ In addition of integers, the answer arrow (put below the number line) begins from where the first arrow started from and ends from where the second arrow has ended and then you write the steps it has moved and show the direction of movement with an arrow.

(ii)  $+5 + -6$



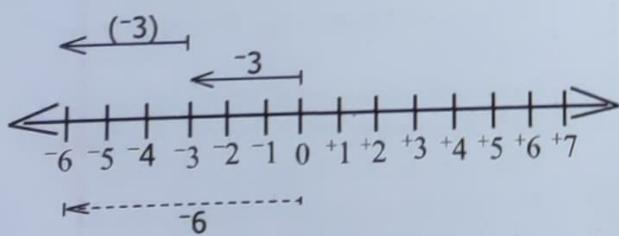
$$+5 + -6 = -1$$

(iii) Work out  $+5 + -5$  using a number line.



$$+5 + -5 = 0$$

(iv) Show  $-3 + -3$  on a number line.



$$-3 + -3 = -6$$

(v) Workout  $+4 + +2$  on a numberline.



$$+4 + +2 = +6$$

## Addition of integers using mind maps.

Examples.

1. Workout  $-3 + +6$  using mind maps.

$-$ ves	$+$ ves
+	*
+	*
+	*
	+
	+
	+

$$-3 + +6 = +3$$



❖ Just draw a table having negatives and positives or negatives and positives following the order of the given integers.

❖ Indicate the negatives asked for and positives and then start cancelling differing signs from either side and the side with the remainders is what takes the answer.

❖ If the question gives us similar signs, then we just add the signs from the two sides and we don't cancel.

2. Workout  $+2 + -5$  using mind maps

$+$ ves	/ /
$-$ ves	/ / - - -

$$+2 + -5 = -3$$

3. Workout  $-4 + -5$  using mind maps

$-$ ves	— — — —
$-$ ves	— — — — —

$$\underline{-4 + -5 = -9}$$

Here the signs given are the same and not differing, so, we don't cancel them. We just combine and count them to get the answer.

4. Work out  $+5 + +6$  using mind maps

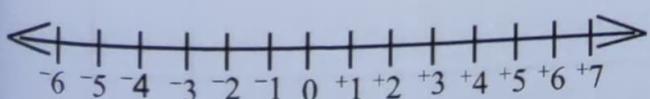
$+$ ves	$+$ ves
+	+
+	+
+	+
+	+
+	+
+	+

$$\underline{+5 + +6 = +11}$$

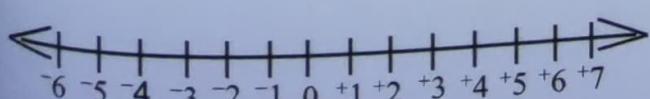
### Activity

.. Use the numberlines below to workout the following.

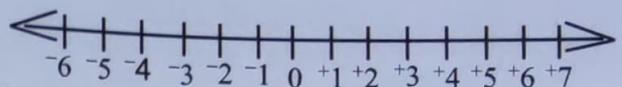
(i)  $+3 + -7$



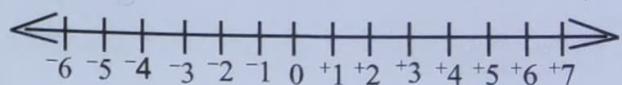
(ii)  $-3 + -2$



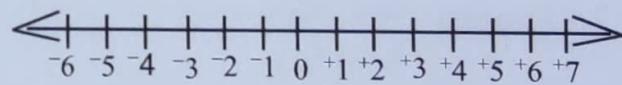
(iii)  $-5 + +8$



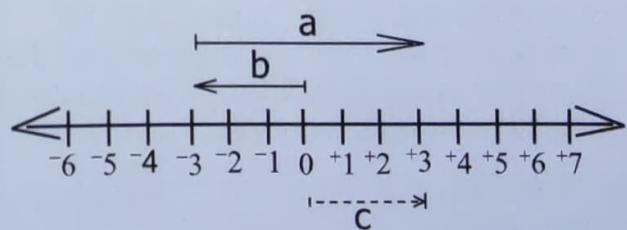
(iv)  $+4 + -2$



(v)  $+3 + +2$



2. Write the value of each of the shown arrows on the numberline below.



(i) a \_\_\_\_\_ (ii) b \_\_\_\_\_

(iii) c \_\_\_\_\_

Workout the additive inverse of the integer represented by arrow **c**.

## SUBTRACTION OF INTEGERS



### Note Carefully!!

Similar signs give a plus (+) sign and differing signs give a minus (-) sign. i.e,

$$\begin{array}{ll} +(+)=+ & +(+) = +7 \\ -(-)=+ & -(-8) = +8 \\ +(-)=- & +(-3) = -3 \\ -(+)=- & -(+) = -7 \end{array}$$

### Examples.

1. Simplify  $+4 - -6$ .

$$\begin{array}{r} +4 - (-6) \\ +4 + 6 \\ \hline +10 \end{array}$$

2. Simplify  $-5 - +4$

$$\begin{array}{r} -5 - (+4) \\ -5 - 4 \\ \hline -9 \end{array}$$

3. Work out  $-5 - +12$  using mind maps.

In subtraction of integers, to use mind maps, you need to first get the product from the multiplication and then you continue with the mind maps unlike in addition where you can use mind maps straight away. i.e.

$$\begin{array}{r} -5 - +12 \\ -5 - (+12) \\ -5 - 12 \end{array}$$

At this step, we can now use mind maps and since we have similar signs, we are just going to count them as illustrated below

-ves	- - - - -
-ves	- - - - - -

$$= -17$$

4. Workout:  $-10 - -3$  using mind map

$$\begin{array}{r} -10 - -3 \\ -10 - (-3) \\ -10 + 3 \end{array}$$

At this step, we can now use mind maps and since we have differing signs, we start cancelling one sign against the other and the side that remains with uncancelled signs determines the answer as illustrated below

