DIVINE EDUCATION CENTRE(DEC)

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# MATHEMATICS

# LESSON NOTES TERM THREE 2023

# (Abridged curriculum)

## PRIMARY SIX

TOPIC 10

# LINES, ANGLES AND GEOMETRIC SHAPES

An angle is the amount of turning between two straight lines at a fixed point.

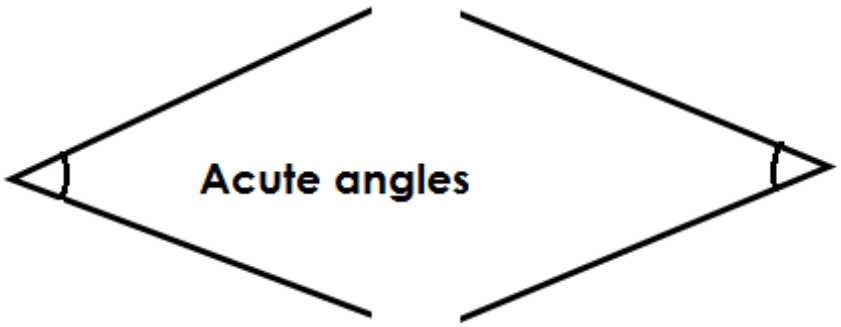
## Types of angles

- Acute angles
- Obtuse angles
- Right angles
- Reflex angles
- Straight line angles
- Centre angles

## ACUTE ANGLES

Acute angles are angles less than $90^{o}$ e.g., $60^{o}$, $80^{o}$, $18^{0}$, $30^{0}$, $88^{0}$, $35^{0}$, $45^{o}$, $1^{o}$, $50^{o}$, $22\frac{1}{2}^{o}$, $75^{o}$, etc.

## Illustration




## Obtuse angles

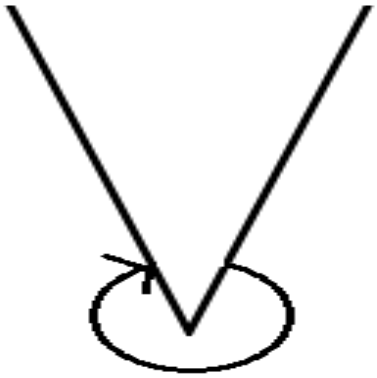
These are angles that are greater than $90^{o}$ but less than $180^{o}$ i.e., $91^{o}$, $179^{o}$, $91^{o}$, $105^{o}$, $98^{o}$, $150^{o}$ etc.

## Illustration

## REFLEX ANGLES

- These are angles greater than $180^{o}$ but less than $360^{o}$ e.g., $181^{o}$ – $359^{o}$ e.g., $190^{o}$, $200^{o}$, $240^{o}$, $354^{o}$, etc.

**Illustration**



## STRAIGHT LINE ANGLES

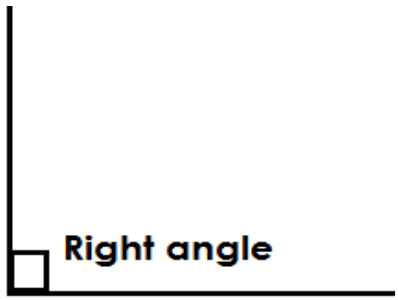
A straight-line angle is an angle that measures $180^{o}$.

**Illustration**

## RIGHT ANGLES

A right angle is an angle that add up to $90^{o}$.

**Illustration**

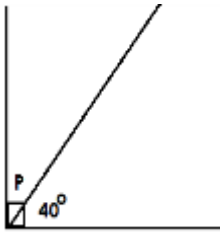


## COMPLEMENTARY ANGLES

These are two or more angles that add up to $90^{o}$.

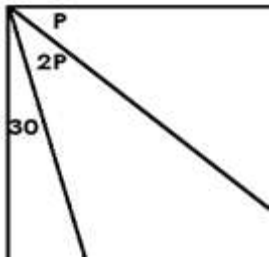
**Examples.**

1. Find the value of P in the figure below.




$$P + 40^{o} = 90^{o}$$
$$P + 40^{o} - 40^{o} = 90^{o} - 40^{o}$$
$$P = 50^{o}$$

2. Find the value of P in the figure below.




soln

$P + 2P + 30^{O} = 90^{O}$

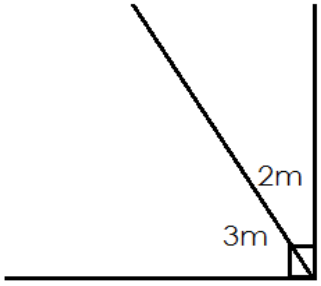
$3P + 30^{O} = 90^{O}$

$3P + 30^{O} - 30^{O} = 90^{O} - 30^{O}$

$\frac{3P}{3} = \frac{60}{3}$

$P = 20^{O}$

3. Find the value of M




soln

$3m + 2m = 90^{O}$

$5m = 90^{O}$

$\frac{5m}{5} = \frac{90^{O}}{5}$

$m = 18^{O}$

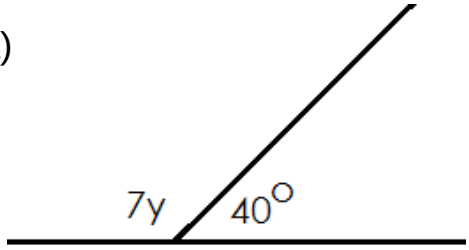
## SUPPLEMENTARY ANGLES

These are two angles on a straight line that adds up to $180^o$.

**Examples.**

Find the value of the unknown in the following.

a)



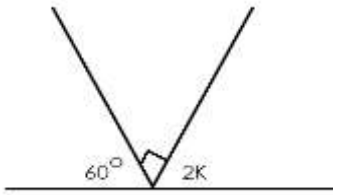

$7y + 40^\circ = 180^\circ$ (suppLs)

$7y + 40^\circ - 40^\circ = 180^\circ - 40^\circ$

$\frac{7y}{7} = \frac{140}{7}$

$Y = 20^\circ$

b)




$2K + 60^\circ + 90^\circ = 180^\circ$

$2K + 150^\circ = 180^\circ$

$2K + 150^\circ - 150^\circ = 180^\circ - 150^\circ$

$\frac{2}{2} = \frac{30}{2}$

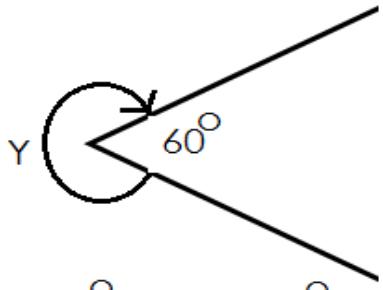
$K = 15^\circ$

## ANGLES AT A POINT

Are angles which add up to $360^0$.

**Examples.**

Find the Size of angle y

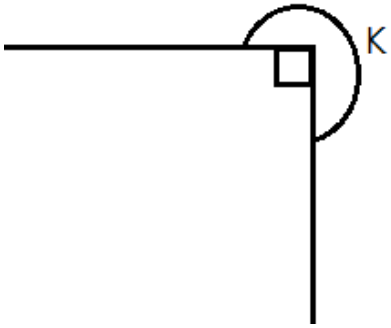



$Y + 60^\circ = 360^\circ$

$Y - 60^\circ - 60^\circ = 360^\circ - 60^\circ$

$Y = 300^\circ$

2. Find the value of K

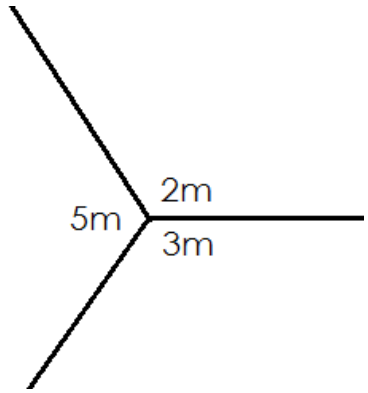



$K + 90^{O} = 360^{O}$ (*L* at a point)

$K + 90^{O} - 90^{O} = 360^{O} - 90^{O}$

$k = 270^{O}$

3. Find the value of m.




$5m + 2m + 3m = 360^{O}$

$10m = 360^{O}$

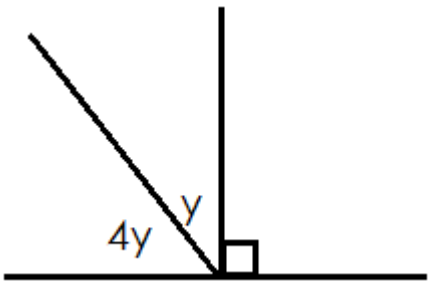
$\frac{10m}{10} = \frac{360^{O}}{10}$

$m = 36$

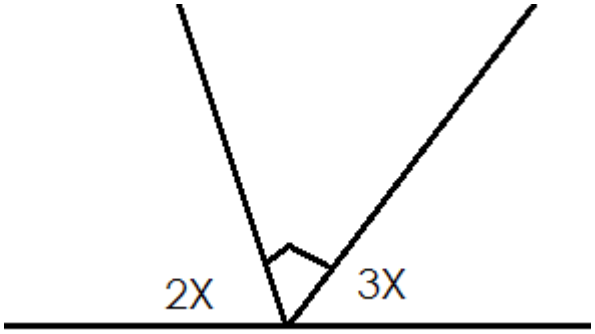
**Activity:**

1. Calculate the value of the unknown angle.

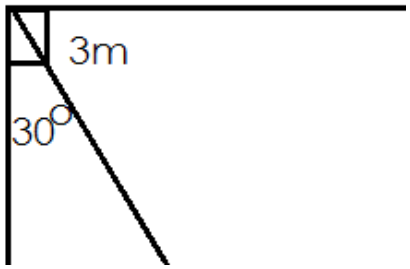
a)



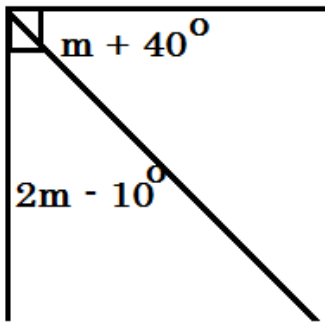

b)



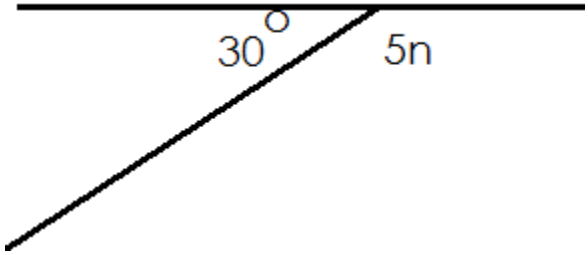
c)



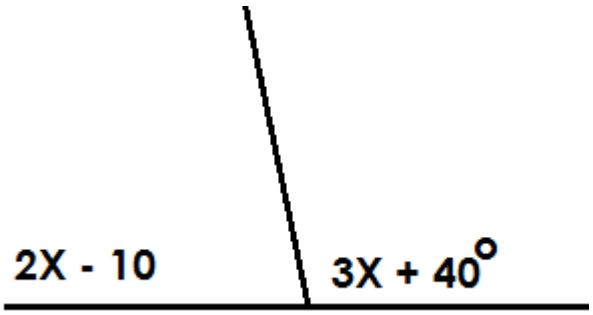

d)



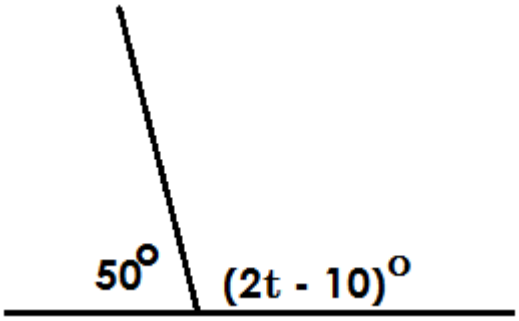

e)



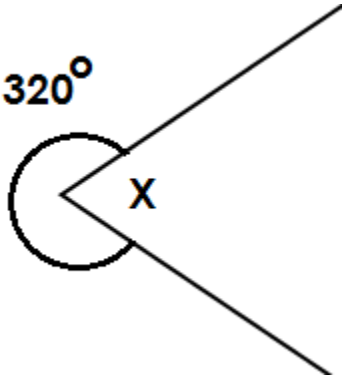

f)



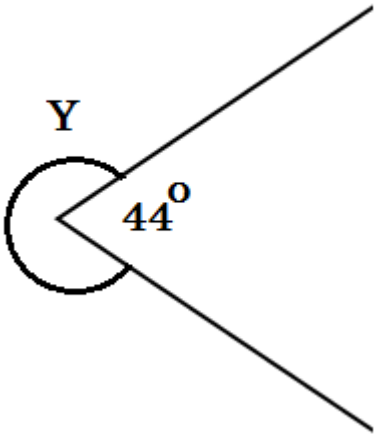

g)




h)




i)



## FINDING COMPLEMENT OF COMPOUND ANGLES.

1. Find the complement of Y

   Comp. = $90^0$ - Y

2. Find the complement of 2X

   Comp. = **90 – 2x**

1. Find the complement of $2Y - 30^0$

   Comp. = $90^o - (2y - 30)^o$

   $= 90^o - 2y + 30^o$

   $= 90^o + 30^o - 2y$

   $= \mathbf{120^o - 2y}$

4. Find the complement of $2P + 60^o$.

   $90^o - (2P + 60^o)$

   $90^o - 2p - 60^o$

   $90^o - 60^o - 2p$

   $30^o - 2p$

5. Find the complement of $2K + 40^o$

   **Soln.**

   $90^o - (2K + 40^o)$

   $90^o - 2K - 40^o)$

   $90^o - 40^o - 2K$

   $50^o - 2k$

Find the complement of the following: -

a) 2m

b) $y + 40^o$

c) $K - 30^o$

d) $3m - 42^o$

e) $2y + 36^o$

## FINDING SUPPLEMENT OF COMPOUND NUMBERS

1. Find the supplement of K.
   **Soln**.

   $180^{o} - K$

2. Find the supplement of 2m
   **Soln**.

   $180^{o} - 2m$

3. Find the supplement of $2K + 40^{o}$
   **Soln**.

   $180^{o} - (2k + 40)^{o}$

   $180^{o} - 2k - 40^{o}$

   $180^{o} - 40^{o} - 2k$

   $140^{o} - 2k$

4. Find the supplement of $m + 70^{o}$
   **Soln.**

   $180^{o} - (m + 70)^{o}$

   $180^{o} - m - 70^{o}$

   $180^{o} - 70^{o} - m$

   $110^{o} - m$

**Activity:**

Finding the supplement of the following angles:

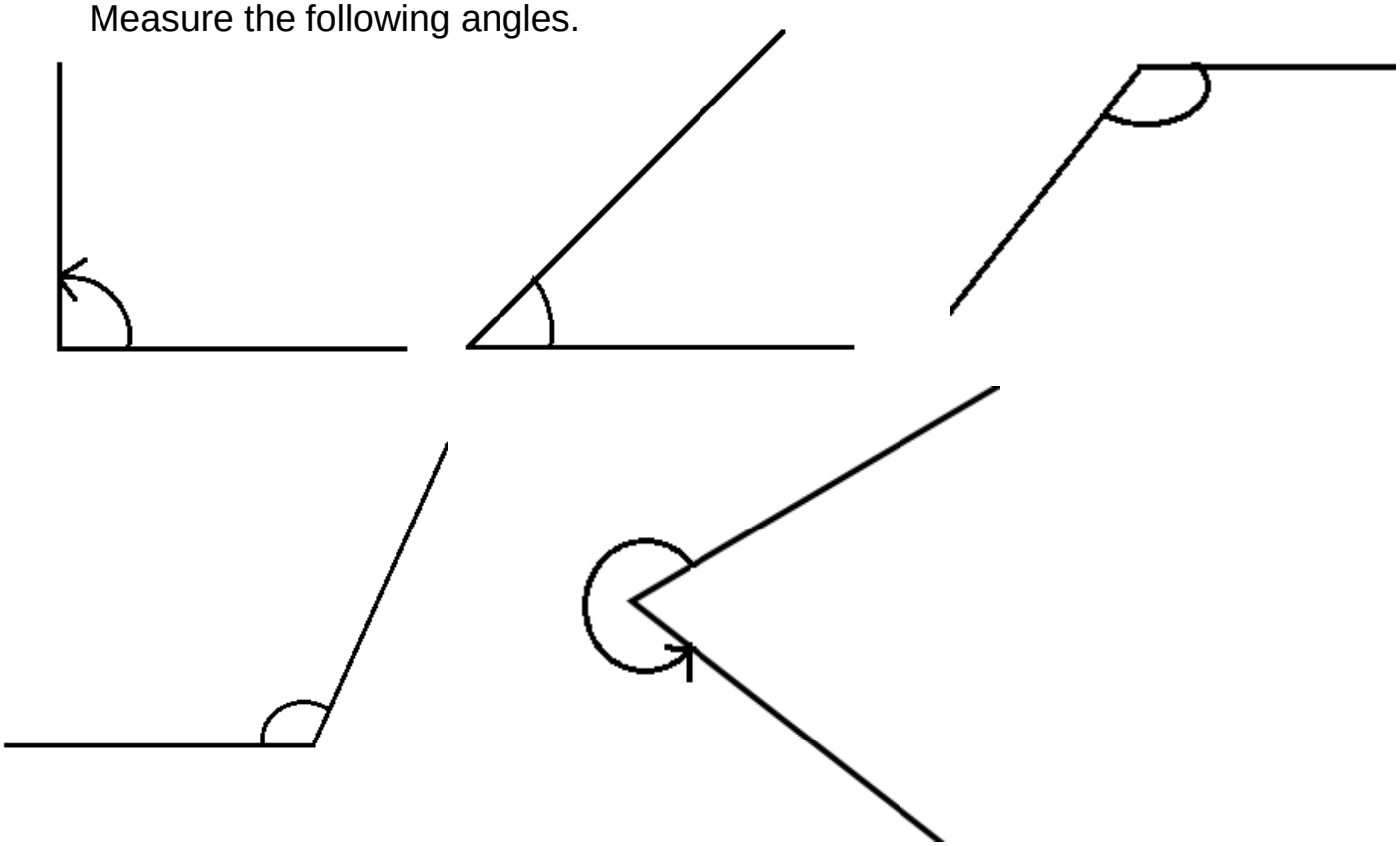
a) m
b) 3K
c) $2y - 120^{o}$
d) $y - 60^{o}$
e) $2y + 36^{o}$
f) $30^{o} - 2p$

## DRAWING AND MEASURING ANGLES

- Angles are measured using a protractor.
- The learners should choose the scale to use i.e., either inner scale or outer scale.

**Examples.**

Measure the following angles.



## CONSTRUCTING ANGLES USING A PAIR OF COMPASSES.

a) $90^{o}$ b) $60^{o}$ c) $75^{o}$ d) $120^{o}$

## Angles got by bisecting

a) $30^{o}$ (bisect $60^{o}$)

b) $150^{o}$ = (construct $30^{o}$ and name $150^{o}$)

c) $45^{o}$ = (bisect $90^{o}$)

d) $135^{o}$

**Activity:**

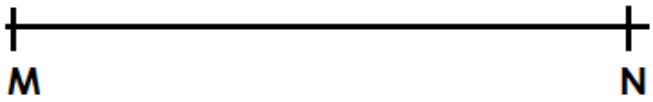
Construct the following angles: -

a) $90^o$, $45^o$, $60^o$, $120^o$, $145^o$, $30^o$, $105^o$

## Bisecting lines and angles.

### Bisecting a line

- Draw a given line and label it (MN).
- Place the compass needle at the two points (M and N) and mark arcs above and below.
- It forms two intersecting arcs up and down and draw a line to join the two intersecting arcs.
  a) Bisect line MN

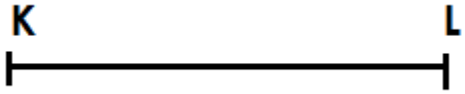



**Activity:**

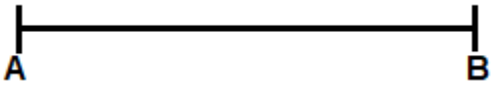
Bisect the following lines

a)

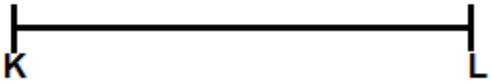
b)




c)




D)




**BISECTING ANGLES.**

Bisecting an angle is to divide the given angle into two equal parts.

### Example I

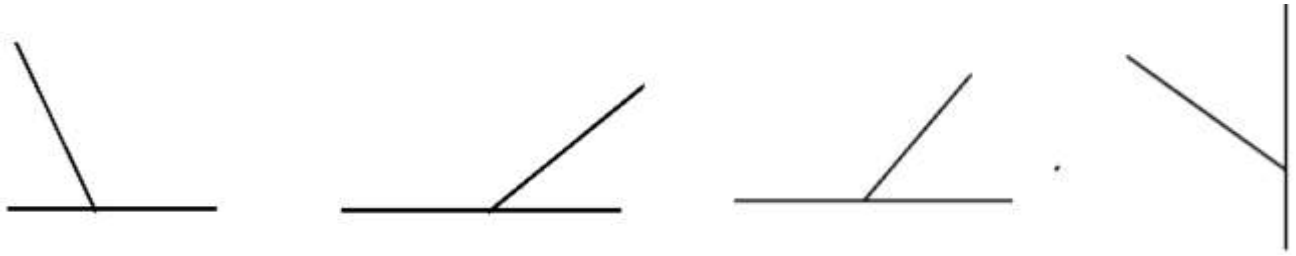
Using a pair of compasses, a ruler and a pencil only. Bisect the given angles below.