-ves	+	+	+	-	-
-	-	-	-	-	-
+ves	+	+	+		

$$\underline{\quad -7 \quad}.$$

5. Simplify:  $+74 - -13$ .

$$\begin{array}{r} +74 - (-13) \\ +74 + 13 \\ \hline +87 \end{array}$$

### Trial Numbers.

1. Simplify:

$-7 - +12$	$+5 - -6$	$-4 - +13$
------------	-----------	------------

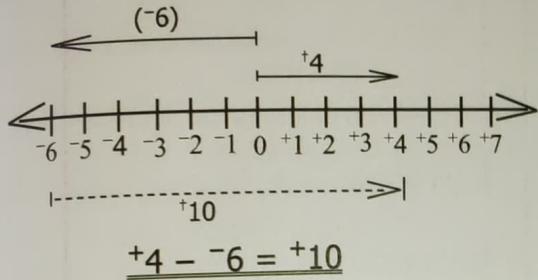
2. Work out using mind maps.

$$\begin{array}{r} +4 - +8 \\ -7 - -9 \end{array}$$

## Subtraction of integers using a number line

Examples.

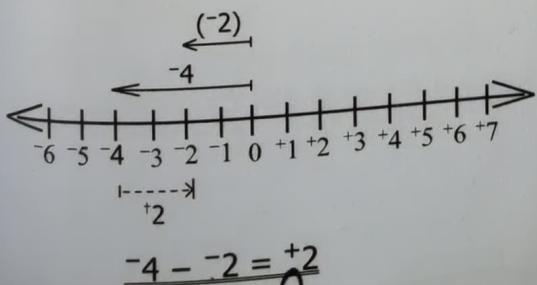
1. Work out  $+4 - -6$  using a number line.



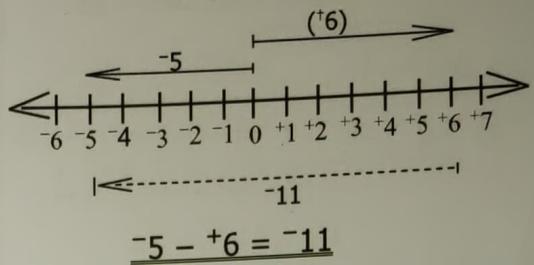
Read through the steps below carefully and let your teacher guide you for better understanding.

- ✓ In subtraction of integers, after drawing the first arrow, we go back to the starting point of that arrow and above it we start drawing the second arrow in the required direction.
- ✓ The answer arrow is drawn starting from where the second arrow has stopped to where the first arrow ended.
- ✓ The answer arrow usually points to the direction of the first drawn arrow.
- ✓ If the answer arrow points to the right, then your answer must be a positive answer, and if it points to the left, then the answer must be a negative answer.

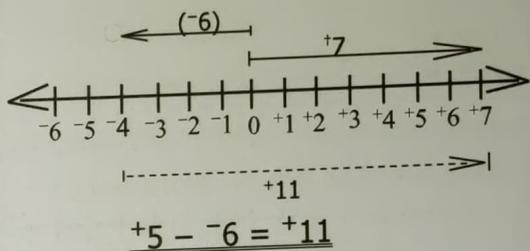
2. Work out  $-4 - -2$  on a number line.



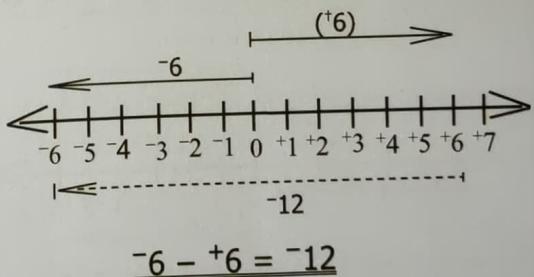
3. Workout:  $-5 - +6$  on a number line.



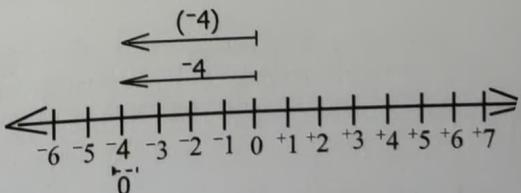
4. Show  $+7 - -4$  on a number line.



5. Show  $-6 - +6$  using a number line.



6. Show  $-4 - -4$  using a number line

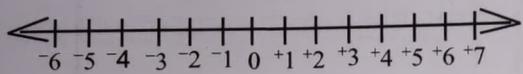


- ✓ Here, the answer is **0** because the second arrow stopped at the same point where the first arrow stopped, thus we don't show any direction on the answer arrow

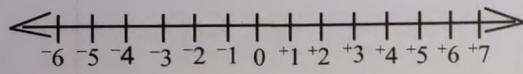
**Activity.**

1. Use the number lines below to workout.

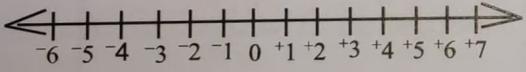
(i)  $-5 - +3$



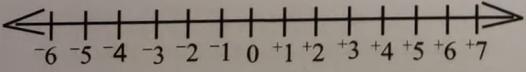
(ii)  $+6 - +3$



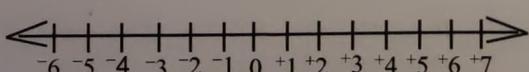
(iii)  $+7 - -3$



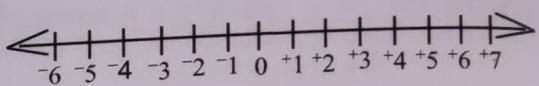
(iv)  $-4 - -3$



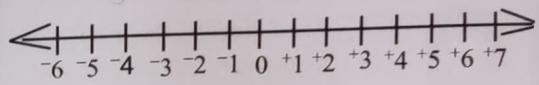
(v)  $-5 - -5$



2. Workout:  $-5 + +6$  on a number line



3. (i) Show  $-3 + -4$  on a number line.



(ii) Work out the additive inverse of answer arrow on the above number line.

4. Workout  $-4 - +6$  using mind maps.

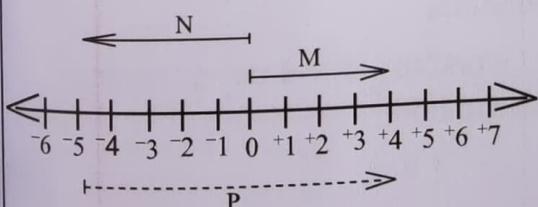
5. Simplify  $+4 - -4$ .

## Writing Mathematical sentences

- In writing Mathematical sentence, we usually consider the order of integers on the number line i.e., we look for the arrow which was drawn first, second and then the answer arrow.
- The operation (either addition or subtraction) is determined by looking at where the second started from. i.e. If the arrow was drawn immediately at the point where the first arrow ended, then we use **addition** but if the second arrow was drawn above where the first arrow started from, then we use **subtraction**.
- For each integer shown by the arrow on the number line, just count the steps skipped by the arrow as you record down but don't count the number where the arrow started at.

### Examples.

- Use the number line below to state the value of arrows M, N and P.



$$M = +4$$

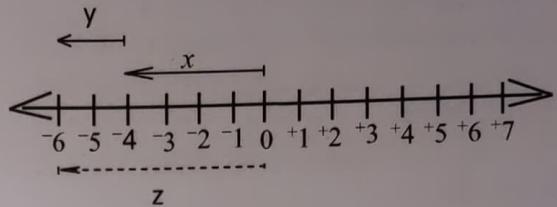
$$N = -5$$

$$\underline{P = +9}$$

- Write the mathematical sentence represented on the above number line

$m - n = p$  Here we use **subtraction**  
 $+4 - -5 = +9$  because the second arrow (N) was  
 drawn from where the first arrow(M) had started from

- Use the number line below to answer the questions that follow.



- Write the values of the letters on the arrows,

$$(i) x = \underline{-4}$$

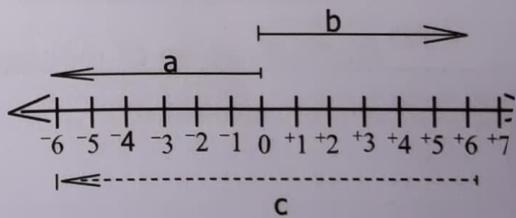
$$(ii) y = \underline{-2}$$

$$(iii) z = \underline{-6}$$

- Write the mathematical statement represented on the above number line.

$x + y = z$  Here we use **addition** because  
 $\underline{-4 + -2 = -6}$  the second arrow (y) was drawn immediately from where the first arrow(x) had stopped .

- Use the number line below to answer the questions that follow.



- Write the values of the letters;

$$(i) a = \underline{-6}$$

$$(ii) b = \underline{+6}$$

$$(iii) c = \underline{-12}$$

- Write the mathematical statement shown on the above number line.

$$a - b = c$$

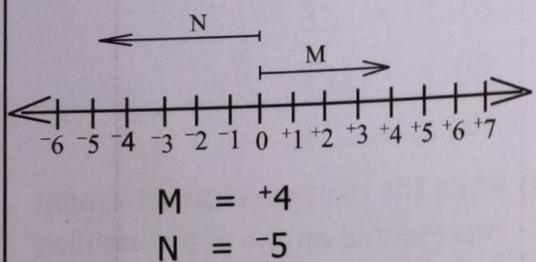
$$\underline{-6 - +6 = -12}$$

### Note carefully.

- In cases where a number line is drawn without the answer arrow, a **Mathematical statement** will be asked for instead of a Mathematical sentence.

### Example.

- Use the number line below to state the value of arrows M and N.



Write the mathematical statement represented on the above number line

$$\underline{M - N}$$

$$\underline{+4 - -5}$$

Here a statement has no answer

### Multiplication of integers.

#### Remember

- Multiplying integers of the similar signs gives a positive result. E.g.

$$- \times - = +$$

$$+ \times + = +$$

- Multiplying integers of different signs gives a negative result E.g.

$$- \times + = -$$

$$+ \times - = -$$

### Examples.

- Work out  $-6 \times -12$

$$\begin{aligned} -6 \times -12 & - \times - = + \\ & = \underline{\underline{+72}}. \end{aligned}$$

- Multiply:  $+6 \times +5$

$$\begin{aligned} +6 \times +5 & + \times + = + \\ & = \underline{\underline{+30}}. \end{aligned}$$

- Evaluate:  $-6 \times +4$

$$\begin{aligned} -6 \times +4 & - \times + = - \\ & = \underline{\underline{-24}}. \end{aligned}$$

- Simplify:  $+2 \times -16$

$$\begin{aligned} +2 \times -16 & + \times - = - \\ & = \underline{\underline{-32}}. \end{aligned}$$

### Using Repeated addition to multiply integers

#### Examples.

- Workout:  $3 \times 4$  using repeated addition.

$$3 \times 4$$

$$\begin{aligned} 4 + 4 + 4 & \text{ It means adding 4 three times not 3 four times} \\ & = \underline{\underline{12}}. \end{aligned}$$

- Work out  $6 \times 10$ .

$$6 \times 10$$

$$\begin{aligned} 10 + 10 + 10 + 10 + 10 + 10 & \text{ It means 10 six times not 6 ten times} \\ & = \underline{\underline{60}}. \end{aligned}$$

3. Use repeated addition to work out

(i)  $5 \times 17$

$$\begin{aligned} 5 \times 17 \\ (17+17)+(17+17)+17 \\ (34+34)+17 \\ 68+17 \\ = 85 \end{aligned}$$

(ii)  $4 \times 100$

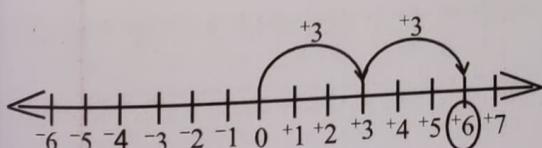
$$\begin{aligned} 4 \times 100 \\ (100+100)+(100+100) \\ 200+200 \\ = 400 \end{aligned}$$

### Multiplication of integers using a numberline

Examples.