**Procedure:**

- Place the needle of the pair of compasses at the fixed point.
- Make two arcs on the two lines that are meeting at the fixed point.
- Transfer the needle to any arcs made and make the upper arc.
- Transfer the needle of the compass to the second arc and intersect the arc made to form the point of intersection or point of bisection.
- Join the point of intersection to the point of origin (fixed point) using a ruler and a pencil only.

**Exercise.**

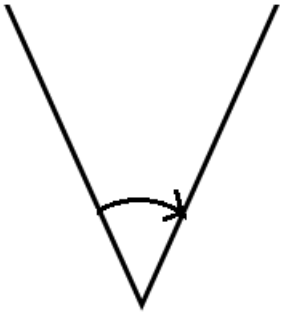
Using a pair of compasses, a ruler and a pencil only, bisect the obtuse angle in the diagram below.



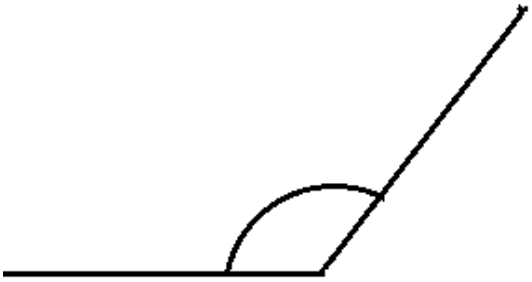
**Activity:**

Using a pair of compasses, a ruler and a pencil only, bisect the given angle.

a)

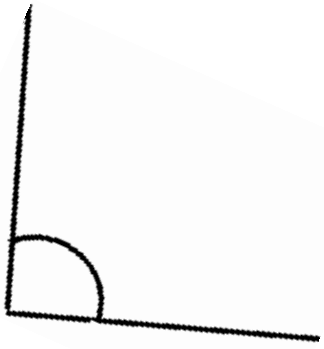


b)

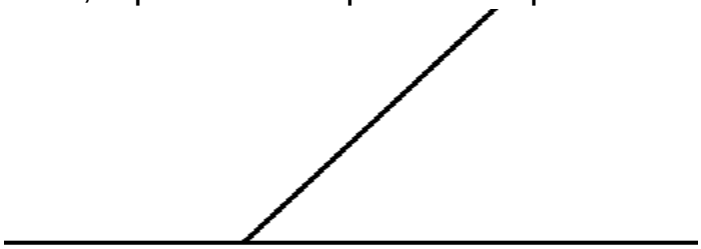


c)

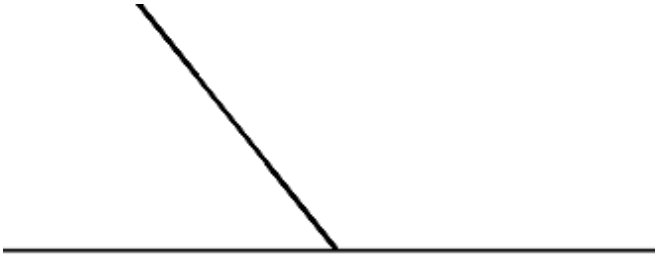
d)



Using a ruler, a pencil and a pair of compasses only. Bisect the acute angle.



Using a ruler, a pencil and a pair of compasses only. Bisect the obtuse angle.



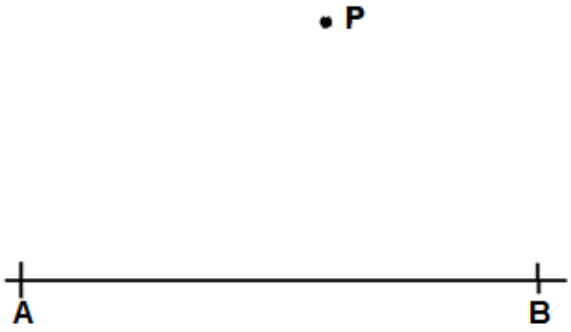
## DROPPING A PERPENDICULAR FROM A GIVEN FIXED POINT

### Example I

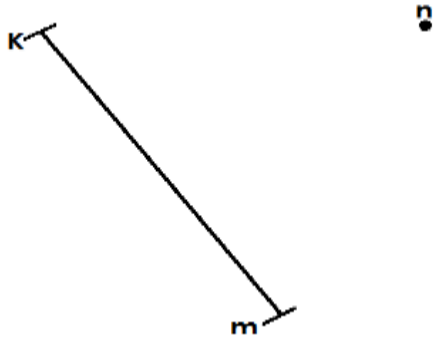
Using a pair of compasses, a ruler and a pencil, drop a perpendicular from point P through line AB at point K.

### Procedure:

- Place the needle at point P.
- Adjust the compass such that you make two acres on the given line.
- Transfer the needle to any of the arcs made and construct lower arc.
- Transfer the needle of the pair of compasses to the second arc and intersect the first arc to form a point of intersection.
- Join the point of intersection to point P using a pencil and a ruler.



1. Using a pair of compasses, a ruler and a pencil only. Drop a perpendicular from n to meet line KM at point S.

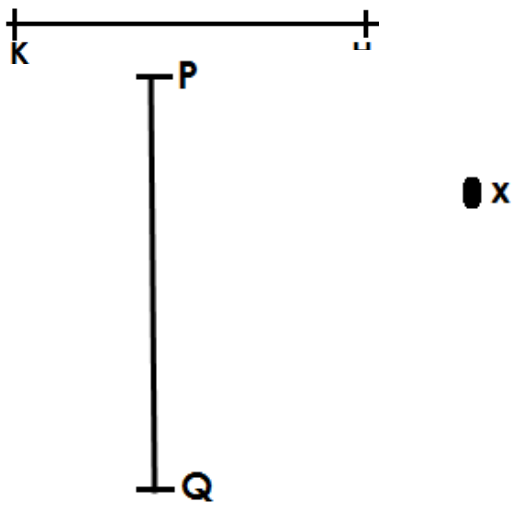


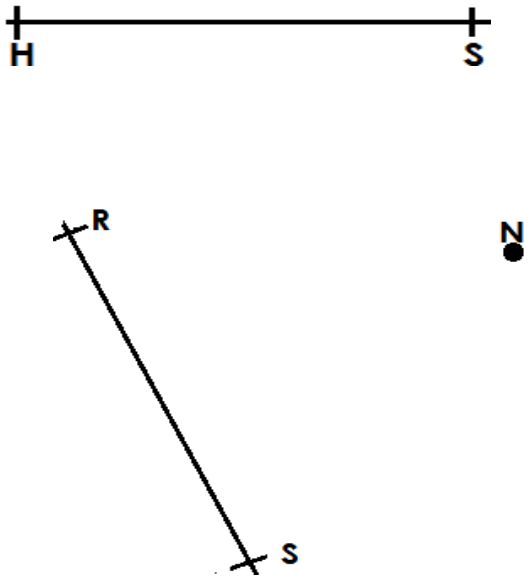

**Exercise.**

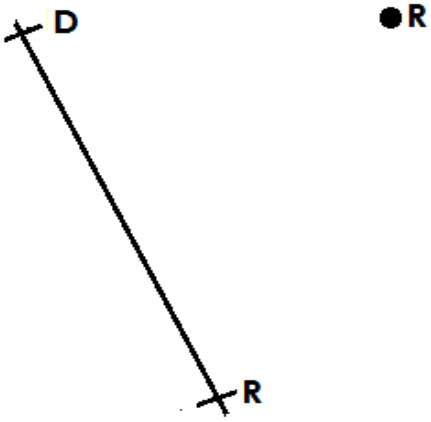
Using a pair of compasses, a ruler and a pencil. Drop a perpendicular from a given point to meet a given line.

a)


b)


c) 


d) 

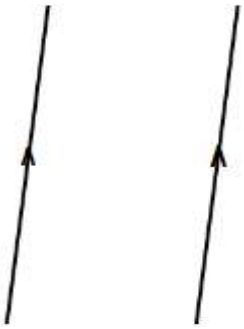

e) 

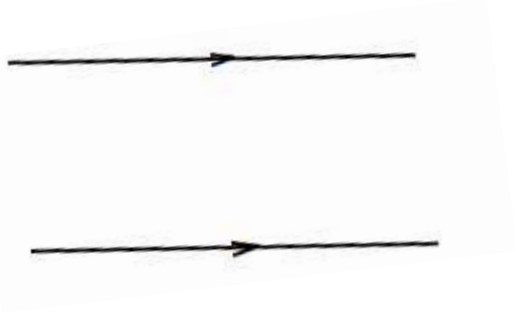
## ANGLES FORMED BETWEEN PARALLEL LINES.

### PARALLEL LINES.

These are lines that cannot meet because they have the same distance apart and running in the same direction.

**symbol**



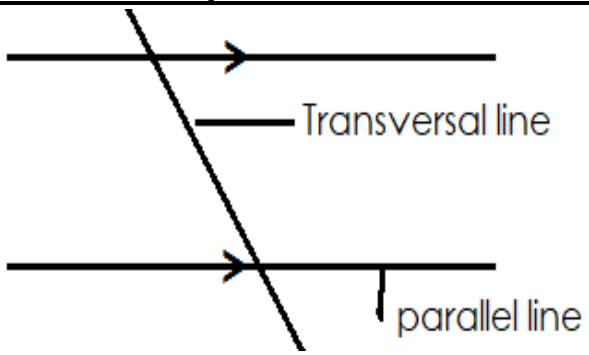


If two or more lines are crossed by a line (Transversal line), different angle properties will be formed.

**These include:**

- Co-interior angles
- Co-exterior angles
- Alternating angles
- Corresponding angles
- Vertically opposite angles
- Supplementary angles
- Complementary angles

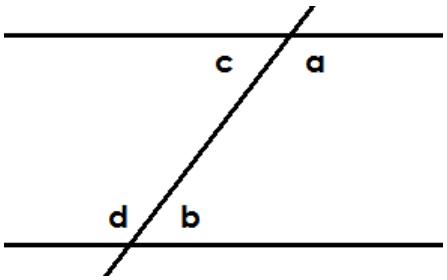
**Illustration of parallel lines with a transversal line.**




**Co-interior angles**

- They add up to $180^{o}$.
- They are found inside parallel lines.
- They are formed on the same side of the traversal line.
- One angle is acute and another angle is obtuse.

**Illustration**

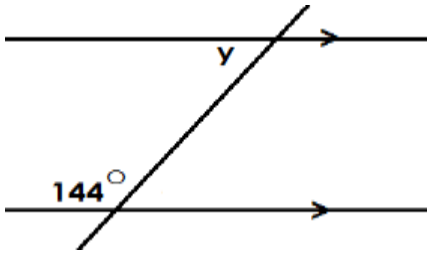



$\angle a + \angle b = 180^{\circ}$ (co-int $\angle$s)

$\angle c + \angle d = 180^{\circ}$ (co-int $\angle$s)

**Examples.**

1. Find the value of Y.

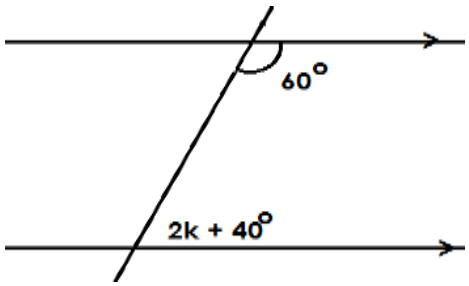



$y + 44^{\circ} = 180^{\circ}$ (Co-int $\angle$ s)

$y + 144^{\circ} - 144^{\circ} = 180^{\circ} - 144^{\circ}$

$\mathbf{y = 36^{\circ}}$

2. Find the value of k.




$2K + 40^{\circ} + 60^{\circ} = 180^{\circ}$ (co-int L s)

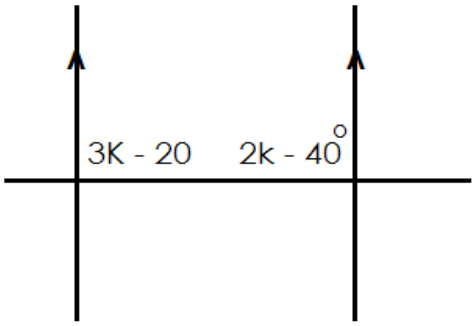
$2K + 100^{\circ} = 180^{\circ}$

$2K + 100^{\circ} - 100^{\circ} = 180^{\circ} - 100^{\circ}$

$\frac{2K}{2} = \frac{80}{2}$

$\mathbf{K = 40^{\circ}}$

3. Find the value of K.




$3K - 20^{o} + 2K - 40^{o} = 180^{o}$ (Co-int L s)

$3K + 2K - 20^{o} - 40^{o} = 180^{o}$

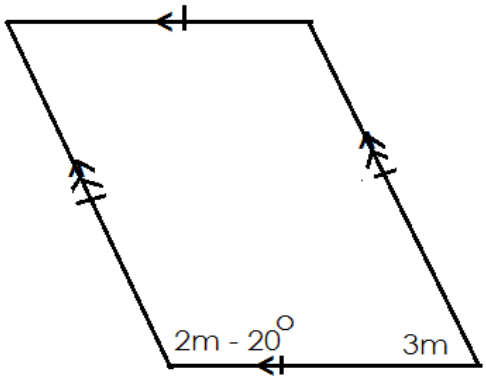
$5K - 60^{o} = 180^{o}$

$5K - 60^{o} + 60^{o} = 180^{o} + 60^{o}$

$\frac{5K}{5} = \frac{240}{5}$

$K = 48^{o}$

4. Find the value of m in the figure below.




$2m + 3m - 20^{o} = 180^{o}$ (Co- int Ls)

$5m - 20^{o} = 180^{o}$

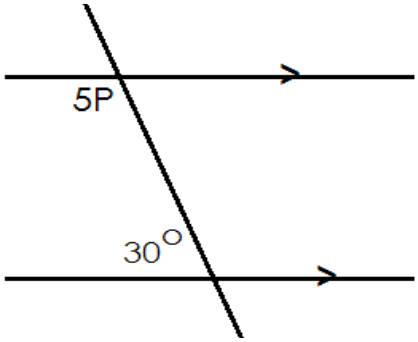
$5m - 20^{o} + 20^{o} = 180^{o} + 20^{o}$

$\frac{5m}{5} = \frac{200}{5}$

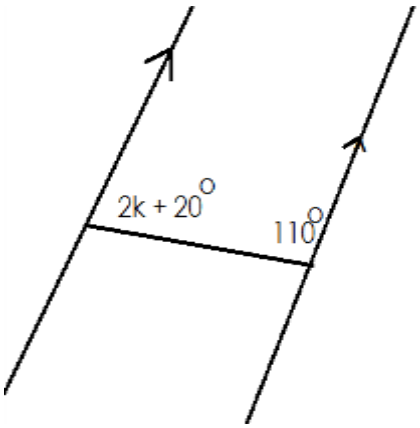
$\mathbf{M = 40^{o}}$

**Activity:**

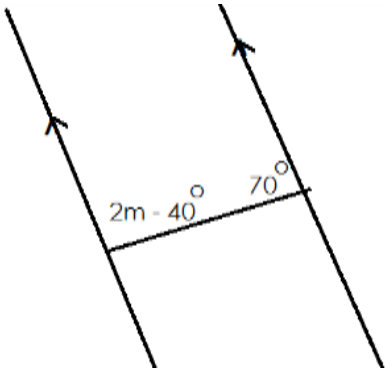
1. Find the value of P.



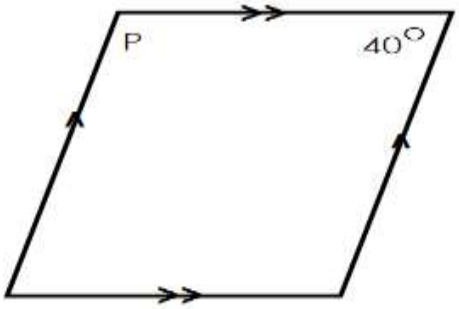

2. Find the value of K



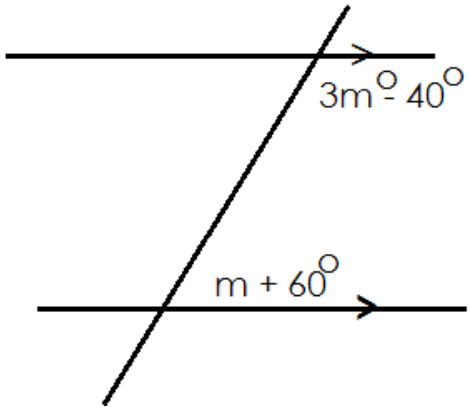

3. Find the value of m.




5. Find the value of p.



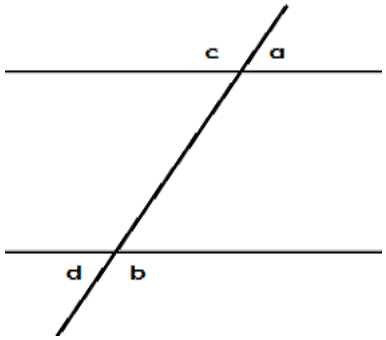

4. Find the value of m.



## CO- EXTERIOR ANGLES

- They add up to $180^{o}$.
- They are found outside the parallel lines.
- They are found on one side of the transversal line.
- One is obtuse and another is acute.

## Illustration

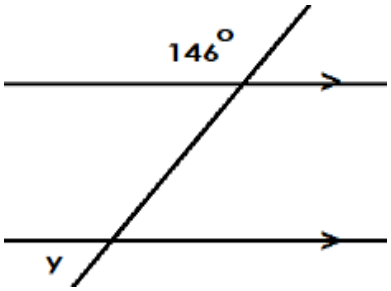



$L\,a + L\,b = 180^{o}$ (co- ext $L$ s)

$L\,c + L\,d = 180^{o}$ (co - ext $L$ s )

**Examples:**

Find the value of y.

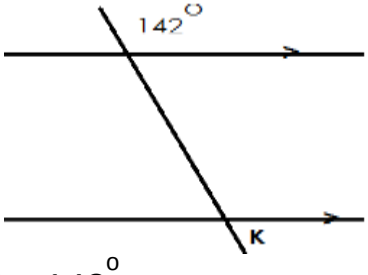



$Y + 146^{o} = 180^{o}$ (Co – ext. L s)

$Y + 146^{o} - 146^{o} = 180^{o} - 146^{o}$

$\mathbf{Y = 34^{o}}$

2. Find the value of K.

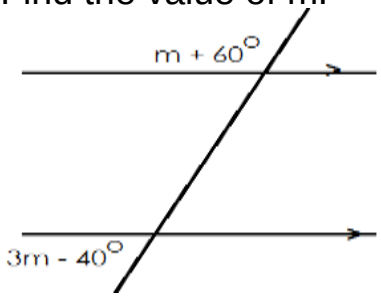



$K + 142^{o} = 180^{o}$ (co – ext. L s)

$K + 142^{o} - 142^{o} = 180^{o} - 142^{o}$

$\mathbf{K = 38^{o}}$

2. Find the value of m.




$3m - 40^{o} + m + 60^{o} = 180^{o}$ (co-ext. L s)

$3m + m + 60^{o} - 40^{o} = 180^{o}$

$4m + 20^{o} = 180^{o}$

$4m + 20^{o} = 180^{o}$

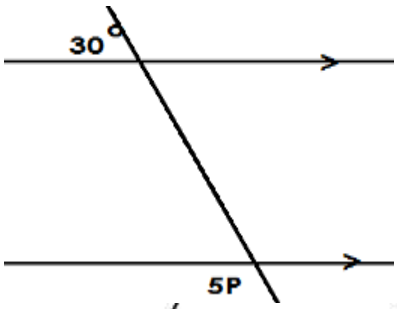
$4m + 20^{o} - 20^{o} = 180^{o} - 20^{o}$

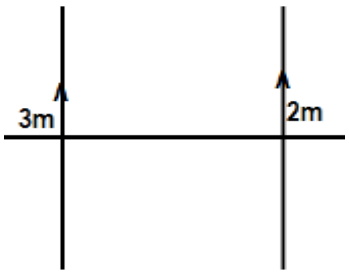
$\frac{4m}{4} = \frac{160}{4}$

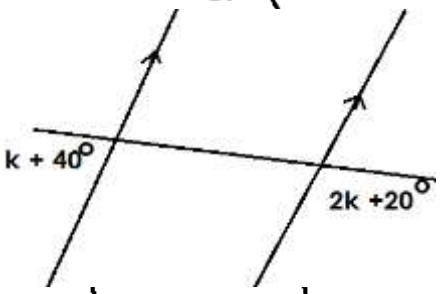
**M = 40°**

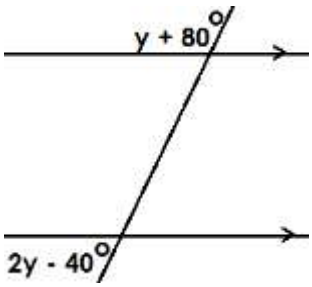
**Activity:**

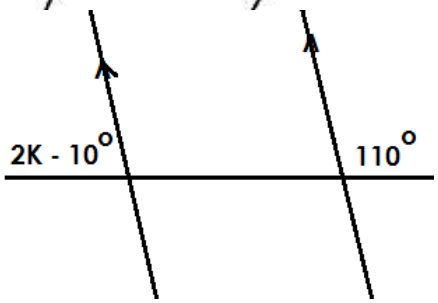
Find the value of unknown in the following:

1. 


2. 


3. 