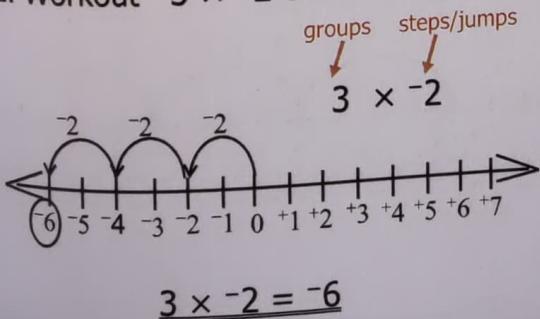
1. Workout  $+2 \times +3$  on a numberline.

$+2 \times +3$  groups steps/jumps  
It means to skip/jump 3 steps of  $+3$  on the numberline two (2) times or two groups of  $+3$  steps.

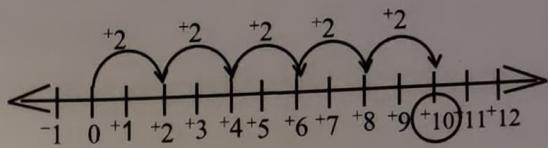


$$+2 \times +3 = +6$$

2. Workout  $3 \times -2$  on a numberline.



4. Work out  $5 \times +2$



$$5 \times +2 = +10$$

### Division of integers.

#### Remember

- Dividing integers of the similar signs gives a positive result. E.g.

$$- \div - = +$$

$$+ \div + = +$$

- Dividing integers of different signs gives a negative result E.g.

$$- \div + = -$$

$$+ \div - = -$$

### Examples.

1. Workout:  $-12 \div 3$ .

$$-12 \div +3.$$

$$(-1 \times 12) \div (1 \times 3)$$

$$-1 \times 1 \times (12 \div 3)$$

$$-1 \times 4$$

$$-4$$

OR

$$-12 \div 3.$$

$$\frac{-12}{3}$$

$$- \div + = -$$

$$-4$$

2. Work out  $-20 \div -5$ .

$$-20 \div -5.$$

$$(-1 \times 20) \div (-1 \times 5)$$

$$-1 \times -1 \times (20 \div 5)$$

$$+1 \times 4$$

$$+4$$

OR

$$-20 \div -5.$$

$$\frac{-20}{5}$$

$$- \div - = +$$

$$+4$$

**3. Work out**

(i)  $19 \div -1$

$$\begin{array}{r} 19 \div -1 \\ +\frac{19}{-1} \\ \hline -19 \end{array}$$

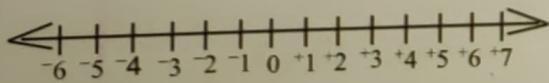
(ii)  $-8 \div -1$

$$\begin{array}{r} -8 \div -1 \\ -\frac{8}{-1} \\ \hline 8 \end{array}$$

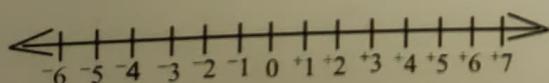
**Activity**

1. Work out the following using a numberline.

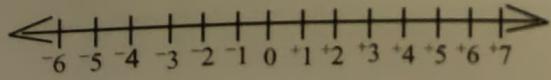
(iv)  $-2 + -4$



(v)  $+4 - -4$



(vi)  $-5 - -5$



**2. Workout the following**

(i)  $9 \div +1$

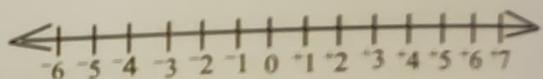
(iii)  $-21 \div +7$

(ii)  $45 \div -9$

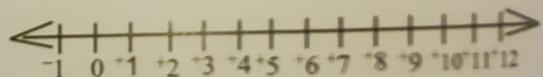
(iv)  $100 \div -10$

3. Multiply the following numbers using a numberline.

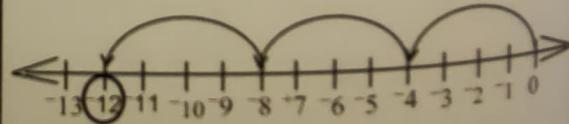
(i)  $2 \times -2$



(ii)  $+4 \times +3$



4. Write the mathematical sentence shown on the numberline below.



5. Work out the following.

(i)  $(+2 \div +5) \times +3$

(ii)  $-4 \times -4$  of  $-6$

(iii)  $(-3 + +4) \times -2$

(iv)  $+12 + (+3 \times -2)$

(v)  $+3 \times +3 \times -5$

### Finding the value of the unknown

#### Examples

(a) Find the value of  $k$  in  $+10 \div 2 = k$

$$+10 \div +2 = k$$

$$\begin{array}{r} +10 \\ \hline +2 \\ \cancel{+2} \\ \hline 5 \end{array} = k$$

$$\underline{\underline{k = 5}}$$

(b) Solve for  $y$ :  $y = -30 \div +3$

$$y = -30 \div +3$$

$$\begin{array}{r} -30 \\ \hline +3 \\ \cancel{+3} \\ \hline -10 \end{array}$$

$$\underline{\underline{y = -10}}$$

(c) Solve for  $m$ :  $-9 \div m = -3$

$$-9 \div m = -3$$

$$\begin{array}{r} -9 \\ \hline m \\ \cancel{m} \\ \hline -3 \end{array} = \frac{-3}{1}$$

Give  $-3$  a denominator of 1  
And then cross multiply

$$m \times -3 = -9 \times 1$$

$$-3m = -9 \quad \text{Divide both sides by the Co-efficient } -3$$

$$\begin{array}{r} -3m \\ \hline -3 \\ \cancel{-3} \\ \hline m \end{array} = \frac{-9}{-3} \div - = +$$

$$\underline{\underline{m = 3}}$$

(d) Solve for  $x$ :  $x \div -4 = +12$

$$x \div -4 = +12$$

$$\begin{array}{r} x \\ \hline -4 \\ \cancel{-4} \\ \hline 1 \end{array} = +12 \quad \text{Eliminate the denominator } -4 \text{ by multiplying it on both sides of the equation.}$$

$$\begin{array}{r} 1 \\ \cancel{-4} \\ \hline x \end{array} = +12 \times -4$$

$$\begin{array}{r} x \\ \hline + \times - = - \\ \cancel{+} \\ \hline -48 \end{array}$$

$$\underline{\underline{x = -48}}$$

**Practice makes perfect**

**Exercise.**



Solve for the unknowns in the equations below.

(i)  $+18 \div -2 = p$

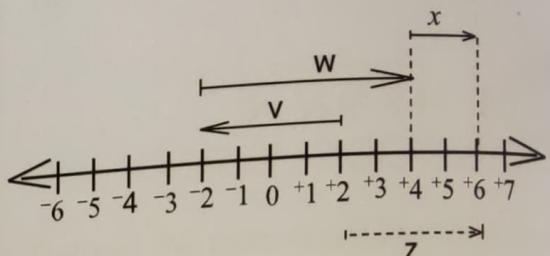
(ii)  $n = -105 \div -21$

(iii)  $-48 \div r = -6$

(iv)  $x \div +7 = -49$

2. What integer is 4 steps left of  $-3$ ?

3. Study the numberline below.



(i) Write integers represented by,

✓ V \_\_\_\_\_ x \_\_\_\_\_

✓ W \_\_\_\_\_ z \_\_\_\_\_

(ii) Write the mathematical sentence for the integers on the numberline.

4. With proper working, arrange the following integers in both ascending and descending order.

(i)  $-4, +5, 0, -3, +1$

Ascending order \_\_\_\_\_

Descending order \_\_\_\_\_

(i)  $-6, +1, 0, -1, +5$  and 3

Ascending order \_\_\_\_\_

Descending order \_\_\_\_\_

## APPLICATION OF INTEGERS

How can we use integers to solve daily life problems?

- We can use the knowledge of integers to know,
  - ✓ How old a person is, given the current year and the birth year.
  - ✓ Durations
  - ✓ Variations on temperature of our places or bodies.
  - ✓ To balance our expenses and income / books of accounts.

### Examples.

1. A man was born in 23BC and died at the age of 53 years. In which year did he die?

New year – Age	BC is for –
$+53 + (-23)$	AD is for +
$+53 - 23$	
$+30$ if the answer is + it means AD	

∴ He was born in 30AD.

2. Brian moved 6 spaces forward, then 3 spaces backward and 2 more spaces forward.  
How many spaces did he move forward?

$+6 + -3 + +2$	Forward steps are +
$+6 + (-3) + (+2)$	Backward steps are -
$+6 - 3 + 2$	
$+3 + 2$	
$+5$	

∴ He moved 5 spaces forward..

3. The temperature of a place was  $+35^{\circ}\text{C}$ . It rose by  $+3^{\circ}\text{C}$ . What is the new temperature?

$+35^{\circ}\text{C} + +3^{\circ}\text{C}$	the word rose is for +
$+35^{\circ}\text{C} + (+3^{\circ}\text{C})$	
$+35^{\circ}\text{C} + 3^{\circ}\text{C}$	
$+38^{\circ}\text{C}$	<u>∴ The new temperature is <math>+38^{\circ}\text{C}</math></u>

### NOTE

- Here, **BC** means a minus(negative) sign and **AD**(positive) means an addition sign.
- To get the year in which a person was born, we get the present year and we subtract your age.
- To get your age, we get the current (New) year and we subtract the year in which you were born (Old).
- Words like **rise/paid/lend/forward** mean a plus/positive sign whereas words like **dropped/borrowed/gave away/backward**, mean a minus or negative sign.

The temperature of a place was  $-15^{\circ}\text{C}$  in the morning, it rose to  $+12^{\circ}\text{C}$  by noon.  
Find the rise in temperature in  $^{\circ}\text{C}$ .

the word rose is for +

$$+12^{\circ}\text{C} - -15^{\circ}\text{C}$$

$$+12^{\circ}\text{C} - (-15^{\circ}\text{C})$$

$$+12^{\circ}\text{C} + 15^{\circ}\text{C}$$

$$+27^{\circ}\text{C}$$

∴ The temperature rose by  $+27^{\circ}\text{C}$

The temperature of Mbale town was  $+5^{\circ}\text{C}$  in the morning. It declined by  $+3^{\circ}\text{C}$ .  
What is the new temperature now?

$$+5^{\circ}\text{C} - +3^{\circ}\text{C}$$

$$+5^{\circ}\text{C} - (+3^{\circ}\text{C})$$

$$+5^{\circ}\text{C} - 3^{\circ}\text{C}$$

$$+2^{\circ}\text{C}$$

∴ The new temperature is  $+2^{\circ}\text{C}$

Paul had sh.300. He bought a pen of sh.500. How much money did he remain with?