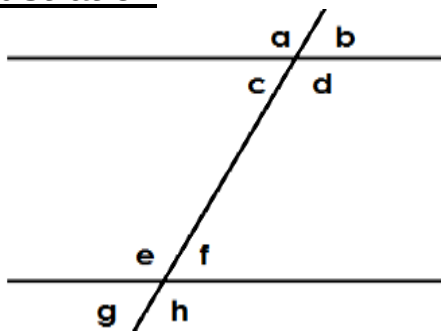

4. 


5. 

## CORRESPONDING ANGLES

- Corresponding angles are equal.
- Corresponding angles are formed on the same side of the transversal line.
- One is found inside and another one outside parallel lines.
- One angle is found on the lower parallel line and another angle on the upper parallel line.

## Illustration

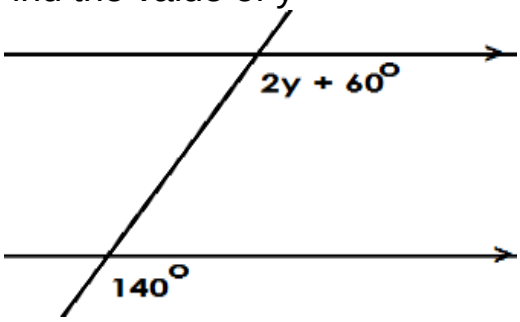



***L*** a = ***L*** e
***L*** c = ***L*** g
***L*** b = ***L*** f
***L*** d = ***L*** n

} corresponding angles

## Examples

Find the value of y




**Soln.**

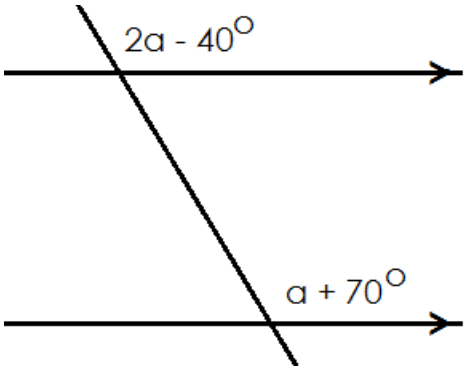
$2y + 60^{o}$ = 140o (Corrs L s)

$2y + 60^{o} - 60^{o} = 140^{o} - 60^{o}$

$\frac{2y}{2} = \frac{30}{2}$

$y = 40^{o}$

2. Find the value of a




**Soln.**

$2a - 40^{o} = a + 70^{o}$ (Corrs. Ls)

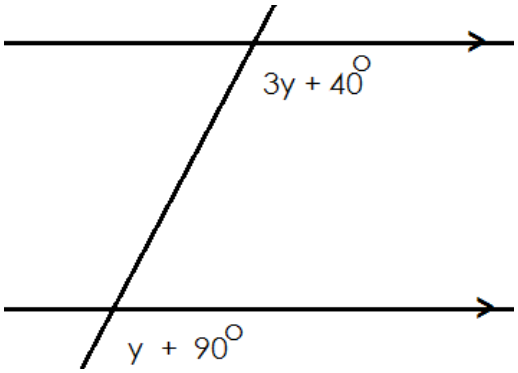
$2a - 40^{o} + 40^{o} = a + 70^{o} + 40^{o}$

$2a = a + 110^{o}$

$2a - a = a - a + 110^{o}$

$a = 110^{o}$

3. Find the value of y.




**Soln.**

$3y + 40^{o} = y + 90^{o}$

$3y + 40^{o} - 40^{o} = y + 90^{o} - 40^{o}$

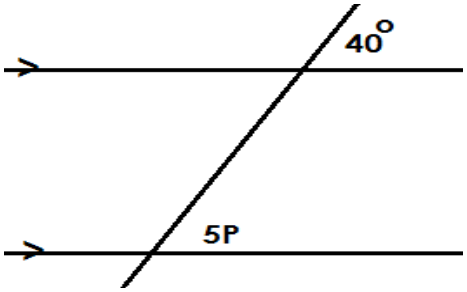
$3y = y + 50^{o}$

$\frac{2y}{2} = \frac{50}{2}$

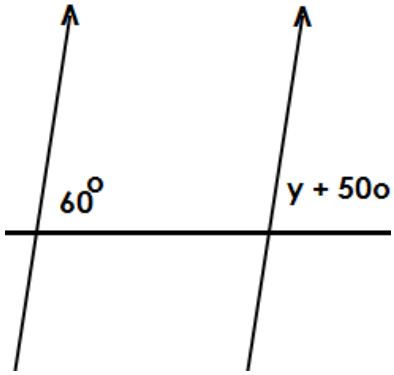
$\mathbf{y = 25^{o}}$

**Activity:**

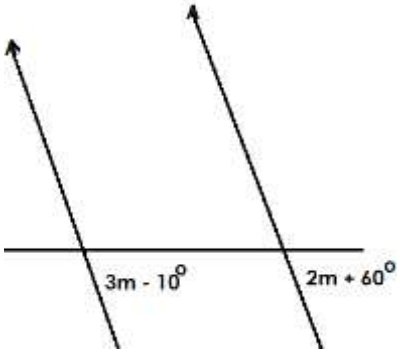
1. Find the value of the unknown letter.



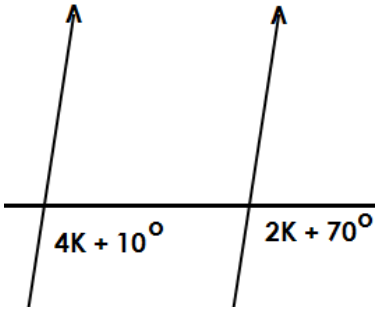

2.



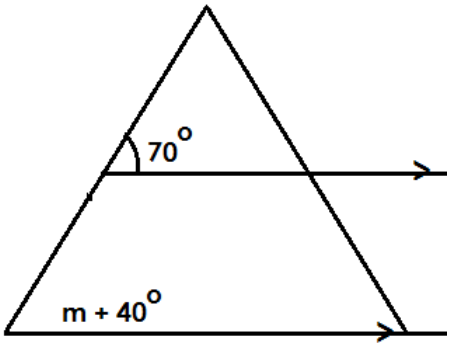

3.




4.



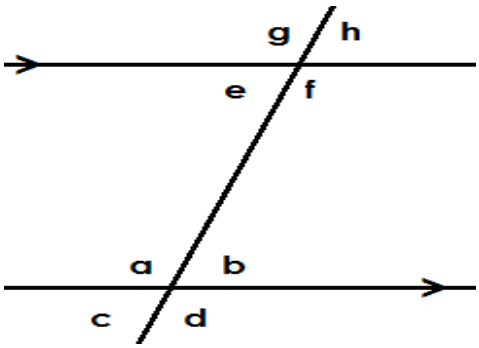

5.



## ALTERNATING ANGLES

- Alternating angles are equal.
- Alternating angles are formed on both sides of the transversal line.
- If they are inside, they are called alternate interior. If they are outside, they are called alternate exterior.

### Illustration




$\angle a = \angle f$

$\angle e = \angle b$

} alternate Interior angles

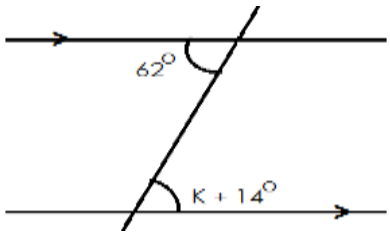
$\angle g = \angle d$

$\angle c = \angle h$

} alternate exterior angles

### Examples

1. Find the value of K in the diagram below.

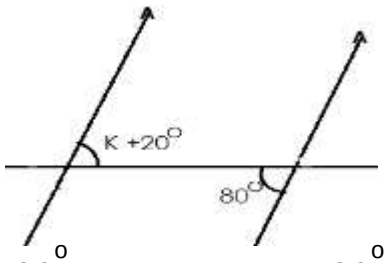



$K + 14^{o} = 62$ (Alt int $\angle$ s)

$K + 14^{o} - 14^{o} = 62^{o} - 14^{o}$

$K = 48^{o}$

2. Find the value of n.

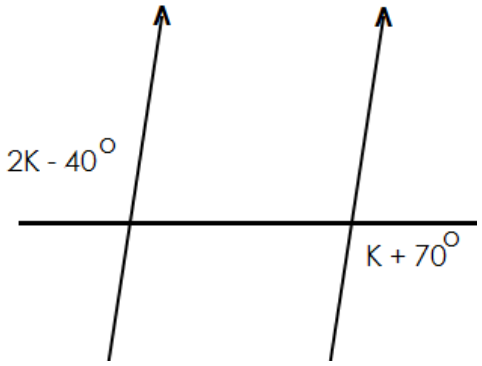



$K + 20^{o} = 80^{o}$ (Alternate int $\angle$ s)

$K + 20^{o} - 20^{o} = 80^{o} - 20^{o}$

$\mathbf{K = 60^{o}}$

3. Find the value of K.




**Soln.**

$2K - 40^{o} = K + 70^{o}$

$2K - 40^{o} + 40^{o} = K + 70^{o} + 40^{o}$

$2K = K + 110^{o}$

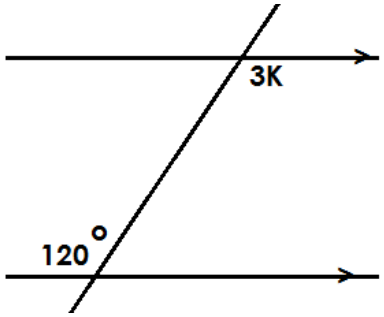
$2K - K = K - K + 110^{o}$

$\mathbf{K = 110^{o}}$

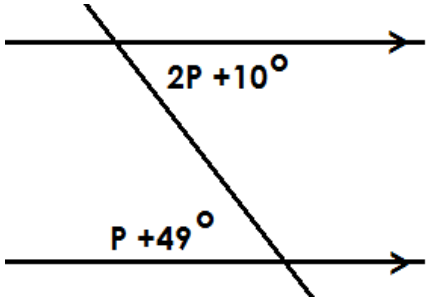
**Activity:**

Find the value of the unknowns in the following: -

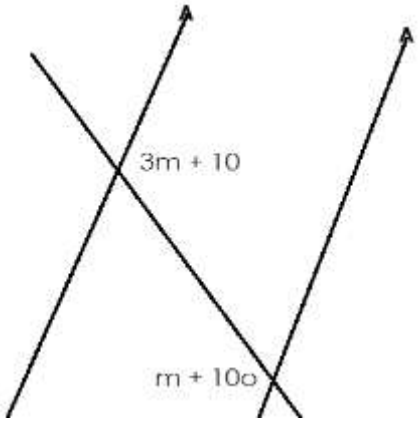
1.



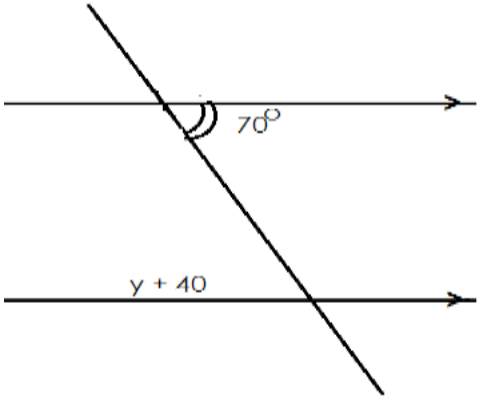

2.




3.




4.

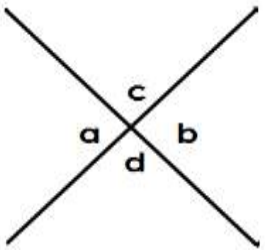


## VERTICALLY OPPOSITE ANGLES.

These are angles formed when two line cross each other to form letter X (**X angles)**

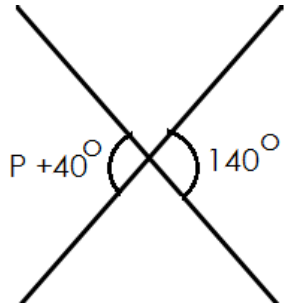
Vertically opposite angles are equal.

**Illustration**




$\angle a = \angle b$
$\angle c = \angle d$
} Vertically opposite angles

1. Find the value of K.



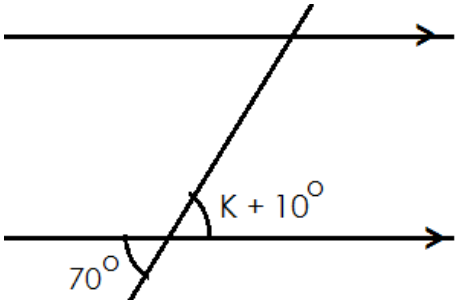

Soln.

$P + 40^{o} = 140$ (Vert. opp. Ls)

$P + 40^{o} - 40^{o} = 140^{o} - 40^{o}$

$P = 100^{o}$

2. Find the value of k.

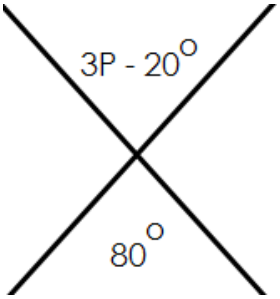



$K + 10^{o} = 70^{o}$ (Vert. Opp. Ls)

$K + 10^{o} - 10^{o} = 70^{o} - 10^{o}$

$K = 60^{o}$

3. Find the value of P.




$3P - 20^{\circ} = 80^{\circ}$ (Vert. Opp. Ls)

$3P - 20^{\circ} + 20^{\circ} = 80^{\circ} + 20^{\circ}$

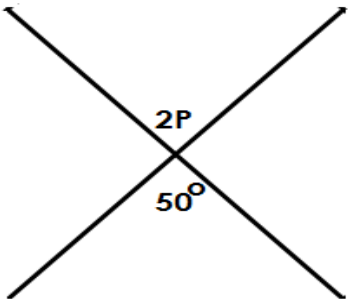
$\frac{3P}{3} = \frac{100}{3}$

$\mathbf{P = 33\ \frac{1}{3}^{\circ}}$

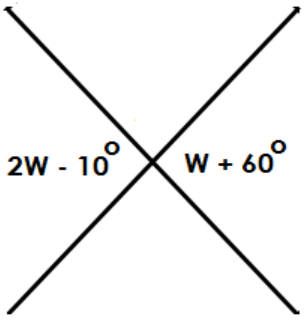
**Activity:**

Find the value of the unknown in the following

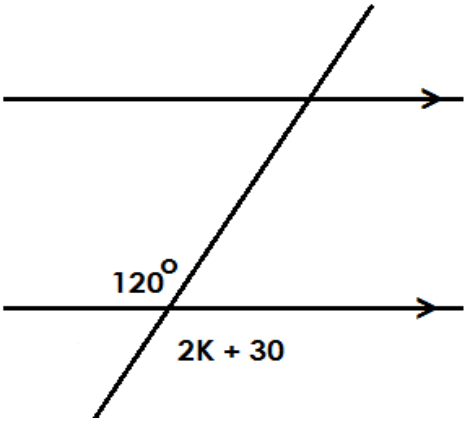
a)



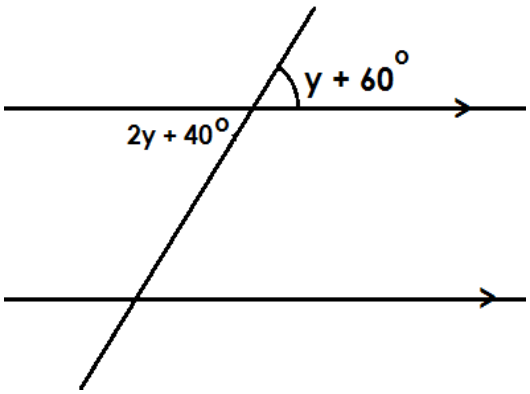

b)




c)

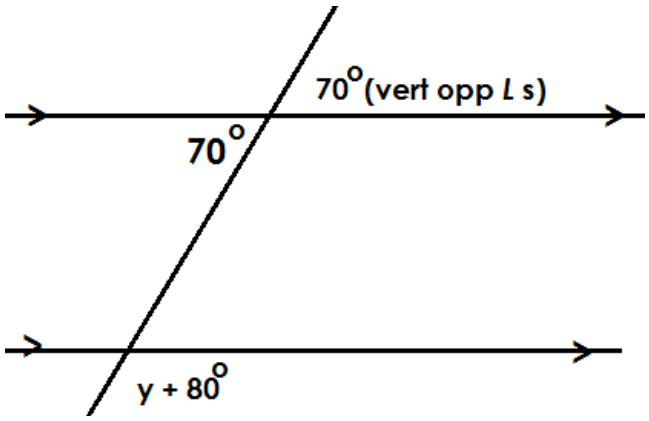



d)



## APPLICATION OF PARALLEL LINES

1. In the diagram below find the value of Y.




Soln

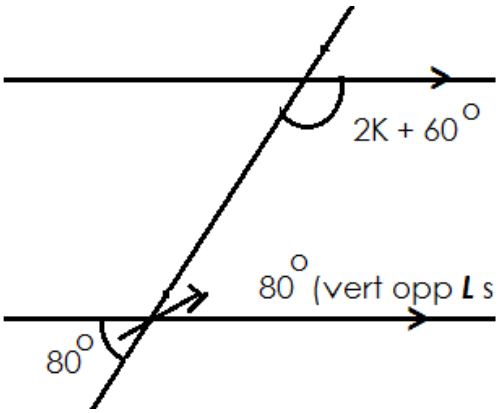
$y + 80^\circ + 70^\circ = 180^\circ$ (Co-ext Ls

$y + 150^\circ = 180^\circ$

$y + 150^\circ - 150^\circ = 180^\circ - 150^\circ$

$y = 30^\circ$

2. Find the value of K.




$2K + 60^\circ + 80^\circ = 180^\circ$ (co-int L s)

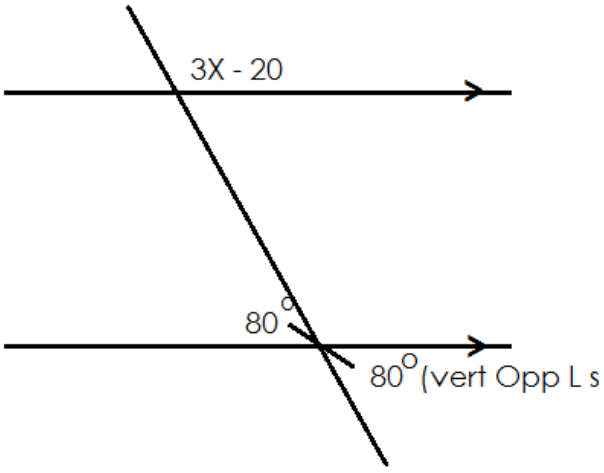
$2K + 140^\circ = 180^\circ$

$2K + 140^\circ - 140^\circ = 180^\circ - 140^\circ$

$\frac{2K}{2} = \frac{40}{2}$

$K = 20^\circ$

3. Find the value of X.




Soln

$3X - 20^\circ + 80^\circ = 180^\circ$ (Co-ext L s)

$3X + 80^\circ - 20^\circ = 180^\circ$

$3X + 60^\circ = 180^\circ$

$3X + 60^\circ - 60^\circ = 180^\circ - 60^\circ$

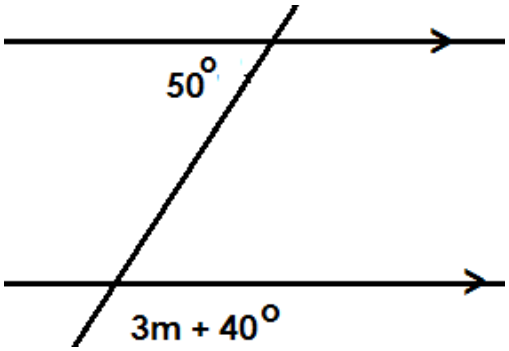
$\frac{3X}{3} \quad \frac{120}{3}$

$X = 40^\circ$

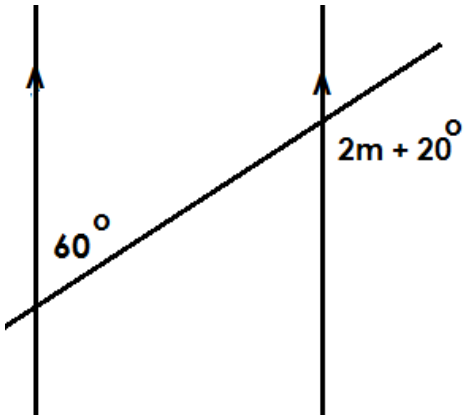
**Activity:**

Find the value of the unknown.

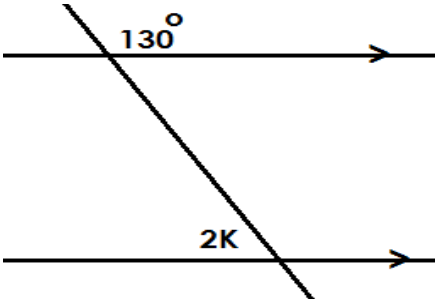
a)



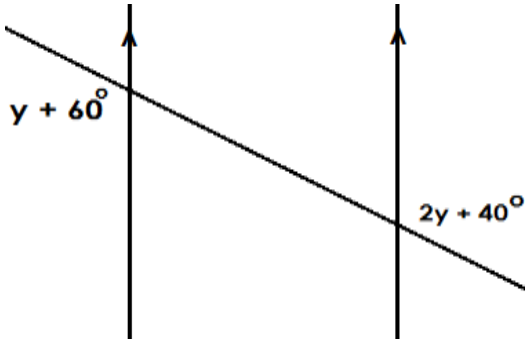

b)




c)

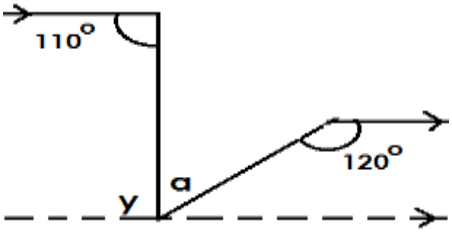



d)




**MORE APPLICATION OF PARALLEL LINES (part 1).**

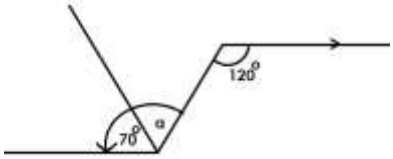
Find the value of a




$Y + 110^{o} = 180^{o}$ (co-int L s)

$Y + 110^{o} - 110^{o} = 180^{o} - 110^{o}$

$\mathbf{Y = 70^{o}}$



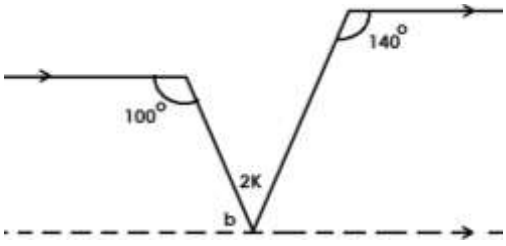

$y + a = 120^{o}$

$70^{o} + a = 120^{o}$

$70^{o} - 70^{o} + a = 120^{o} - 70^{o}$

$\mathbf{a = 50^{o}}$

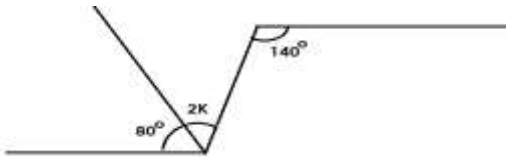
Find the value of k.




$b + 100^{o} = 180^{o}$ (Co-int Ls)

$b + 100^{o} - 100^{o} = 180^{o} - 100^{o}$

$b = 80^{o}$



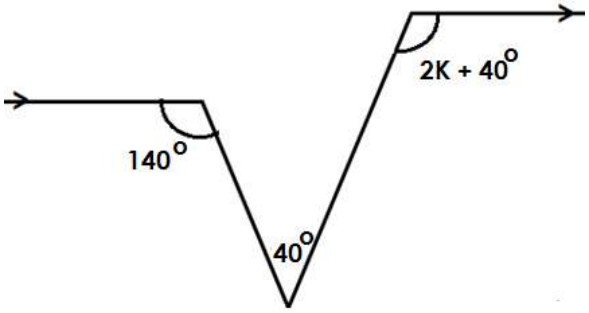

$2K + 80^{o} = 140^{o}$ (Alt int ***L*** s)

$2K + 80^{o} - 80^{o} = 140^{o} - 80^{o}$

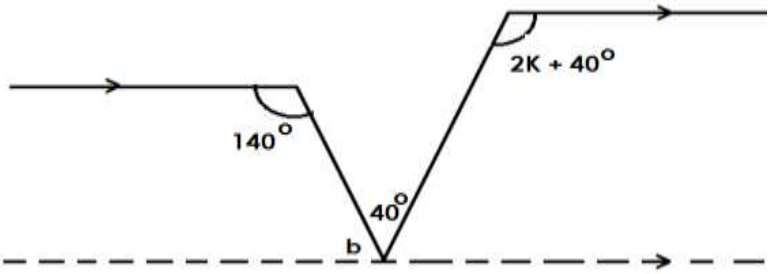
$\frac{2K}{2} = \frac{60}{2}$

$K = 30^{o}$

3. Find the value of K



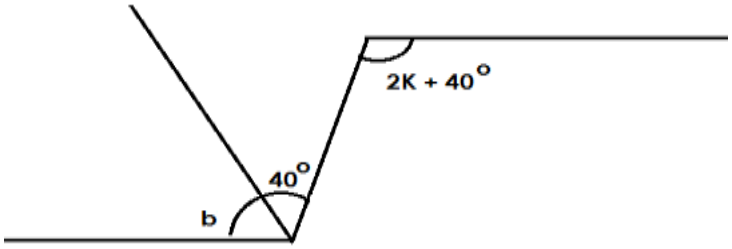

**Soln.**




$b + 140^{o} = 180^{o}$ (Co-int ***L*** s)

$b + 140^{o} = 180^{o} - 140^{o}$

$b = 40^{o}$




$2K + 40^{o} = b + 40^{o}$ (Alt int ***L***s)

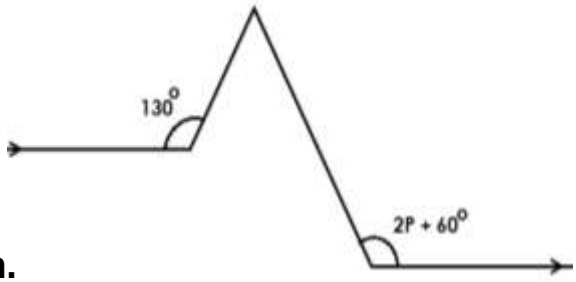
$2K + 40^{o} = 40^{o} + 40^{o}$

$2K + 40^{o} - 40^{o} = 80^{o} - 40^{o}$

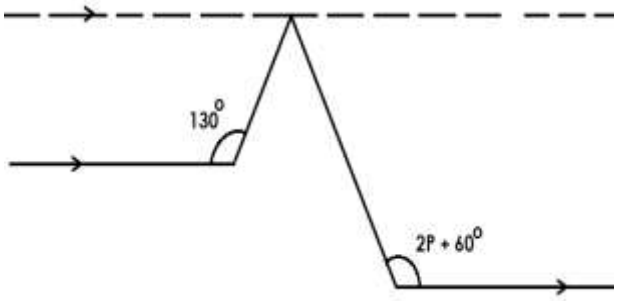
$\frac{2K}{2} = \frac{40}{2}$

$K = 20^{o}$

4. Find the value of P



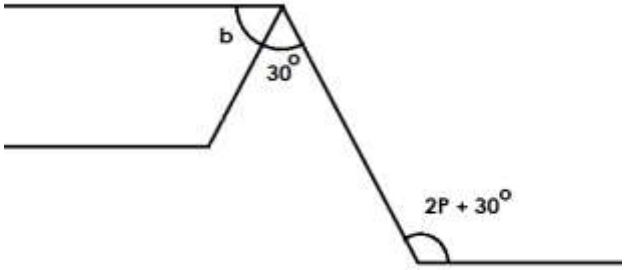

**Soln.**




$b + 130^{o} = 180^{o}$

$b + 130^{o} - 130^{o} = 180^{o} - 130^{o}$

$b = 50^{o}$



$2P + 30^{o} = 30^{o} + 50^{o}$ (Alt int ***L***s)

$2P + 30^{o} = 80^{o}$

$2P + 30^{o} - 30^{o} = 80^{o} - 30^{o}$

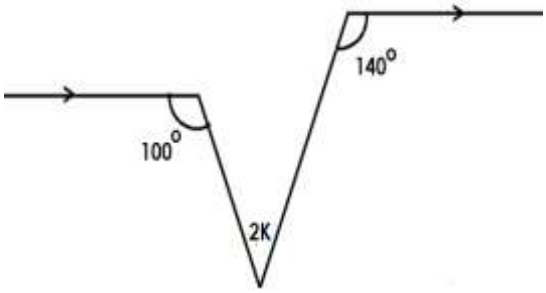
$\frac{2P}{2} = \frac{50}{2}$

$P = 25$

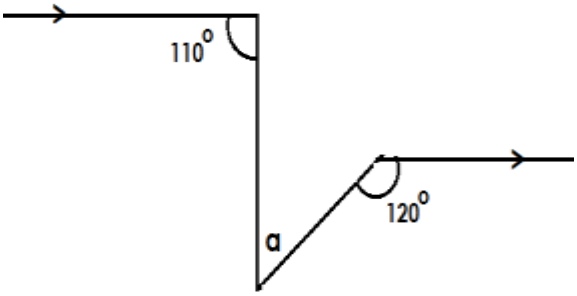
**Activity:**

Find the value of the unknown

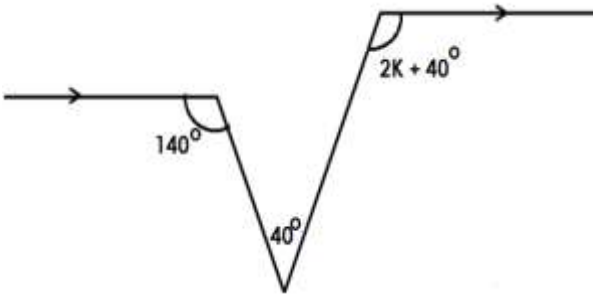
1.



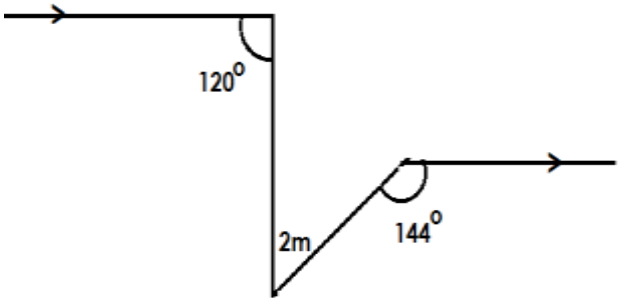

2.



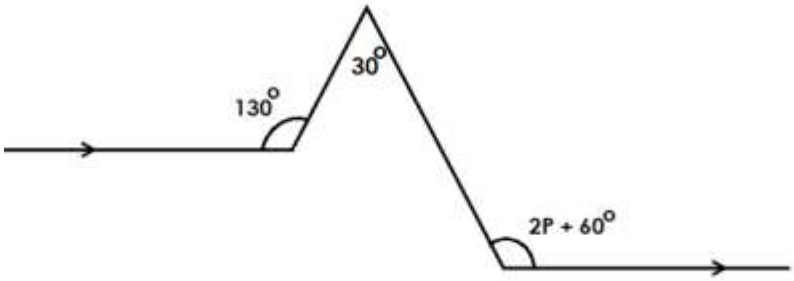

3.




4.

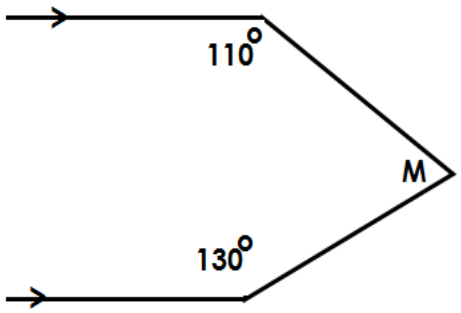



5.

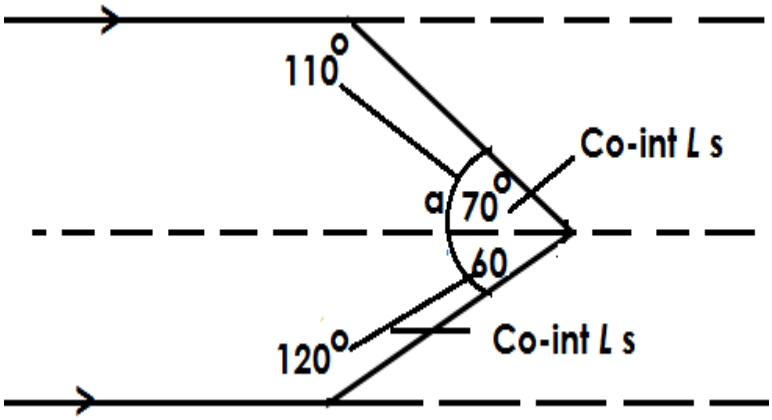


## MORE ON APPLICATION OF PARALLEL LINES (Part 2)

Find the value of P




soln.




**Soln.**

$a + 110^{o} = 180^{o}$ (Co-int. angles)

$a + 110^{o} = 180^{o} - 110^{o}$

$a = 60^{o}$

$b + 120^{o} = 180^{o}$

$b + 120^{o} - 120 = 180^{o}$

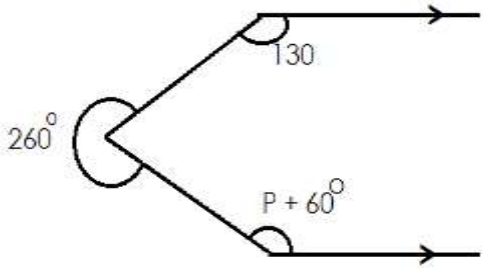
Therefore;

$m = a + b$

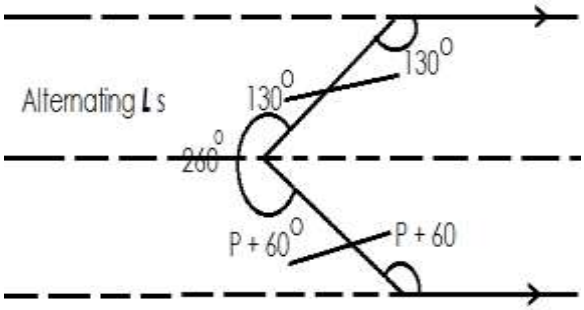
$= 70^{o} + 60^{o}$

$= 130^{o}$

2. Find the value of P.




**Soln.**



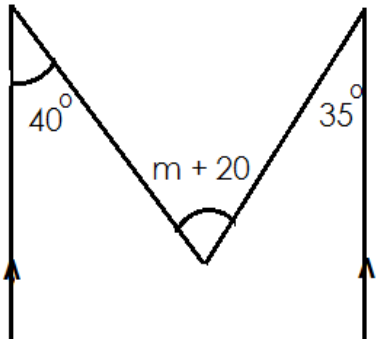

$P + 60^{\circ} + 130^{\circ} = 260^{\circ}$

$P + 190^{\circ} = 260^{\circ}$

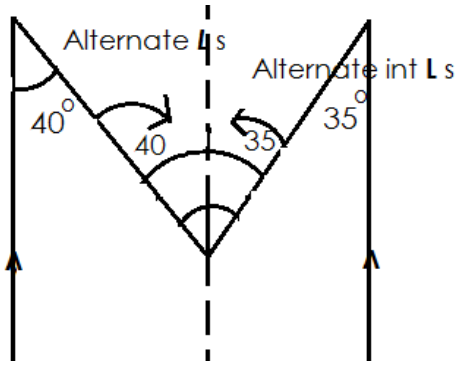
$P + 190^{\circ} - 190^{\circ} = 260^{\circ} - 190^{\circ}$

$P = 70^{\circ}$

3. Find the value of m.




**Soln.**



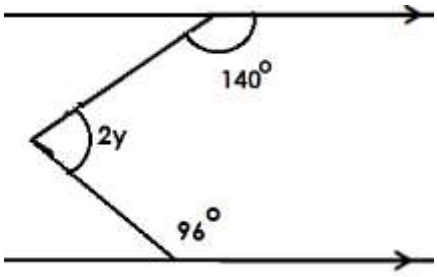

$m + 20^{\circ} = 40 + 35^{\circ}$

$m + 20^{\circ} = 75^{\circ}$

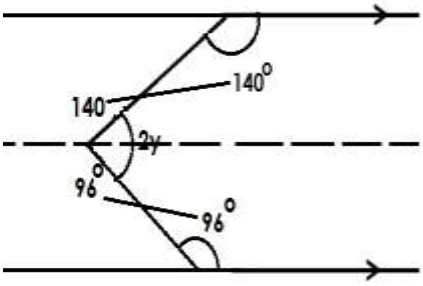
$m + 20^{\circ} - 20^{\circ} = 75^{\circ} - 20^{\circ}$

$m = 55^{\circ}$

4. Find the value of Y.




**Soln.**




$2y + 140^{o} + 96^{o} = 360^{o}$ (Ls at a point)

$2y + 236^{o} = 360^{o}$

$2y + 236^{o} - 236^{o} = 360^{o} - 236^{o}$

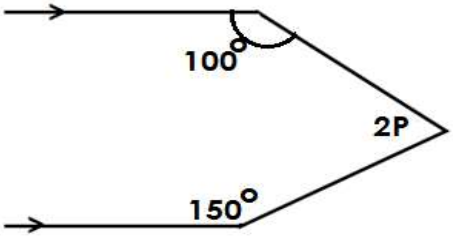
$\frac{2y}{2} = \frac{124}{2}$

$y = 62^{o}$

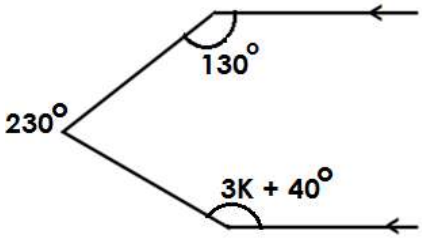
**ACTIVITY:**

Find the unknown in each of the figures below.

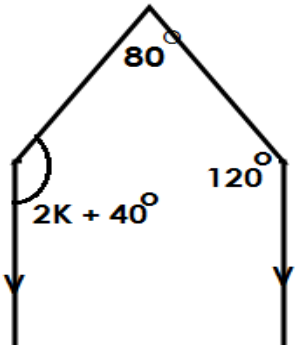
a)



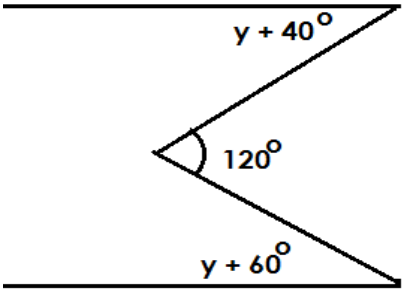

b)



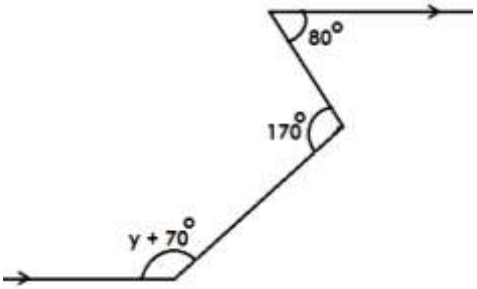

c)



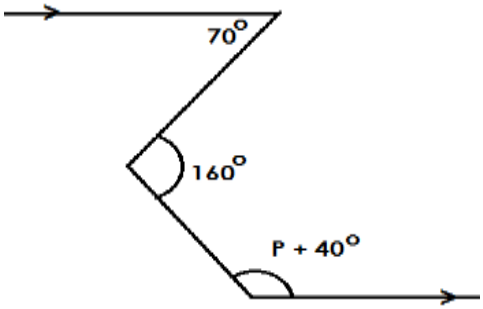

d)



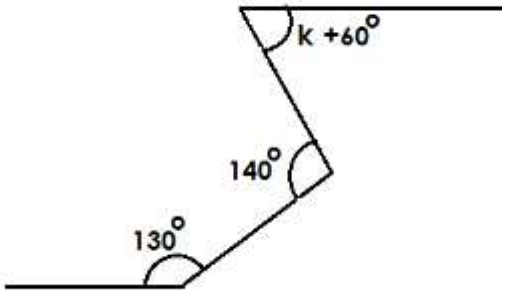
e)




f)




g)

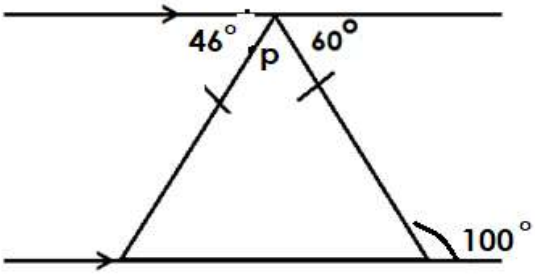



## PARALLEL LINES AND TRIANGLES

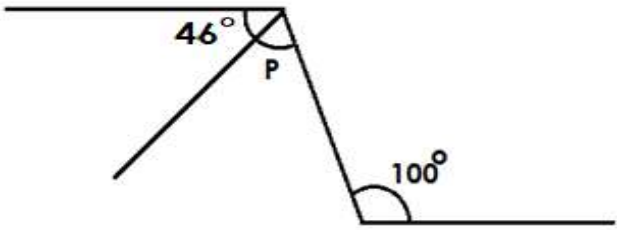
**Example**

1. Find the value of P

.




**Soln.**

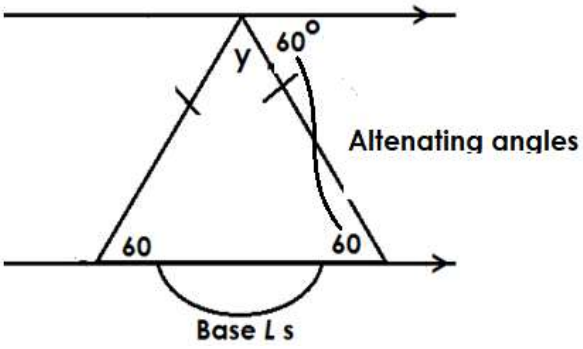



$P + 46^{o} = \mathbf{100^{o}}$ (Alt. int L sum)

$P + 46^{o} - 46^{o} = 100^{o} - 46^{o}$

$P = 54^{o}$

2. Find the value of Y



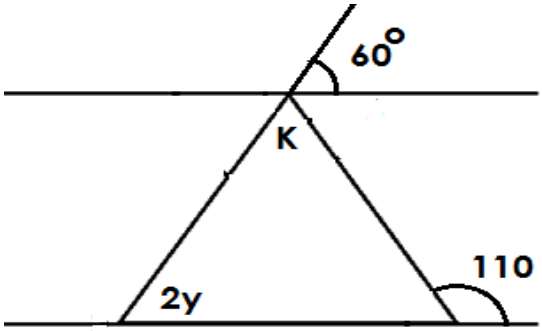

$y + 60^{o} + 60^{o} = 180o$ (int. L sum $\triangle$ of )

$y + 120^{o} = 180^{o}$

$y + 120^{o} = 180^{o} - 120^{o}$

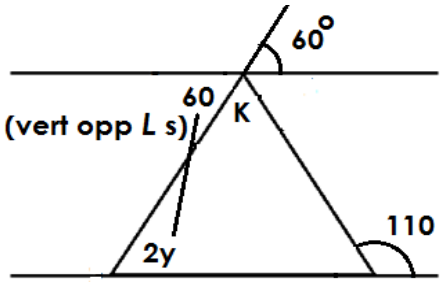
$y = 60^{o}$

3). Use the diagram below to answer questions




Find the value of y.