$$+\text{sh.}300 - \text{sh.}500 \quad \text{He had } +300 \text{ and bought meaning he spent } -500$$

$$= -\text{sh.}200$$

He remained with a debt of sh.200

7. Kaima borrowed sh.3,000 and paid Sarah sh2,400. How much did he remain with?

$$-\text{sh}3,000 - \text{sh}2,400 \quad \text{He borrowed } -3000 \text{ and paid meaning he spent } -2400$$

$$= -\text{sh.}600$$

He remained with a debt of sh.600

8. Kijambo borrowed sh50,000 and then received sh72,000 as his monthly salary at the end of the month. How much did he remain with after paying back the money he had borrowed?

$$+\text{sh}72,000 - \text{sh}50,000 \quad \text{He received } +72,000 \text{ and paid meaning he spent } -50000$$
$$= +\text{sh}22,000$$

He remained with sh22,000

9. Moses bought water from a fridge at  $-15^{\circ}\text{C}$ . He waited when the water was at  $+5^{\circ}\text{C}$  and drunk it. What was the difference in the temperature of the water by the time he drank it?

$$+5^{\circ}\text{C} - -15^{\circ}\text{C}$$

the word difference means subtraction -

$$+5^{\circ}\text{C} - (-15^{\circ}\text{C})$$

$$+5^{\circ}\text{C} + 15^{\circ}\text{C}$$

$$+20^{\circ}\text{C}$$

The difference in the water was  $+20^{\circ}\text{C}$

10. A man was born in 20BC and died in 45AD. How old was the man by the time he died?

$$\text{Death year} - \text{Birth year} \quad \text{AD is for +}$$

$$+45 - (-20) \quad \text{BC is for -}$$

$$+45 + 20 \quad - X - = +$$

$$+65$$

He was 65 years by the time he died.

11. Kwooya was born in 15BC. He was elected as a member of LEGCO in 41AD. At what age was he elected to the LEGCO?

$$\text{Current year} - \text{Birth year} \quad \text{AD is for +}$$

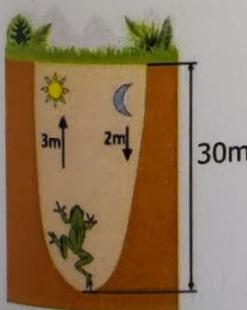
$$+41 - (-15) \quad \text{BC is for -}$$

$$+41 + 15 \quad - X - = +$$

$$+56$$

He was 56 years by the time he was elected to LEGCO.

12. A frog fell into a pit that was 30m deep. Each day, the frog climbs 3m but falls back 2m at night. How many days will it take to escape from the pit?



### Activity

1. A woman was born in 13BC and died in 74AD. How old was the woman when she died? (02 Marks)
  
2. A teacher arrived at the school 15 minutes before the normal time for the school to open. If the school was opened 40 minutes late, how long did he wait outside the school gate? (03 Marks)
  
3. Vincent misses his bus by 10 minutes. If the bus arrives every 10 minutes, how long does he have to wait for the next bus? (03 Marks)
  
4. Kiwanuka was born in 15BC and celebrated his birthday in 45AD. How old was he when he celebrated his birthday? (02 Marks)

5. Kaweesi arrived in Namboole for a football match 25 minutes before kickoff time but the kickoff was delayed by a quarter of an hour. Find the time Kaweesi spent in Namboole before the kickoff. (03 Marks)
6. Agnes moved 6 steps forward, she then moved 3 steps backwards and then 2 Steps forward. How many steps in all did she make? (02 Marks)
7. The temperature of Masaka town was  $13^{\circ}\text{C}$ . After it rained, the temperature dropped by  $4^{\circ}\text{C}$ . Find the new temperature of the place. (02 Marks)
8. The temperature of a place reduced from  $-32^{\circ}\text{C}$  to  $-53^{\circ}\text{C}$ . Find the decrease in the temperature. (02 Marks)
9. The temperature of a place increased from  $-5^{\circ}\text{C}$  to  $+15^{\circ}\text{C}$ . Find the rise in the temperature. (02 Marks)

10. After a COVID 19 upset, Kibilango used a Temperature Gun to measure himself. He found out that his normal body temperature had dropped by  $+5^{\circ}\text{C}$ , What was Kibilango's new body temperature? (02 Marks)



11. Betty was born in 15BC and died in 61AD. At what age did she die? (02 Marks)

12. Assuming that you are 12 years old in 2020. Find your birth year using the knowledge of integers you have learnt. (02 Marks)

12. Lets take it that you were born in 2002 and we are in 2023, how old are you? (02 Marks)

13. The school canteen lady was given sh25,000 for your breakfast snacks and on the day of going for a school tour, she gave you eats worth sh6,200 and then you met your uncle at the tour site and he deposited sh32,000 on the canteen lady's mobile money and after the tour, she gave you eats worth sh1,200 every day for 8 consecutive days. How much money do you think you still have left at Canteen? (05 Marks)



## More about application of integers.

### Examples.

1. A teacher awarded 3 marks for every correct answer and subtracted 2 marks for every wrong answer in a quiz of 30 questions.
- (a) If a girl answered 25 questions correctly, what was her final score?

**NOTE:** For one to get the final score, use the formula.

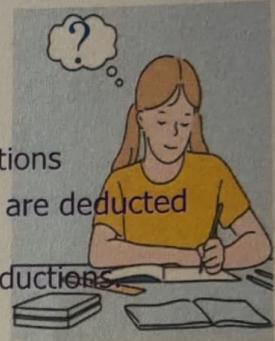
Correct answers X award – Wrong answers x deduct = Final score

$$(25 \times 3) - (5 \times 2)$$

Remember she got 3 marks for all the 25 correct questions

75 – 10 and since the quiz had 30 qns, she failed 5 for which 2 marks are deducted

65 marks meaning she scored 65 marks after the rewarding and deductions.



- (b) A boy failed 9 questions. Find his final score.

Here, we see that the boy failed 9 qns from the 30 qns asked. using the same formula.