**Soln**.



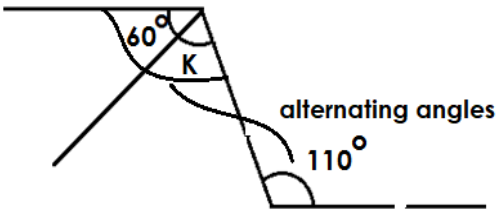

$2y = 60^{o}$ (Alt int ***L*** s)

$\frac{2y}{2} = \frac{60}{2}$

$y = 30^{o}$

Find the value of K.

**Soln.**

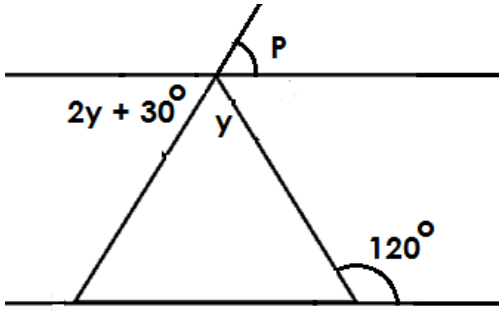



$K + 60^{o} = 110$ (Alt int ***L***s)

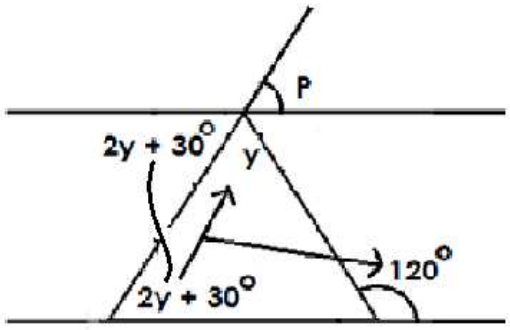
$K + 60^{o} - 60^{o} = 110^{o} - 60^{o}$

$K = 50^{o}$

Find the value of y in the figure below




**Soln.**




$y + 2y + 30^{o} = 120^{o}$ (sum of 2 int<s = 1 Opp. ext.**<**)

$3y + 30^{o} = 120^{o}$

$3y + 30^{o} - 30^{o} = 120^{o} - 30^{o}$

$\frac{3y}{3} = \frac{90}{3}$

$y = 30^{o}$

Find the value of P

**Soln.**

P = $2y + 30^{o}$ (vert. Opp. <s)

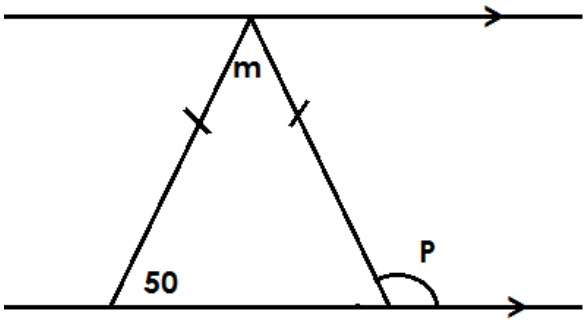
P = $(2x\ 30^{o}) + 30^{o}$

P = $60^{o} + 30^{o}$

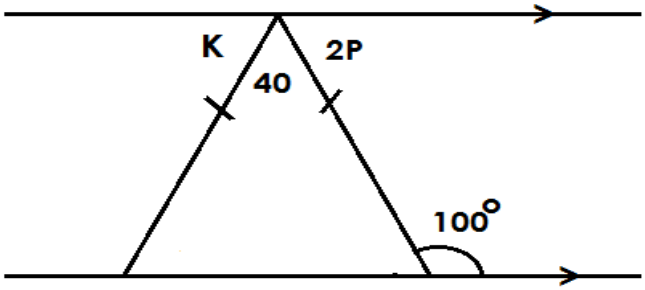
P = $90^{o}$

**Activity:**

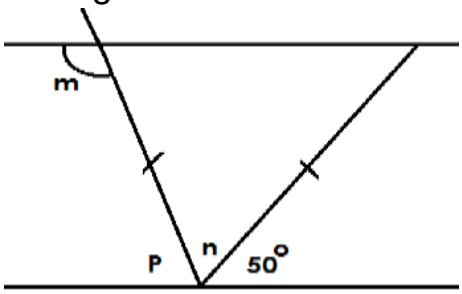
1. Find the value of the unknowns in the figure bellow.




2. Find the value of K and P.




3. Use the figure below to answer questions below.



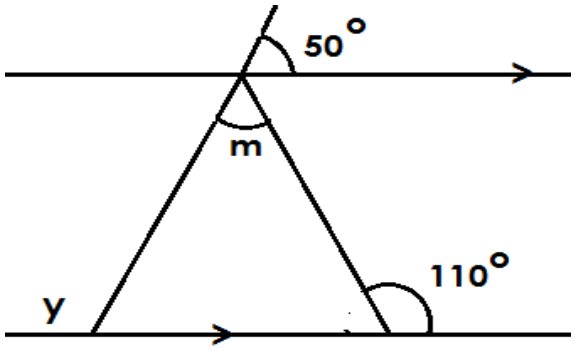

Find the value of;

a) n

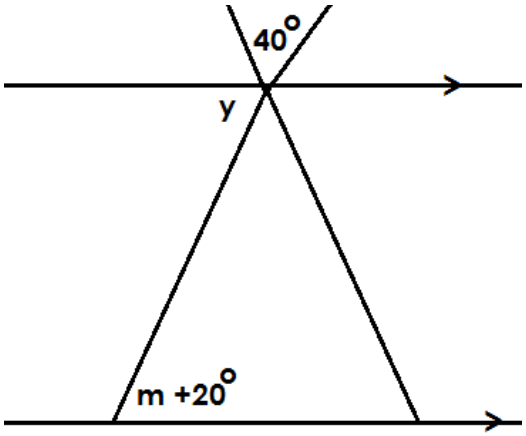
b) P

c) m

4. Find the value of y and m.



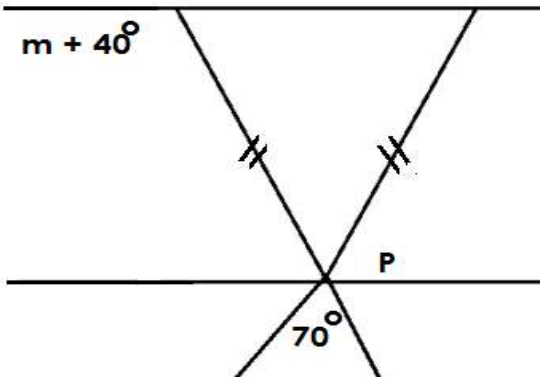

5. Use the figure below to answer the given questions.




Find the value of;

i) y
ii) m

6. Use the figure below to answer the given questions.




Find the value of

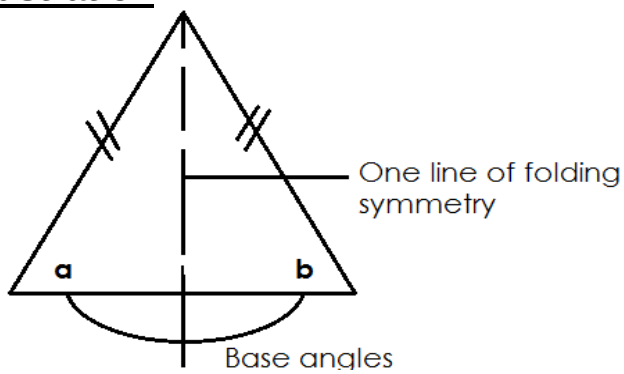
i) P

ii) m

## ISOSCELES TRIANGLES

- These are triangles with two sides equal.
- Their base angles are equal.
- An isosceles triangle has one line of folding symmetry.

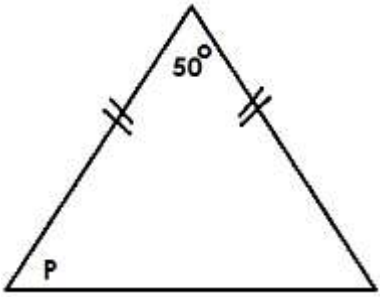
## Illustration



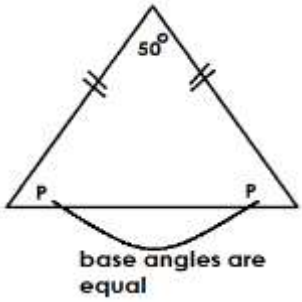

**<**a = **<** b (base angles of an isosceles triangle)

**Examples.**

1. Use the diagram below to answer questions.




Find the value of P.




$P + P + 50^{o} = 180^{o}$ (int L sum of $\Delta$)

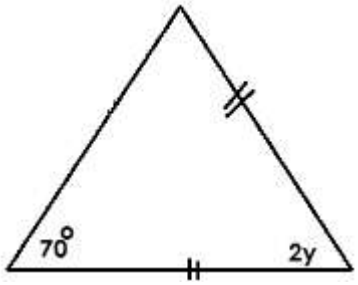
$2P + 50^{o} = 180^{o}$

$2P + 50^{o} - 50^{o} = 180^{o} - 50^{o}$

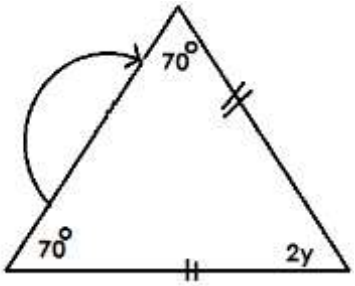
$\frac{2P}{2} = \frac{130}{2}$

$P = 65^{o}$

2). Find the value of y in the figure below.




**Soln.**




$2y + 70^{o} + 70^{o} = 180^{o}$ (int L sum of $\triangle$)

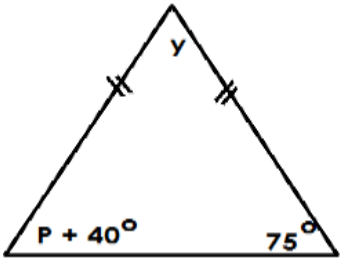
$2y + 140^{o} = 180^{o}$

$2y + 140^{o} - 140^{o} = 180^{o} - 140^{o}$

$\frac{2y}{2} = \frac{40}{2}$

$Y = 20^{o}$

3. Find the value P.




**Soln**.

$P + 40^{o} = 75$ (Base Ls of $\triangle$)

$P + 40^{o} - 40^{o} = 75^{o} - 40^{o}$

$P = 35^{o}$

ii) Find the value of Y.

$y + P + 40^{o} + 75^{o} = 180^{o}$ (int L sum of $\triangle$)

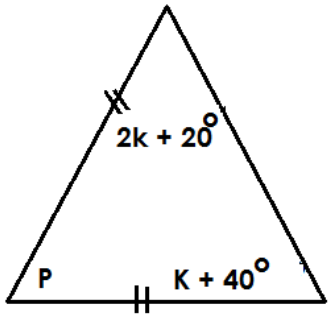
$y + 35^{o} + 40^{o} + 75^{o} = 180^{o}$

$y + 150^{o} = 180^{o}$

$y + 150^{o} - 150^{o} = 180^{o} - 150^{o}$

$\mathbf{y = 30^{o}}$

4. Below is a triangle. Use it to answer questions.




a) Find the value of K.

**Soln.**

$2K + 20^{o} = K + 40^{o}$ (Base <s)

$2k + 20^{o} - 20^{o} = K + 40^{o} - 20^{o}$

$2K = K + 20^{o}$

$2K - K = K - K + 20^{o}$

$K = 20^{o}$

Find the value of P

$P + 2K + 20^{o} + 2K + 40^{o} = 180^{o}$ (int L sum of $\Delta$)

$P + (2 \times 20^{o}) + 20^{o} + 20^{o} + 40^{o} = 180^{o}$

$P + 40^{o} + 20^{o} + 20^{o} + 40^{o} = 180^{o}$

$P + 120^{o} = 180^{o}$

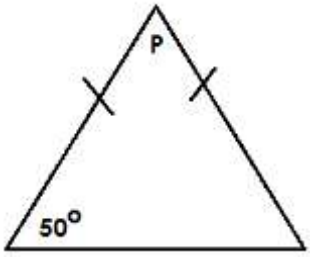
$P + 120^{o} - 120^{o} = 180^{o} - 120^{o}$

$P = 60^{o}$

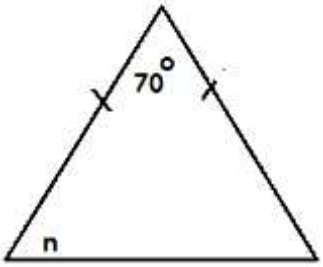
**Activity:**

1. Find the value of unknowns in the following.

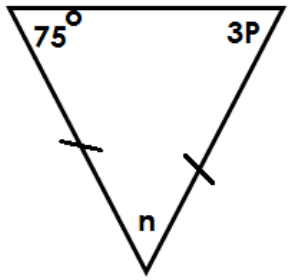
a)



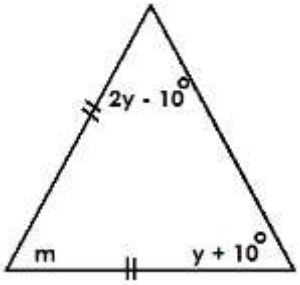

b)



c)



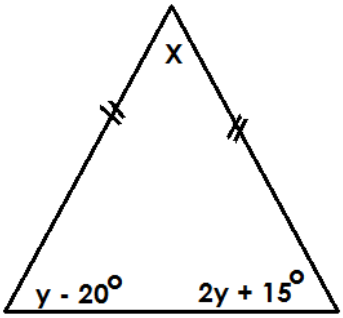

4. Use the figure below to answer the given questions below.




Find the value of;

i) y ii) m

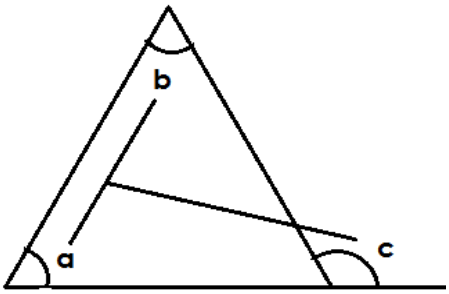
5. Use the figure below to answer the given questions below.




Find the value of

i) Y ii) X

## THE SUM OF TWO INTERIOR ANGLE BEING EQUAL TO ONE OPPOSITE EXTERIOR ANGLE




***L*** a + ***L*** b = ***L***c (sum of 2 int ***L*** s = 1 Opp. ext.<)

## Examples

1. Find the value of y in the triangle.

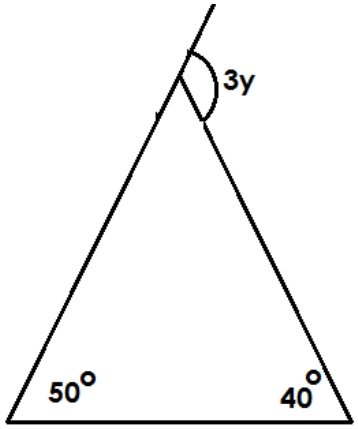
**Soln.**

$y + 40^{o} = 100^{o}$ (sum of 2 int Ls = 1 Opp. ext.<)

$y + 40^{o} - 40^{o} = 100^{o} - 40^{o}$

$y = 60^{o}$

2. Find the value of K

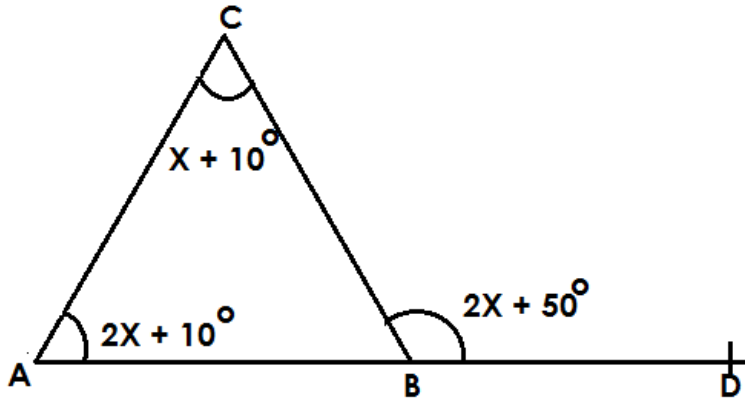



$50^{o} + 40^{o} =$ 3y (sum of 2 in ***L*** s = 1 Opp. Ext ***L***)

$\frac{90}{3} = \frac{3y}{3}$

$\therefore$ **y = $30^{o}$**

3. Study the diagram below and answer questions.




a) Find the value X.

**Soln**.

$2X + 10^{o} + X + 10^{o} = 2X + 50^{o}$ (sum of 2 int L s = 1 Opp. ext. L)

$2X + X + 10^{o} + 10^{o} = 2X + {}^{o}3X + 20^{o} - 20^{o} = 2X + 50^{o} - 20^{o}$

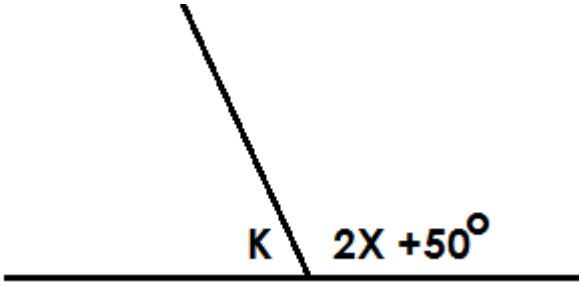
$3X^{o} = 2X + 30^{o}$

$3X - 2X = 2X - 2X + 300^{o}$

$X = 30^{o}$

b) Find the size of angle ABC.

**Soln.**




$K + 2X = 50^{o}$ $= 180^{o}$ (supp L s)

$K + (2 \times 30^{o}) + 50^{o} = 180^{o}$

$K + 60^{o} + 50^{o} = 180^{o}$

$K + 110^{o} = 180^{o}$

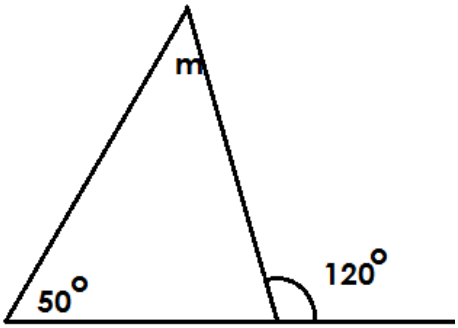
$K + 110^{o} - 110^{o} = 180^{o} - 110^{o}$

$K = 70^{o}$

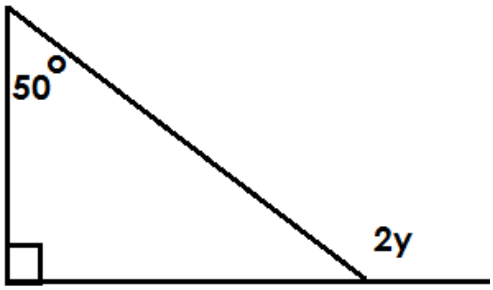
**Activity:**

1. Find the value of unknowns in the following.

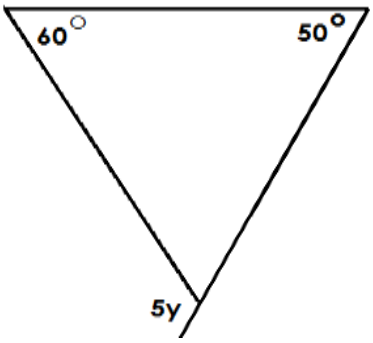
a)

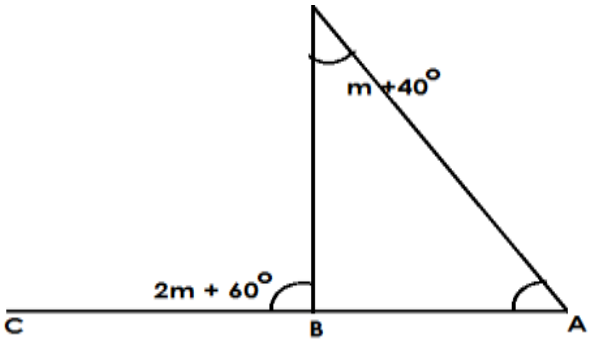



b)




c)



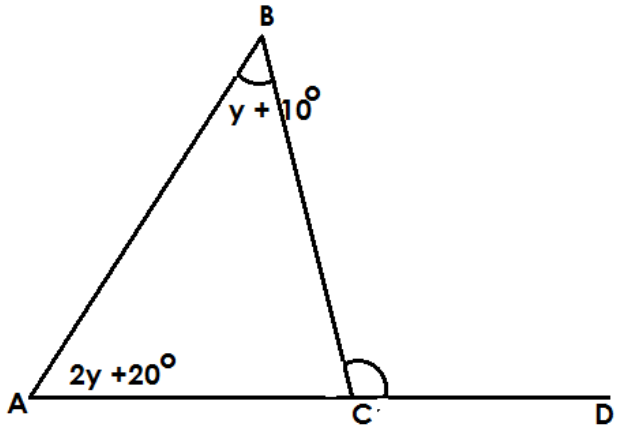



a) Find the value of m.

b) Find the size of angle CBD

c) Find the size of the angle DBA.