Correct answers X award – Wrong answers x deduct = Final score

Lets find the number of correct answers he got having failed 9 out of the 30 questions

Correct answers

$$30 - 9 = 21$$

$$(21 \times 3) - (9 \times 2)$$

$$63 - 18$$

45 marks meaning he scored 45 marks after the rewarding and deductions.

- (c) What will be the score of a candidate who failed 15 questions?

Here, we see that the candidate failed 15 qns from the 30 qns asked. using the same formula

Correct answers X award – Wrong answers x deduct = Final score

Lets find the number of correct answers he/she got having failed 15 out of the 30 questions

Correct answers

$$30 - 15 = 15$$

$$(15 \times 3) - (15 \times 2)$$

$$45 - 30$$

15 marks meaning he/she scored 15 marks after the rewarding and deductions.

- .. In an interview, 5 marks are awarded for any correct response and 2 marks subtracted for wrong responses given. If the panel had 20 questions to answer.

(a) What was the score of a candidate who failed 3 questions?

Failed - 3 qns

Passed -  $20 - 3 = 17$  qns

So, the final score will be,

Passed x 5 marks - Failed x 2 marks

$$(17 \times 5) - (3 \times 2)$$

$$85 - 6$$

79 marks

meaning he/she scored 79 marks after the rewarding and deductions.

(b) Another candidate passed 11 questions. What was her final score?

Passed - 11 qns

Failed -  $20 - 11 = 9$  qns

So, the final score will be,

Passed x 5 marks - Failed x 2 marks

$$(11 \times 5) - (9 \times 2)$$

$$55 - 18$$

37 marks

meaning she scored 37 marks after the rewarding and deductions.

(c) How many questions were passed by the candidate who scored 51 marks?

**NOTE:** When given the final score, we have to let the questions asked (either the questions

Passed or failed) to be any letter then we substitute in the formula.

Final score = Correct answers X award - Wrong answers x deduct. So here, we shall say

Let the passed questions be **h**.

so, if she got **h** correct questions, that means to get the ones

Passed - **h** qns                  she failed, we get the total number of questions the panel

Failed -  $(20 - h)$  qns                  asked and we subtract the **h** questions she passed. i.e  $(20 - h)$



So, when we try to substitute in our formula we shall come up with,

5marks (passed qns) - 2marks (failed qns) = Final score    **OR**

$$\begin{aligned} & \quad - \times - = + \\ 5(h) - 2(20 - h) &= 51 \text{marks} \quad (\text{lets open the brackets properly}) \\ 5xh - (2 \times 20) - x - (2xh) &= 51 \end{aligned}$$

$$\begin{aligned} 5h - 40 + 2h &= 51 \quad (\text{then we collect like terms}) \\ 5h + 2h - 40 &= 51 \\ 7h - 40 + 40 &= 51 + 40 \end{aligned}$$

$$7h = 91 \quad (\text{then we divide each side by the co-efficient of } h \text{ which is 7})$$

$$\frac{1}{7}h = \frac{91}{7}$$

$$h = 13$$

(d) How many wrong responses were given by a candidate who scored 65 marks?

Let the wrong responses be  $w$ .

$$\begin{array}{ll} \text{wrong} & - w \text{ qns} \\ \text{correct} & - (20 - w) \text{ qns} \end{array}$$

So, when we try to substitute in our formula we shall come up with,  
5marks (correct qns) - 2marks (wrong qns) = Final score **OR**

$$5(20 - w) - 2(w) = 65 \text{ marks}$$

$$100 - 5w - 2w = 65$$

$$100 - 7w = 65$$

$$100 - 100 - 7w = 65 - 100$$

$$-7w = -35 \quad (\text{then we divide each side by the co-efficient of } w = -7)$$

$$\begin{array}{r} \frac{1}{-7w} \\ \hline \frac{-35}{-7} \end{array} = +$$

$$\underline{\underline{w = 5}} \quad \text{meaning 5 wrong responses were given}$$

3. When marking a test, a teacher awarded 3 marks for every correct response and subtracted a mark for every wrong answer in a test of 20 questions.

(a) What is the score of a candidate who failed 7 questions?

failed - 7 out of 20 qns

Passed - 20 - 7 = 13 qns

So, the final score will be,

Passed x 3 marks - Failed x 1 mark

$$(13 \times 3) - (7 \times 1)$$

$$39 - 7$$

$$\underline{\underline{32 \text{ marks}}}$$

(b) What will be the score of a candidate who passed 17 questions?

Passed - 17 out of 20 qns

Failed - 20 - 17 = 3 qns

So, the final score will be,

Passed x 3 marks - Failed x 1 mark

$$(17 \times 3) - (3 \times 1)$$

$$51 - 3$$

$$\underline{\underline{48 \text{ marks}}}$$

(c) How many correct answers did a candidate who scored 44 marks give?

Let the correct answers be  $m$ .

Correct answers  $- m$

Wrong answers  $- (20 - m)$

Substitute in our formula,  
3marks (correct ans)  $- 1$ mark (wrong ans) = Final score    OR

$$\begin{aligned} 3(m) & \quad 1(20 - m) = 44 \text{ marks} \\ 3m - 20 + m & = 44 \\ 3m + m - 20 & = 44 \\ 4m - 20 + 20 & = 44 + 20 \\ 4m & = 64 \\ \frac{4m}{4} & = \frac{64}{4} \\ m & = 16 \end{aligned}$$

(c) How many wrong answers were given by a candidate who scored 16 marks?

Let the wrong answers be  $n$ .

wrong answers  $- n$

correct answers  $- (20 - n)$

Substitute in our formula,  
3marks (correct ans)  $- 1$ mark (wrong ans) = Final score    OR

$$\begin{aligned} 3(20 - n) - 1(n) & = 16 \text{ marks} \\ 60 - 3n - n & = 16 \\ 60 - 4n & = 16 \\ 60 - 60 - 4n & = 16 - 60 \\ -4n & = -44 \\ \frac{-4n}{-4} & = \frac{-44}{-4} \\ n & = 11 \end{aligned}$$

Kamuntu has a total of 30 ducks and goats in his farm. The animals have 82 legs altogether. How many animals of each category are in the farm?

**NOTE:** At the farm, there are a total of 30 animals both ducks and goats but when Kamuntu counted the legs on both ducks and goats, they were 82 in total. But remember that Ducks have 4 legs and Goats have 2 legs each. So if we try to let one category be letter k, We shall have such equations

Let the number of ducks be **k**.

Ducks - **k** (If the ducks are **k**, and there are 30 animals in the farm, then the goats will be  $30 - k$ )  
 Goats -  $(30 - k)$

So, since all the animals have 82 legs in total, we can form a formula that states,  
 'legs (ducks) + 4legs (goats) = Total number of legs **OR**

$$\begin{aligned}
 & 2(k) + 4(30 - k) = 82 \text{ legs} \quad (\text{lets open the brackets properly}) \\
 & 2xk + (4 \times 30) + x - (4xk) = 82 \\
 & 2k + 120 - 4k = 82 \quad (\text{then we collect like terms}) \\
 & 2k - 4k + 120 = 82 \\
 & -2k + 120 - 120 = 82 - 120 \\
 & -2k = -38 \quad (\text{then we divide each side by the co-efficient of } k^{-2}) \\
 & \frac{-2}{2} k = \frac{-38}{2} \\
 & k = 19
 \end{aligned}$$

So, basing on our equations, we can now see that

**Ducks** are  $(k)$  and **Goats** are  $(30 - k)$  (when we substitute the value of **k**, we get)

$$\begin{array}{ll}
 \text{Ducks are } (k) & \text{and } \text{Goats are } (30 - k) \\
 \text{k} & \\
 \underline{19 \text{ ducks}} & \underline{30 - k} \\
 & \underline{30 - 19} \\
 & \underline{11 \text{ goats}}
 \end{array}$$

- (d) From the total of 82 legs on all the 30 animals in the farm, determine the total number of legs each ducks and goats have respectively.

$$\begin{array}{lll}
 \text{Ducks are } 19 \text{ with 2 legs each} & \text{and} & \text{Goats are } 11 \text{ with 4 legs each} \\
 \underline{19 \times 2} & & \underline{11 \times 4} \\
 & & \underline{44 \text{ legs}}
 \end{array}$$

Annet raises only chicken and pigs in her farm. When she counted their heads, they were 29 and when she counted their feet, they were 80. How many chicken and pigs are in Annet's farm?

**Summary:** ✓ Basing on the heads, the total of chicken and pigs at the farm is 29.

✓ Chicken always have 2 legs each and Pigs have four legs each.

✓ They have told us that all the two combined have a total of 80 legs but they

Have not specified legs for any one type in particular, so we have to let one of them

Let the number of chicken be  $x$ .

Chicken  $- x$

Pigs  $- (29 - x)$

So, since all have 80 legs in total, we can form a formula that states,  
 $2\text{legs (chicken)} + 4\text{legs (pigs)} = \text{Total number of legs}$  **OR**

$$\begin{aligned} 2(x) + 4(29 - x) &= 80 \text{ legs} \\ 2x + 116 - 4x &= 80 \\ 2x - 4x + 116 &= 80 \\ -2x + 116 - 116 &= 80 - 116 \\ -2x &= -36 \\ \cancel{-2}^1 x &= \cancel{-36}^{18} \\ \underline{-2}_1 & \\ x &= 18. \end{aligned}$$

So, basing on our equations, we can now see that

**Chicken** are  $(x)$  and **Pigs** are  $(29 - x)$

$$\begin{array}{ll} x & 29 - x \\ \underline{18 \text{ chicken}} & \underline{29 - 18} \\ & \underline{11 \text{ pigs}} \end{array}$$

- (e) From the total of 80 legs on all the 29 chicken and pigs in the farm, determine the total number of legs chicken and pigs have each.

**Chicken** are 18 with 2 legs each and **Pigs** are 11 with 4 legs each

$$\begin{array}{ll} 18 \times 2 & 11 \times 4 \\ \underline{36 \text{ legs}} & \underline{44 \text{ legs}} \end{array}$$

Proof??

$$\begin{array}{r} \text{Chicken + Pigs} \\ 18 + 11 \\ \hline 29 \end{array}$$

Legs

$$\begin{array}{r} \text{Pigs & Chicken} \\ 44 + 36 \\ \hline 80 \end{array}$$

## Activity

A teacher awarded 5 marks for every correct answer and subtracted 2 marks for every wrong answer given in a quiz of 20 questions.

- (a) How many marks were scored by a candidate who;
- (i) failed 2 questions?      (ii) failed 10 questions?      (02 Marks @)
- (iii) passed 13 questions?      (iv) passed 8 questions?      (02 Marks @)
- (b) How many wrong answers were given by a candidate who scored 72 marks?  
(02 Marks)
- (c) Assuming you were part of the candidates who took up that Quiz and results came back when you are having 86 marks, how many correct and wrong answers would you have given?      (05 Marks)

2. A Kadodi's farm, there are a total of 12 sheep and cocks. If they have 32 legs altogether; (03 Marks)
- (a) How many cocks are there?
- (b) Find the number of sheep at Kadodi's farm. (02 Marks)
- (c) If Kadodi decided to sell  $\frac{2}{4}$  of the cocks and  $\frac{1}{2}$  of the sheep on his farm, at sh.25,000 each cock and sh.130,000 each sheep; (05 Marks)
- (i) How much money will he get from the total sales?
- (ii) Assuming he used  $\frac{1}{4}$  of that money to pay his son's school fees and sh.70,000 to pay a debt, how much money will he remain with? (03 Marks)