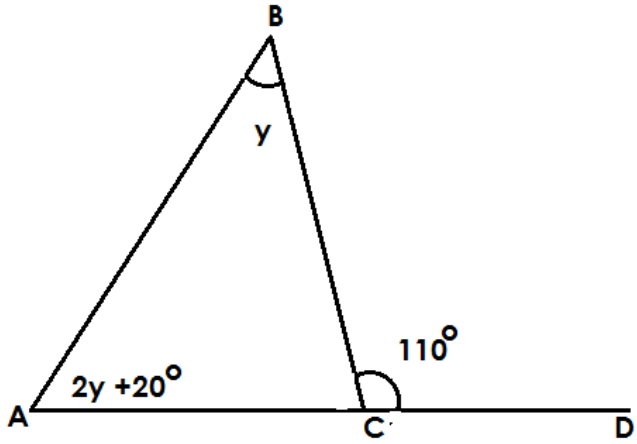
5. Use the figure below to answer the given questions below.




a) Find the value of y.

b) Find the size of angle ACB

6. Find the value of y.

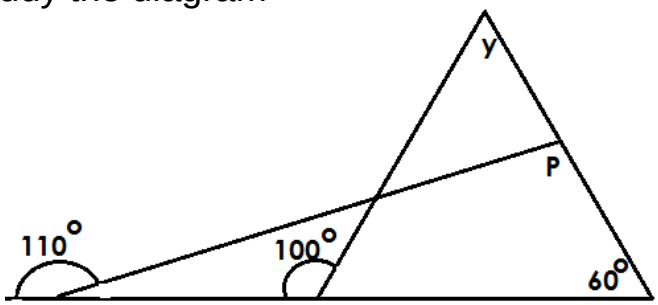



a) Find the value of y.

b) Find the size of angle ACD

## MORE ABOUT SUM OF TWO INTERIOR ANGLES EQUALS TO ONE OPPOSITE EXTERIOR ANGLES

Study the diagram




Find the value of y.

**Soln.**

$y + 60^{o} = 100^{o}$ (sum of 2 int Ls = 1 Opp. ext. L)

$y + 60^{o} - 60^{o} = 100^{o} - 60^{o}$

$y = 40^{o}$

Find the value of P.

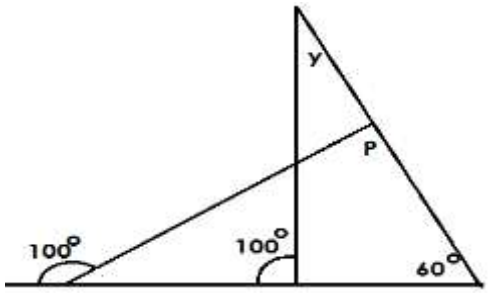
$P + 60^{o} = 110^{o}$

$P + 60^{o} - 60^{o} = 110^{o} - 60^{o}$

$P = 50^{o}$

**Activity:**

1. Find the value of the unknowns.




Find the value of y

**Soln.**

$y+60^{o} = 100^{o}$ (sum of 2 int ***L*** s = Opp. ext. ***L***)

$y + 60^{o} - 60^{o} = 100^{o} - 60^{o}$

$y = 40^{o}$

Find the value of P.

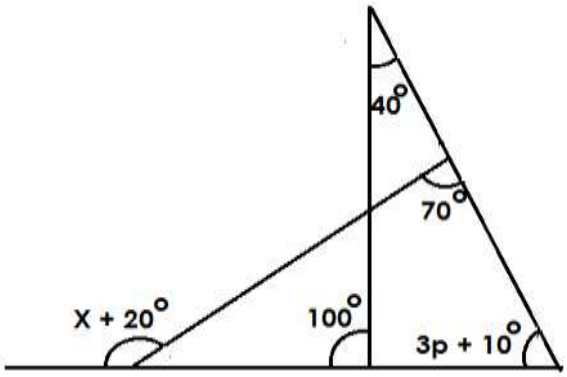
$P + 60^{o} = 110^{o}$

$P + 60^{o} - 60^{o} = 110^{o} - 60^{o}$

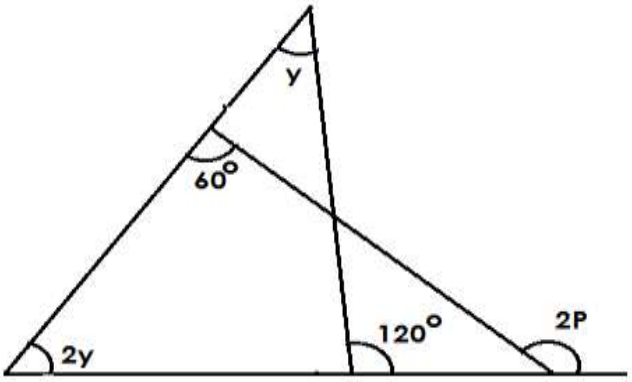
$P = 50^{o}$

**Activity:**

1. Find the value of the unknowns in the figure below.



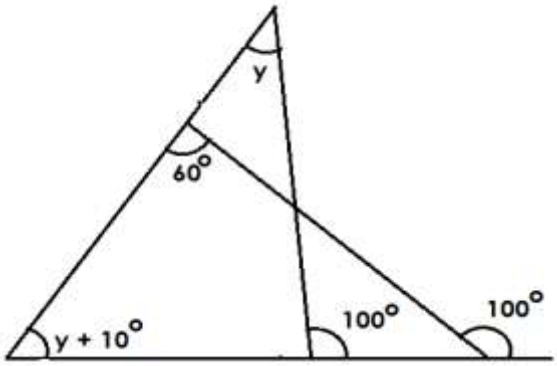

2. Use the figure below to answer the given questions below.




a) Find the value of y.

b) Find the value of P.

3. Use the figure below to answer the given questions below.




Find the value of;

i) y

ii) P

## CONSTRUCTION OF POLYGONS

### Square

- It has four equal sides.
- It has four right angles.

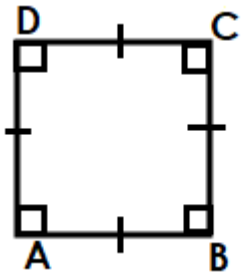
**Procedure**

- Draw a sketch
- Draw a base line
- Mark two points and label them.
- Construct an angle of $90^{o}$ at each point.

### Example

Using a pencil, a ruler and a pair of compasses only construct a square ABCD of side 5cm.

### Sketch




**Accurate square.**

Measure diagonal DB = 9cm.

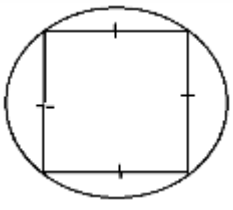
## CONSTRUCTING A SQUARE IN A CIRCLE

1. Construct a square in a circle of radius 4cm.

### Step I

- Draw a circle of radius 4cm and on it draw diameter AB.
- Draw a perpendicular bisector of AB and name the points of intersection with the circle CD.
- Join the adjustment to form a square.

### Sketch



**Accurate square.**

**Activity:**

Using a ruler, pencil and a pair of compasses only construct in a square in a circle of radius.

a) 3cm
b) 4.5cm
c) 5cm

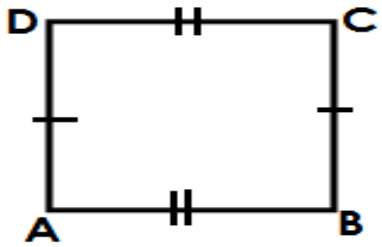
## CONSTRUCT A RECTANGLE

- Draw a sketch
- Draw the base line AB.
- Construct $90^{o}$ at the two points.

### Example

Using a ruler, a pencil and a pair of compasses only, construct a rectangle ABCD where AB = 6cm and BC = 4cm.

### Sketch




**Accurate rectangle**.

### Activity:

1. Using a ruler, a pencil and a pair of compasses only. Construct a rectangle MNOP where MN = 8cm and NO = 6cm.

a) Measure diagonal $\overline{MO}$

b) Measure angle PMN

2. Using a ruler, a pencil and a pair of compasses only, construct a rectangle KLMN where KL = 7.5cm, LM = 5.5cm.

a) Measure diagonal NL

b) Measure the size of angle LKM

## CONSTRUCTING A TRIANGLE

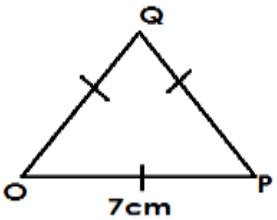
**Note:**

- In constructing of triangles, a sketch must be drawn.
- The given information in the question must be represented.

**Sketch**

Using a pair of compasses, a ruler and a pencil only, construct a triangle of OPQ where $\overline{OP} = \overline{PQ} = QO = 7cm$.

Sketch

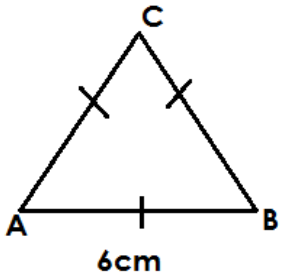



**Accurate triangle.**

Measure angle OPQ = $60^{o}$

2. Using a pair of compasses, a ruler and a pencil. Construct a triangle ABC where AB = BC = CA = 6cm. drop a perpendicular sketch from C to meet AB at point X.

**Sketch**




**Accurate triangle**.

Measure line $\overline{CX}$ =

**Activity:**

1. Using a pencil, a ruler and a pair of compasses. Construct a triangle MNO where MN =NO =OM = 7.5cm.
2. Using a pair of compasses, a ruler and a pencil. Construct a triangle XYZ where XY = YX = ZX = 5.5cm.

b) Measure angle XZY

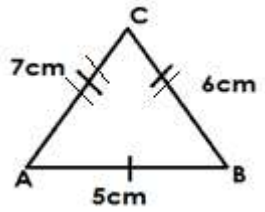
3. Using a ruler, a pencil and a pair of compasses only. Construct a triangle MNO where MN = NO = OM =7.5cm.

b) Drop a perpendicular from O to meet MN at K.

## CONSTRUCTING A SCALENE TRIANGLE

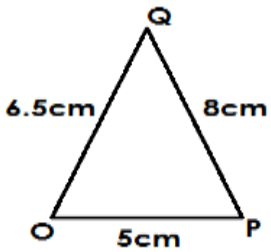
Using a pair of compasses, a ruler and a pencil only. Construct a triangle ABC where AB = 5cm, BC = 6cm and CA = 7cm.

**sketch**




2. Using a pair of compasses, a ruler and a pencil only. Construct a triangle OPQ where OP = 5cm OQ = 8cm and QO = 6.5cm.

**sketch**




Measure angle OPQ

**Activity:**

1. Using a pair of compasses, a ruler and a pencil. Construct a triangle KLN where KL = 6.5cm. LM = 7cm and MK = 5cm.

b) Measure angle MKL

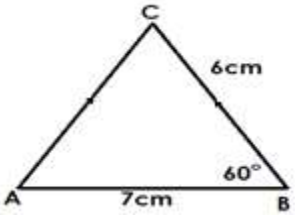
2. Using a ruler, a pencil and a pair of compasses only. Construct a triangle LMN where LM = 7cm MN = 5.5cm and NL =6cm.

b) Measure LMN

## CONSTRUCTION OF TRIANGLES GIVEN SIDE ANGLE SIDE (S.A.S)

Using a pair of compasses, a ruler and a pencil only ABC where $\overline{AB}$ = 7cm, ***L*** ABC = 600 and line BC = 6cm.

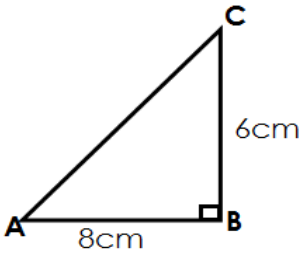
**Sketch**




Measure AC

2. Using a pair of compasses, a ruler and a pencil only. Construct a triangle ABC where AB = 8cm, BC = 6cm and ABC = $90^{o}$.

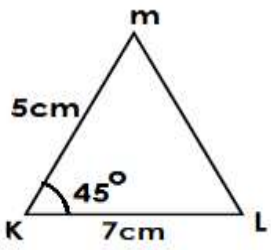
   **Sketch**




3. Construct a triangle KLM where KL = 7cm and angle MKL = $45^{o}$ and MK = 5cm.

   Measure L KLM

   **Sketch**




Measure angle KLM

**Activity:**

1. Using a pair of compasses, a ruler and a pencil only. Construct a triangle MNO where MN = 6cm MO =7cm and OMN = $60^{o}$.

   b) Measure line NO.

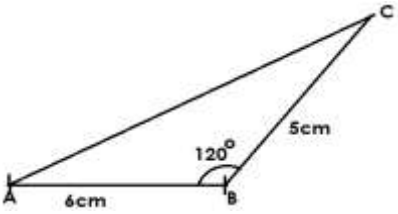
2. Using a ruler, a pencil and a pair of compasses only construct a triangle BCD where BC = 8cm CD = 8cm and angle BCD = $45^{o}$.

3. Using a ruler, a pencil and a pair of compasses only. Construct a triangle XYZ where XY= 7.5cm, ZX = 5.5cm and angle ZXY = $90^{o}$.

## OBTUSE ANGLES

1. Using a pair of compasses, a ruler and a pencil only, construct a triangle ABC where AB = 6cm and angle ABC = $120^{o}$ and BC = 5cm.

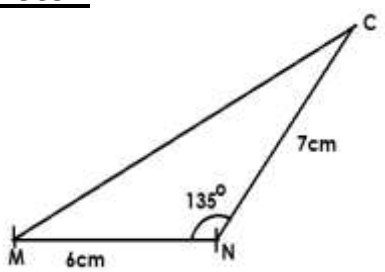
**Sketch**




b) Measure L ACB
c) Measure line $\overline{AC}$

2. Using a ruler, a pencil and pair of compasses only. Construct a triangle MNO where MN = 6cm, NO = 7cm and angle MNO = $135^{o}$.

**Sketch**

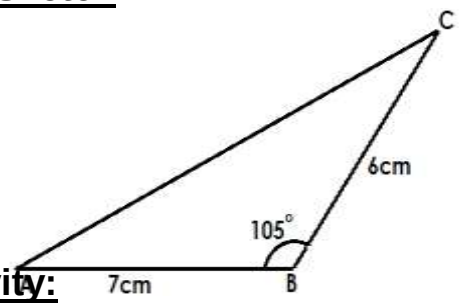



b) Measure line MO.

c) Measure angle MON.

3. Using a ruler, a pencil and a pair of compasses only. Construct a triangle ABC where AB = 7cm, ***L*** ABC = **$105^{o}$** and BC = 6cm.

**Sketch**




Measure angle ACB =

**Activity:**

1. Using a ruler, a pencil and a pair of compasses only. Construct a triangle OPQ where OP = 7cm, ***L***QOP = $120^{o}$ and OQ = 4cm

b) Measure QP

c) Angle A

2. Using a pair of compasses, a ruler and a pencil only, construct a triangle MKL where MK = 5.5cm. ***L*** LMK = 13 and line LM = 6cm.

   b) Measure ***L*** K

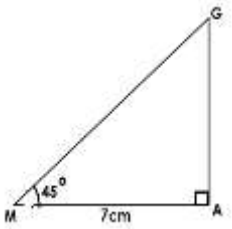
3. Using a pair of compasses, a ruler and a pencil only. Construct a triangle POT where TPO = $105^{o}$ and PT = 5cm.

   b) Measure TO

## CONSTRUCTION OF TRIANGLES GIVEN SIDE ANGLES (SAA)

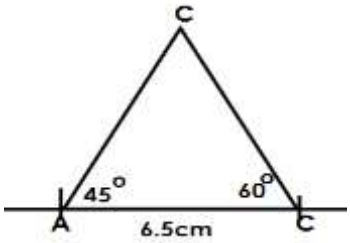
1. Using a pair of compasses, a ruler and a pencil only. Construct a triangle MAG where MA = 7cm, ***L*** MAG = $90^{o}$ and GMA = $45^{o}$.

**Sketch**




2. Using a ruler, a pencil and a pair of compasses only. Construct a triangle ABC where AB = 6.5cm ***L*** ABC = $60^{o}$ and ***L*** CAB=$45^{o}$ Drop a perpendicular from C to meet AB at K.

**Sketch**




**Activity:**

1. Using a ruler, a pencil and a pair of compasses only. Construct a triangle MNO where MN = 7cm, ***L*** MNO = $45^{o}$, and L NMP = $90^{o}$.

   a) Measure the length $\overline{NO}$

2. Using a ruler, a pencil and a pair of compasses only. Construct a triangle KLM where KL = 8cm. KLM = $45^{o}$ and KL = $60^{o}$

b) Measure angle KMN

3. Using a ruler, a pencil and a pair of compasses only. Construct a triangle ABC where AB = 7.cm, ABC = $60^{o}$ and BAC = $45^{o}$. drop a perpendicular line from C to meet AB at X.

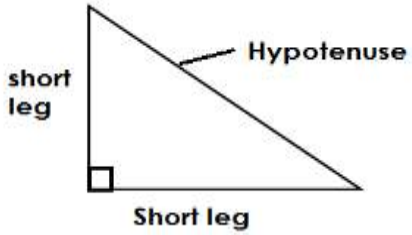
b) Measure line $\overline{CX}$

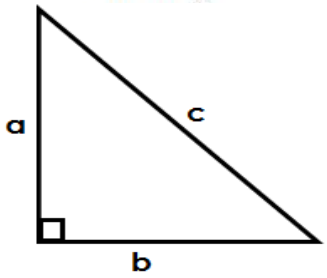
**TOPIC:9**

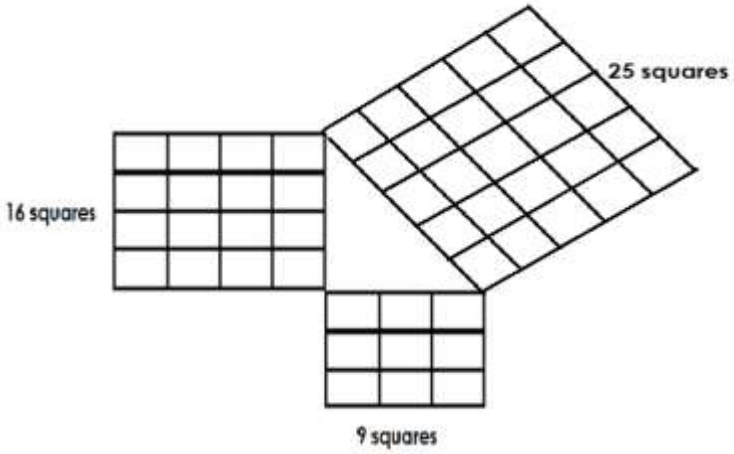
# LENGTH MASS AND CAPACITY

## PYTHAGORAS THEOREM

- It states that the sum of squares on the short legs will equal to the number of squares on its hypotenuse



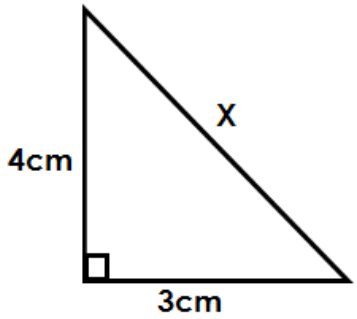




$\therefore\ a^2 + b^2 = c^2$

**Examples.**

1. In the figure below, find the value of X.




**Soln.**

$a^2 + b^2 = c^2$

$4^2 + 3^2 = x^2$

$4 \times 4 + 3 \times 3 = x^2$

$16 + 9 = x^2$

$\sqrt{25} = \sqrt{x^2}$

$5 = X$

$X = 5cm$

Find its perimeter

P = S + S + S

= 4cm + 3cm + 5cm

= 12cm

c) Find its area

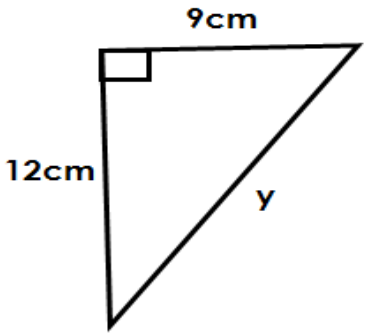
**soln.**

A = $\frac{1}{2}$ X b x h

= $\frac{1}{2}$ x 3cm x 4cm

= 6cm

2. Given the figure below. Find its height.




$a^2 + b^2 = c^2$

$12^2 + 9^2 = y^2$

$12 \times 12 + 9 \times 9 = y^2$

$144 + 81 = y^2$

$\sqrt{225} = \sqrt{y^2}$

$15 = y$

**y = 15**

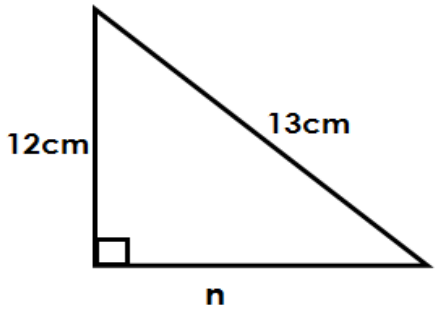
b) Find its area.

Area = $\frac{1}{2}$ x b x h

= $\frac{1}{2}$ X 9cm x12cm

**= 54cm$^2$**

3. Use the figure below to answer questions that follow




a) Find the value of n.

$n^2 + b^2 = c^2$

$n^2 + 12^2 = 13^2$

$n^2 + 12 \times 12 = 13 \times 13$

$n^2 + 144 = 169$

$n^2 + 144 - 144 = 169 - 144$

$\sqrt{n^2} = \sqrt{25}$

**n = 5cm**

b) Find the perimeter

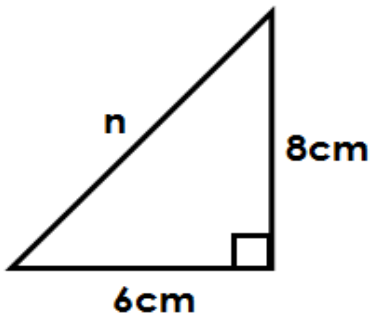
P = S + S + S

= 12cm + 5cm + 13cm

**= 30cm**

**Activity:**

1. In the figure below,




a) Find the value of n.

b) Find its area and perimeter.

2) Find the value of the;

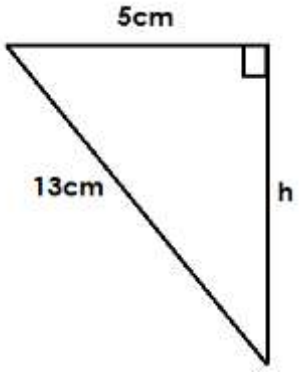
i) Unknown

ii) Area

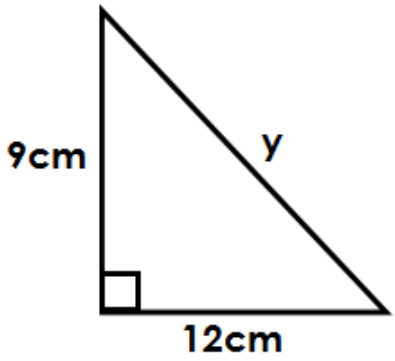
iii) Perimeter

of the following: -

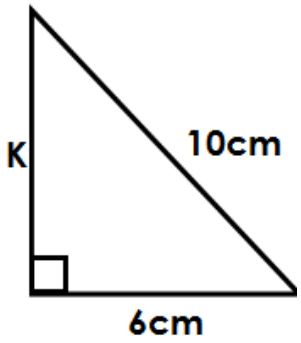
a)



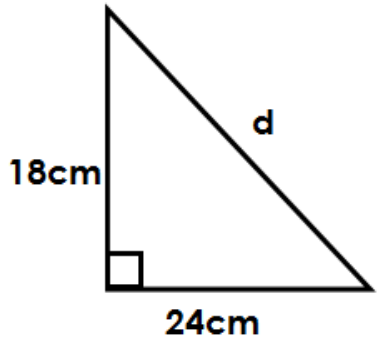

b)



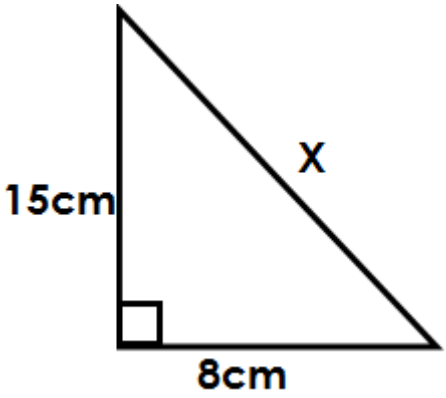

c)



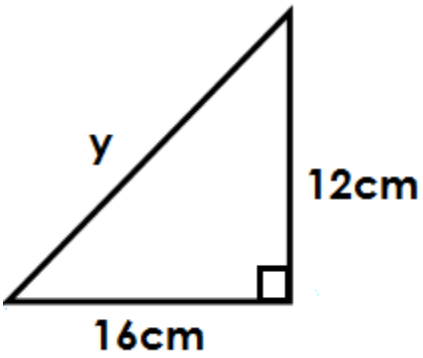

d)



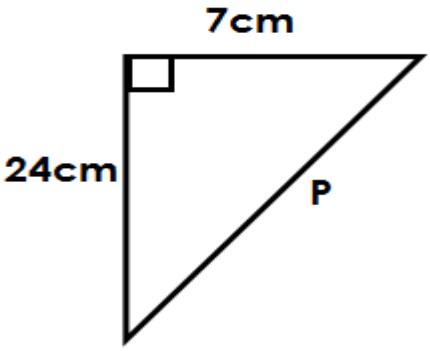

e)



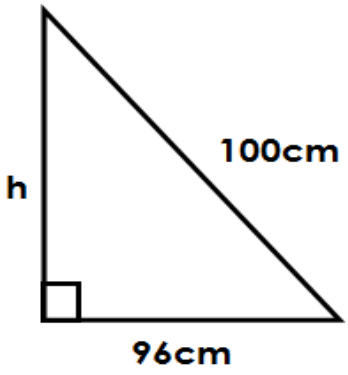

f)




g)



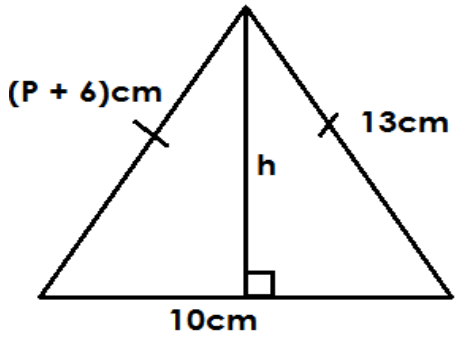

h)



## ISOSCELES TRIANGLE AND PYTHAGORAS THEOREM

Below is a triangle. Use it to answer questions.

a) Find P.



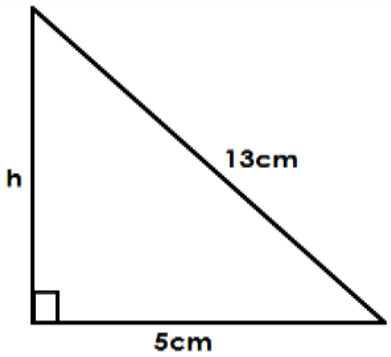

side = side

P + 6 = 13

P + P – 6 = 13 – 6

P = 7cm

b) Find the value of h.




$a^2 + b^2 = c^2$

$h^2 + 5^2 = 12$

$h^2 + 5 \times 5 = 13 \times 13$

$h^2 + 25 = 169$

$h^2 + 25 - 25 = 169 - 25$

$\sqrt{h^2} = \sqrt{144}$

**h = 12cm**

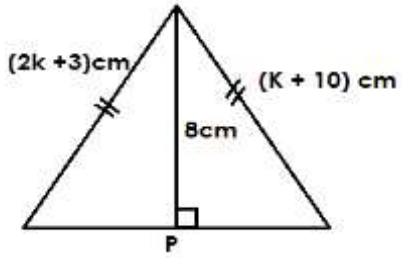
c) Calculate its area.

A = $\frac{1}{2}$ x b x h

= $\frac{1}{2}$ x 10cm x 12cm

**= 60cm$^2$**

2. Below is a triangle. Use it to answer questions.




Find the value of K

Side = side

2k + 3 = k + 10

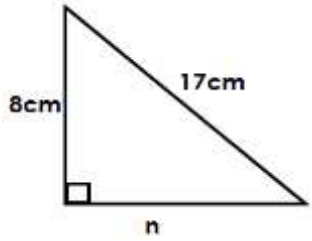
2k + 3 – 3 = k +10 – 3

2k = k + 7

2k – k = K – k + 7

K = 7

**Find the value of P.**




$a^2 + b^2 = c^2$

$n^2 + 8^2 = 17$

$n^2 + 64 - 64 = 289 - 64$

$\sqrt{n^2} = \sqrt{225}$

**n = 15cm**

p = n + n

= 15cm + 15cm

**= 30cm**

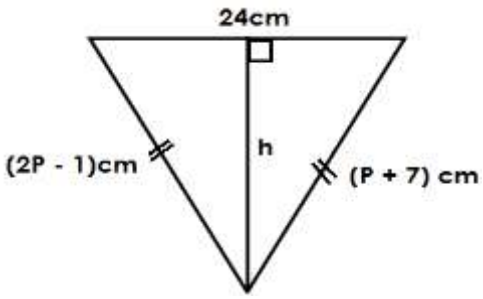
Find its area.

Area = $\frac{1}{2}$ x b x h

= $\frac{1}{2}$ x 30cm x 8cm

**= 120cm$^2$**

3. Study the figure below and answer questions.




a) Find the value of P.

**soln.**

side = side

2P – 1 = P + 7

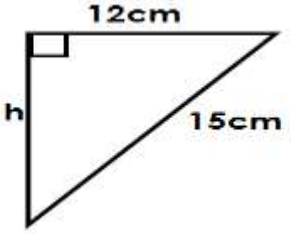
2P – 1 + 1 = P + 7 + 1

2P = P + 8

2P – P = P – P + 8

**P = 8**

Find the value of h




$a^2 + b^2 = c^2$

$h^2 + 12^2 = 15^2$

$h^2 + 12 \times 12 = 15 \times 15$

$h^2 + 144 = 225$

$h^2 + 144 - 144 = 225 - 144$

$\sqrt{h^2} = \sqrt{81}$

**n = 9cm**

find its area

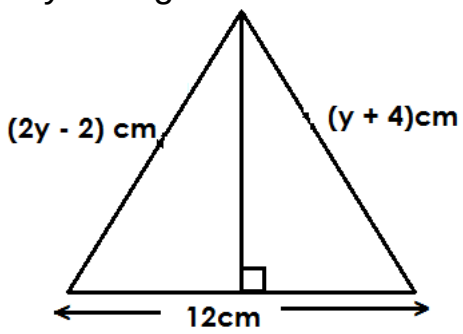
Area = $\frac{1}{2}$ X b x h

= $\frac{1}{2}$ x 24cm x 9cm

**= 108cm$^2$**

**Activity:**

1. Study the figure below and answer questions.



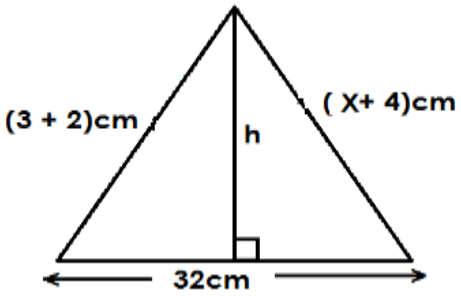

a) Find the value of Y.

b) Find the value of h

c) Find its i) Area

ii) Perimeter

2. Study the figure below and answer questions

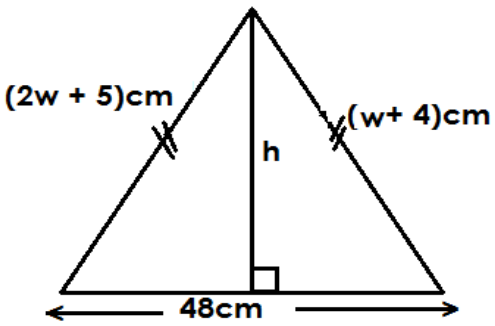



a) Find the value of i) X

ii) h

b) Find its area.

3. Study the figure below and answer questions




Find the value of;

i) W

ii) h

## FINDING BASE OR HEIGHT OF TRIANGLE GIVEN AREA

Here, apply the formula for finding area of a triangle which is;

Area = $\frac{1}{2}$ x b x h

1. The area of a triangle is 48cm$^2$. If its base is 16cm, find the height.

$\frac{1}{2}$ x b x h = Area

$\frac{1}{2}$ x 16cm x h = 48cm$^2$

8cmh = 48cm$^2$

$\frac{8cmh}{8cm} = \frac{48cm \times cm}{8cm}$

h = 6cm

Base = 8cm

3. Find the height of a triangular garden whose area is 60cm2 and has of 10m.

$\frac{1}{2}$ x b x h = Area

$\frac{1}{2}$ x 10cm x h = 60m$^2$

$\frac{5mh}{5m} = \frac{60m^2}{12}$

$\frac{5mh}{5m} = \frac{60m \times m}{5m}$

h = 12m

height = 12m

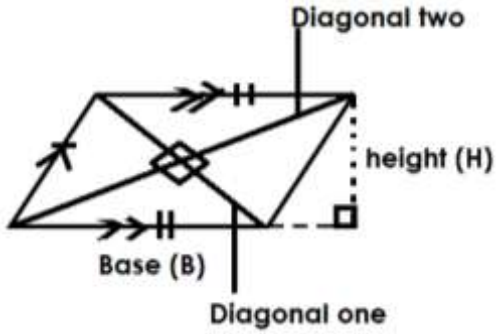
## Activity

1. Find the height of a triangle whose is 33cm$^2$ and has height of 11cm.
2. What is the base of a triangle of area 65cm$^2$ and has height of 13dm?
3. Find the base of a triangle whose area is 84m$^2$ and has height of 14m.
4. The area of a triangle is 104cm$^2$. Find its base of its height is 16cm$^2$.
5. The area of a triangular flower garden is 300m2. Find the length of its base if it has height of 20m.

## A PARALLELOGRAM

- A parallelogram is slanted rectangle.
- Its two opposite sides are equal and parallel to each other.
- It has two diagonal bisecting each other at an angle of $90^0$ hence perpendicular to each other.
- It has no line of folding symmetry.

**Illustration**

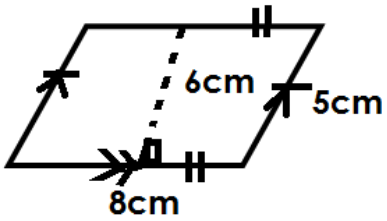



## FINDING AREA OF A PARALLELOGRAM

**Area = B x H**

1. Find the area of the figures below.

(a)

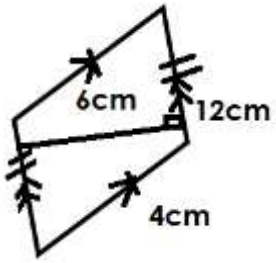



Area = B x H

= 8cm x 6cm

= $48cm^2$

(b)




Area = B x H

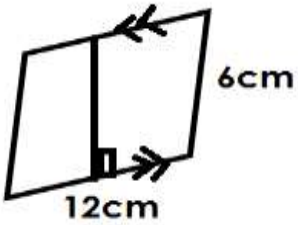
= 12m x 6m

= $72m^2$

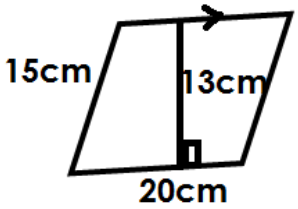
**Activity**

Find the area of the following

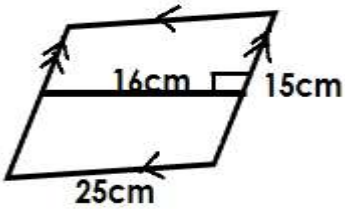
(a)



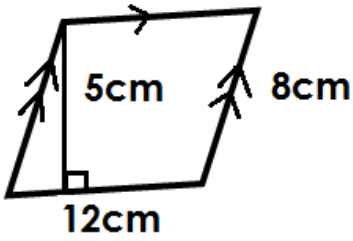

(b)




(c)




(d)



## FINDING HEIGHT OR BASE OF PARALLELOGRAM GIVEN AREA

**Note**:

Use the formula; Area = B x H to find base or weight of a parallelogram.

1. Find the base of a parallelogram whose area is 32cm2 and its height is 4cm.

   B x H = Area

   B x 4cm = $32cm^2$

   4cm B = $32cm^2$

   8

   4cm = 32cm x cm

   4cm

   B = 8cm

2. Find the height of a parallelogram whose area is 45cm2 and has base of 9m.

   B x H = Area

   9m x h = $45cm^2$

   5

   9mh = 45m x m

   9m 9m

   h = 5m

   height = 5m

3. The area of a parallelogram is 54dm2. Find its base if it has heigh of 9dm.

   B x H = Area

   B x 9dm = $54dm^2$

   9dmb = $54dm^2$

   6

   9dmb = 54dm x dm

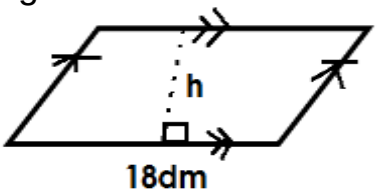
   9dm 9dm

   B = 6dm

   ∴ Base = 6dm

## Activity

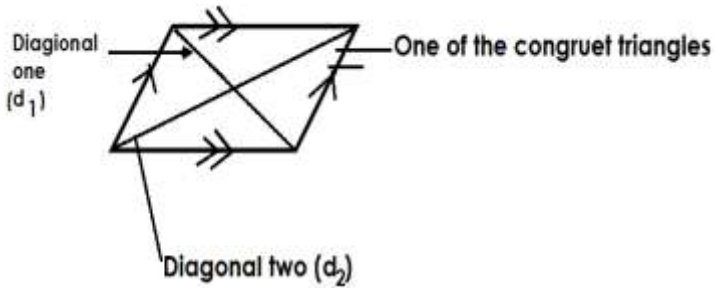
1. Find the base of a parallelogram whose area is $36cm^2$ and has height of 12cm.
2. The area of a parallelogram is $84cm^{2.}$ Find its height if its base 14m.
3. Find the height of a parallelogram of area of 48dm2 and base of 8 dm.
4. Given that a parallelogram has area of 64cm2 and height of 16cm. Find its base.
5. The figure below has area of 81dm2. Find the value of h.




## A RHOMBUS

- A rhombus is a slanted square.
- All its sides are equal.
- It has two opposite sides parallel.
- It has two diagonals bisecting each other at an angle of $90^0$ and also acting as its line of folding symmetry.
- A rhombus is made up of 4 congruent triangles.

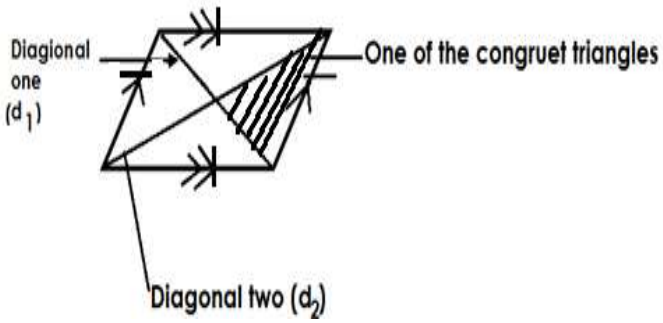
**Illustration**



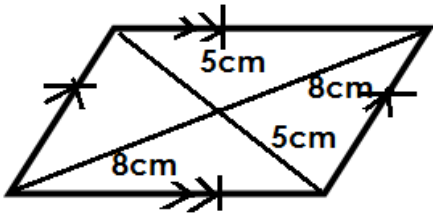

## FINDING AREA OF ARHOMBUS AND PERIMETER

Area $= \frac{1}{2} \times d_1 \times d_2$

Area $= \frac{1}{2} \times b \times h$ (Where 4 represents 4 congruent triangles)



1. Find the area of the rhombus below.




$d_1$ = 5cm + 5cm

10cm

$d_2$ = 8cm + 8cm

16cm

Area = $\frac{1}{2}$ x $d_1$ x $d_2$

8

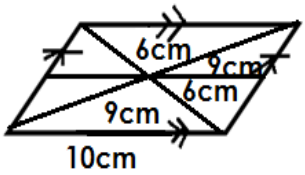
= $\frac{1}{\cancel{2}}$ x 10cm x ~~18~~cm

1

= 10cm x 8cm

= 80cm$^2$

2. Find the area and perimeter of the figure below.




$d_1$ = 6cm+6cm

= 12cm

$d_2$ = 9cm+9cm

= 18cm

Area = $\frac{1}{2}$ x $d_1$ x $d_2$

= $\frac{1}{2}$ x 12cm x 18cm

= 6cm x 18cm

= 108cm$^2$

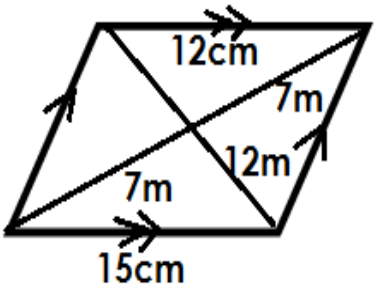
Perimeter

P= 4 x S

= 4 x 10cm

= 40cm

3. Find the area and perimeter of the figure below.




$d_1$ = 7m + 7m

= 14m

$d_2$ = 12m + 12m

$d_2$ = 24

Area = $\frac{1}{2}$ x $d_1$ x $d_2$

7

$\frac{1}{2}$ x ~~14m~~ x 24m

= 168m$^2$

**Perimeter**

P = S + S + S + S

= (15m + 15m) + 15m + 15m

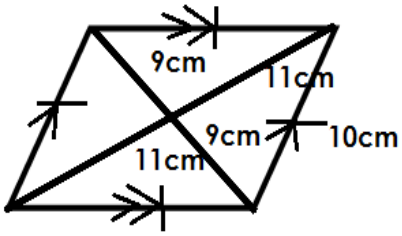
= 30m + 30m

= 60m

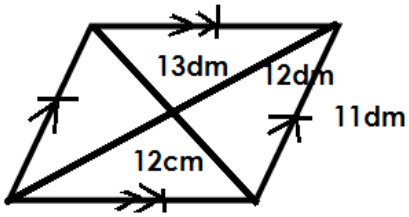
**Activity and perimeter**

1. Find the area of the following figures.

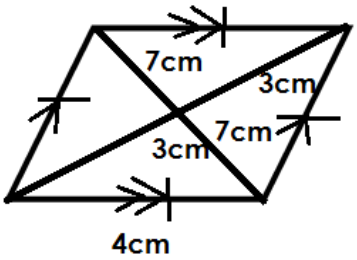
(a)



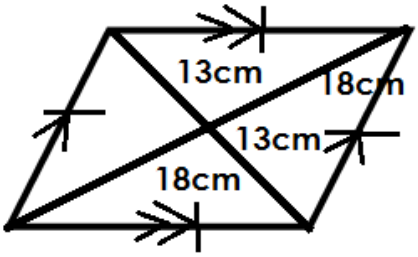

(b)



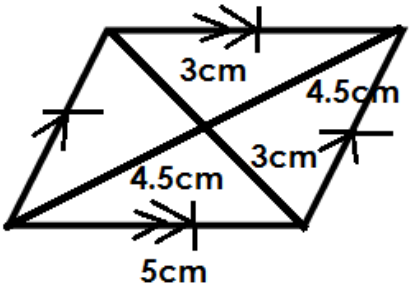

(c)



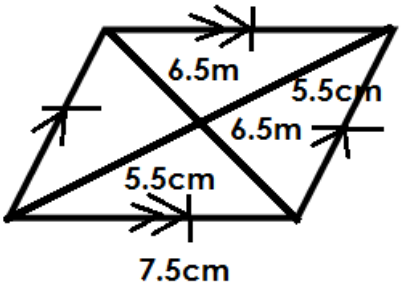

(d)




(e)




(f)



## FINDING THE MISSING DIAGONAL OF ARHOMBUS GIVEN AREA

1. The area of a rhombus is 80cm2. If one diagonal is 16cm. Find the other diagonal.

$\text{Area} = \frac{1}{2} \times d_1 \times d_2$

$\frac{1}{2} \times 16\text{cm} \times d2 = 80\text{cm}^2$

$8\text{cm}d2 = 80\text{cm}^2$

$10$

$8\text{cm}d_2 = \frac{80\text{cm}^2 \times \text{cm}}{8\text{cm}}$

$d_2 = 10\text{cm}$

2. Find the second diagonal of a rhombus whose area is 120dm2 and its other diagonal is 10dm.

$\text{Area} = \frac{1}{2} \times d_1 \times d_2$

$\text{Area} = \frac{1}{2} \times d_1 \times d_2$

$5\text{dm}\ d_2 = 120\text{dm}^2$

$24$

$\frac{5\text{dm}\ d^2}{5\text{dm}} = \frac{120\text{dm}^2 \times \text{dm}}{5\text{dm}}$

$d^2 = 24\text{dm}$

$\therefore$ Diagonal = 24dm

3. A rhombus whose area is 40cm2 has one diagonal of 16cm. Find the length of the second diagonal.

$\text{Area} = \frac{1}{2} \times d_1 \times d_2$

$\frac{1}{2} \times 16\text{cm} \times d_2 = 40\text{cm}^2$

$8\text{d}\ 8\text{cm}\ d_2 = 40^2$

$5$

$\frac{8\text{cm}\ d_2}{8\text{cm}} = \frac{40\text{cm} \times \text{cm}}{8\text{cm}}$

$d_2 = 5\text{cm}$

Diagonal = 5cm

**Activity**

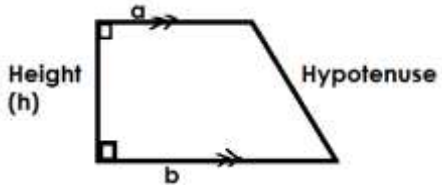
1. The area of a rhombus is $36cm^2$. If the first diagonal is 6cm, find the second diagonal.
2. Given that the area of a rhombus is $48cm^2$ and is its first diagonal is 12m, find the second diagonal.
3. Find the length of the second diagonal of a rhombus whose area is $96cm^2$ and the shorted diagonal is 9dm.
4. Find the second diagonal of a rhombus of area $24cm^2$ and the length of its second diagonal is 8m.
5. If a rhombus has area of $54cm^2$ and the longer diagonal of length 12cm, find the length of the shorter diagonal.

**TRAPEZIUM**

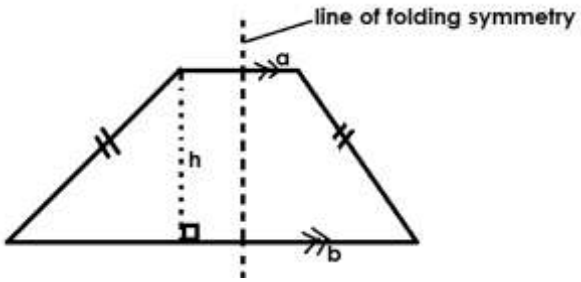
- A trapezium is a quadrilateral made up a triangle or triangles and another quadrilateral (square or rectangle).
- It has two parallel sides.
- A scalene trapezium has no line of folding symmetry.
- An Isosceles trapezium has one line of folding symmetry.

Illustration

(a) **Scalene trapezium**




(b) **Isosceles trapezium**




**a** is the shorter parallel side.

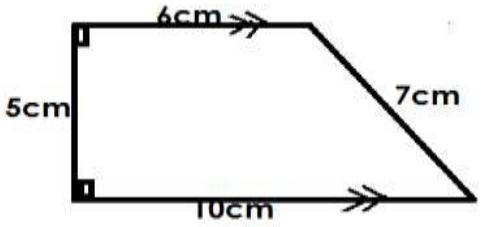
**b** is the longer parallel side.

**h** is the height of the parallelogram.

## FINDING AREA AND PERIMETER OF A TRAPEZIUM

Area = $\frac{1}{2}$ x $d_1$ x $d_2$

1. Find the area of the figure below.




Area = $\frac{1}{2}$ x 5cm ( 10cm + 6cm)

$\frac{1}{2}$ x 5cm x 8cm

5cm x 8cm

$40cm^2$

(b) Find its perimeter

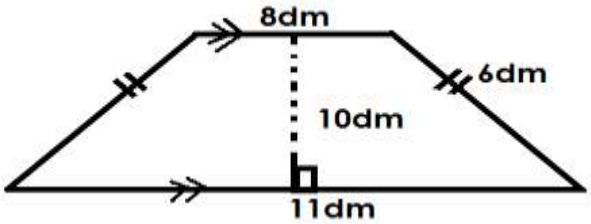
P = S + S + S + S

= (10cm + 7cm) + (6cm + 5cm)

= 17cm + 11cm

= 28cm

2. Find the area and perimeter of the figure below.




Area

Area= $\frac{1}{2}$ x h (a + b)

$\frac{1}{2}$ x 10dm (11dm + 8dm)

5dm x 19dm

= $95dm^2$

Perimeter

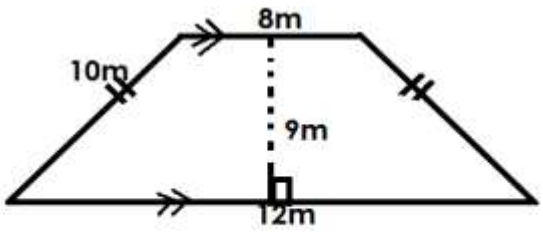
P = S + S + S + S

= (11dm + 6dm) + (8dm + 6dm)

= 17dm + 14dm

= 21dm

3. Below is a figure, use it to answer questions that follow.




Area

Area= $\frac{1}{2}$ x h (a + b)

$\frac{1}{2}$ x 9m (12m + 8m)

$\frac{1}{\cancel{2}_{1}}$ x 9m x $\cancel{20m}^{10}$

= $90m^2$

Perimeter

P = S + S + S + S

= (12m + 8m) + (10m + 10m)

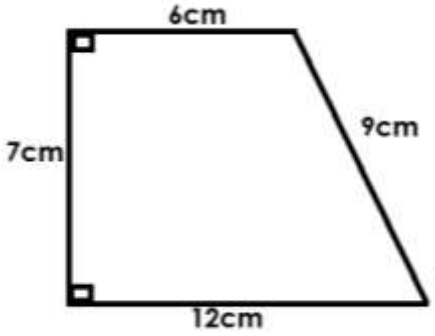
= 20m + 20m

= 40m

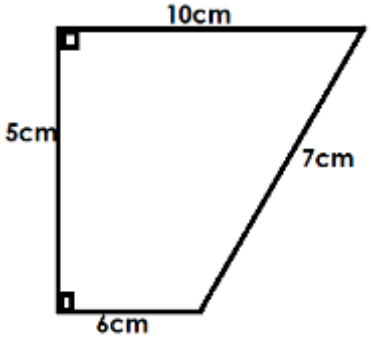
**Activity**

Find the area and perimeter of the following figures.

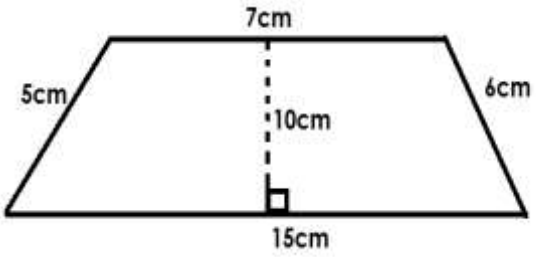
(a)



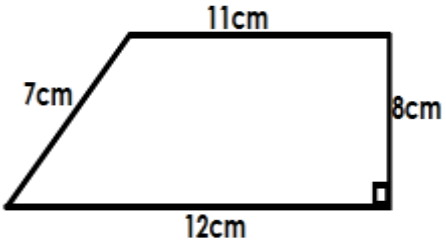

(b)



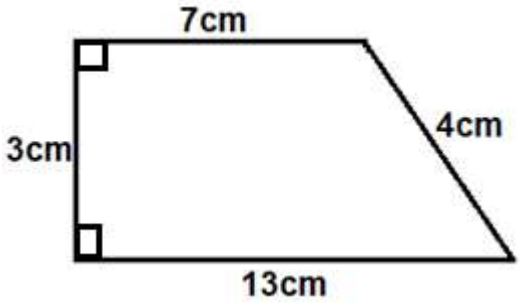

(c)




(d)

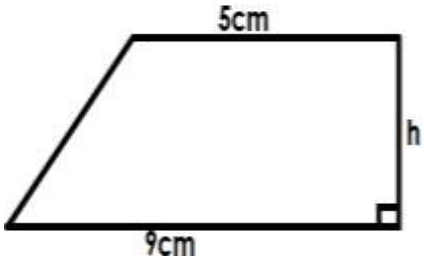



(e)



## FINDING UNKNOWN SIDES OF A TRAPEZIUM GIVEN AREA.

1. Below is a trapezium whose area is $42cm^2$.




Find the value of h.

**Soln.**

$\frac{1}{2}h(a+b) = \text{Area}$

$\frac{1}{2} \times h(9cm + 5cm) = 42cm^2$

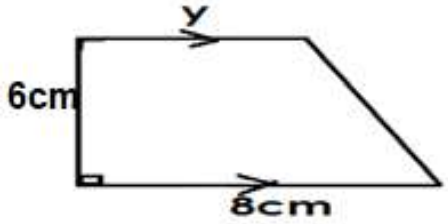
$\frac{1}{2} \times h \times \cancel{14cm}^{7} = 42cm^2$

$\cancel{2}$

$\cancel{7cm}\ h = \frac{\cancel{42}^{6}cm \times \cancel{cm}}{\cancel{7cm}}$

$h = 6cm$

2. Below is a trapezium whose area is $42cm^2$.




$\frac{1}{2} \times h(a+b) = \text{Area}$

$\frac{1}{2} \times 6cm(y + 8cm) = 42cm^2$

$3cm \times y + 8 \times 3cm = 42cm^2$

$3cmy + 24cm^2 - 24cm = 42cm^2 - 24cm^2$

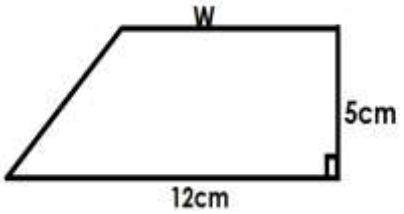
$3cmy = 18cm$

$\cancel{3cm}^{1}y = 18cm \times cm$

$\cancel{3cm}$

$y = 6cm$

3. The figure below is a trapezium whose area is $50cm^2$.




$\frac{1}{2} \times h\,(a + b) = \text{Area}$

$\frac{1}{2} \times 5cm\,(W + 12cm) = 50cm^2$

$\frac{5cm\,(W + 12cm)}{2_1} = 50cm^2 \times 2$

$5cmW + 60cm^2 = 100cm^2$

$5cm\,W + 60cm^2 - 60cm^2 = 100cm^2 - 60cm^2$

$5cmW = 40cm^2$

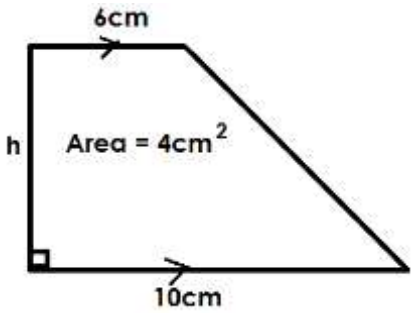
$\frac{5cm\,W}{5cm} = \frac{40cm \times cm}{5cm}$

$W = 8cm$

## Activity

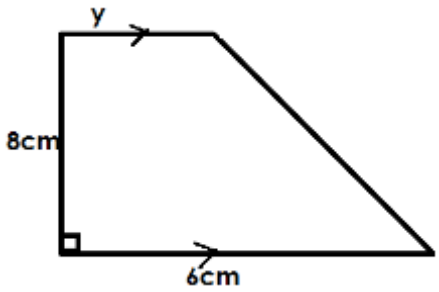
1. Given the figure below find the unknown.

(a)




(b) Find its perimeter.

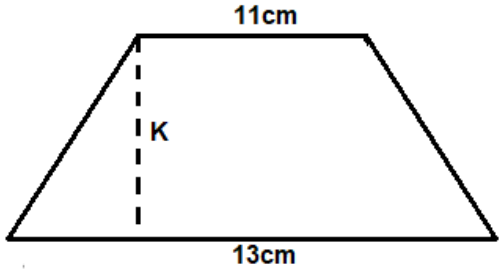
2. The figure below is a trapezium whose area is $44cm^2$.



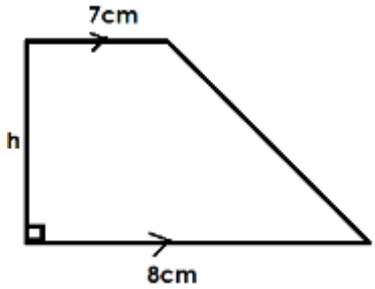

a) Find the value of y

b) find the perimeter of the figure.

3. The figure below is trapezium whose area is 144cm$^2$. Find the value of K.

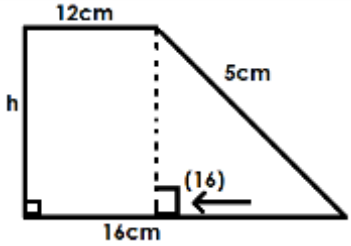



4. The area of the figure below is 90cm$^2$. Find the value of h.

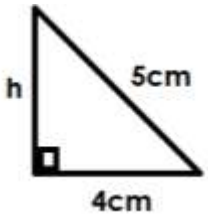



## A TRAPEZIUM AND PYTHAGORAS THEOREM

1. Below is a trapezium. Use it to find the value of h.




**Soln.**




$a^2 + b^2 = c^2$

$h^2 + 4^2 = 5$

$h^2 + 4 \times 4 = 5 \times 5$

$h^2 + 16 = 25$

$h + 16 - 16 = 25 - 16$

$\sqrt{h^2} = \sqrt{9}$

$h = 3cm$

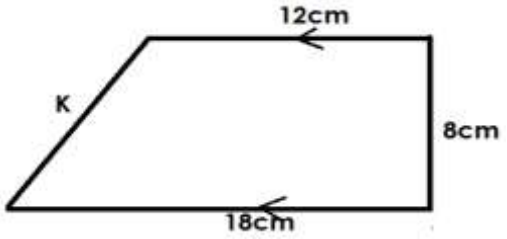
(b) Find its perimeter

$P = S + S + S + S$

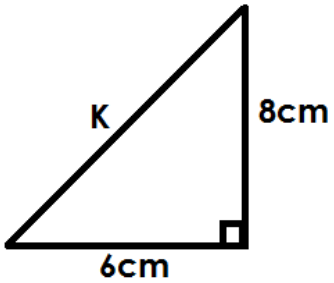
$= 16cm + 5cm + 12cm + 3cm$

$= 36cm$

2. Use the figure below to answer questions that follow.




(a) Find the value of K.




$a^2 + b^2 = c^2$

$6^2 + 8^2 = c^2$

$6 \times 6 + 8 \times 3 = c^2$

$36 + 64 = c^2$

$\sqrt{100} = \sqrt{c}$

$\therefore c = 10cm$

$K = 10cm$

(b) Find the area of the figure.

$\text{Area} = \frac{1}{2} \times h(a + b)$

$= \frac{1}{\cancel{2}_1} \times \cancel{8}^{4}cm\ (12cm + 8cm)$

$= 4cm\ (30cm)$

$= 120cm^2$

(c) Find its perimeter

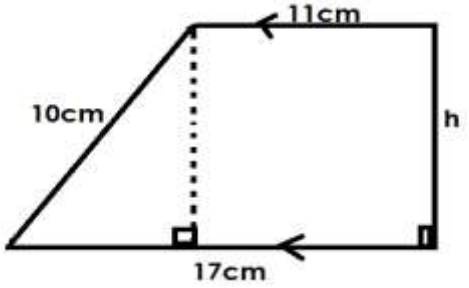
$P = S + S + S + S$

$= 18cm + 8cm + 12cm + 10cm$

$= 48cm$

**Activity**

1. Below is a trapezium. Use it to answer question.

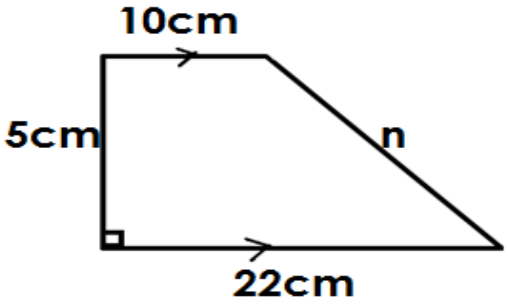



(a) Find the value of h.

(b) Find its area.

(c) Find the perimeter of the figure.

2. Below is a trapezium

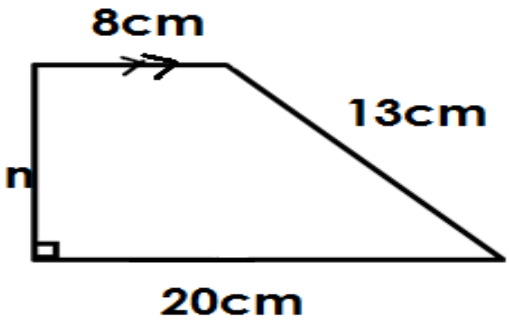



(a) Find the value of n.

(b) Find its perimeter.

(c) Find its area.

3. In the diagrams below.

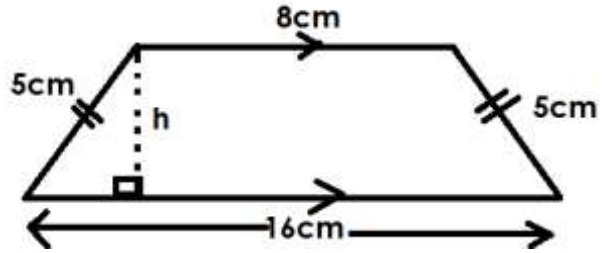



(a) Find the value of h.

(b) Find its area.

(c) Find its perimeter.

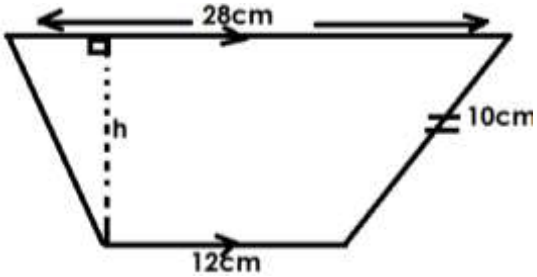
4. Use the figure below to answer questions that follow.




(a) Find its height.

(b) Find its area.

5. Below is a trapezium, use it to answer questions that follow.

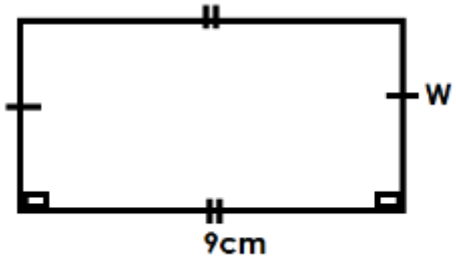



(a) Find the value of h.

(b) Find its area.

## FINDING ONE SIDE OF A RECTANGLE GIVEN AREA AND PERIMETER

1. Below is a rectangle whose area is 36cm2. Find its width.




L x W = Area

$9cm \times W = 36cm^2$

$\frac{\cancel{9cm}W}{\cancel{9cm}} = \frac{\overset{4}{\cancel{36cm}}}{9cm} \times cm$

W = 4cm

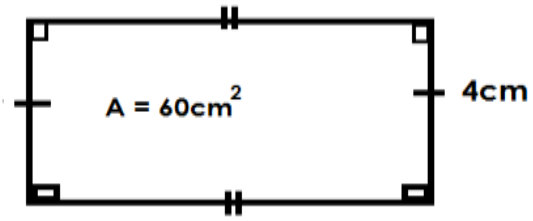
(b) Calculate its perimeter

P = L + W + L + W

P = 9cm + 4cm + 9cm + 4cm

= 26cm

2. Find the perimeter of a rectangle whose area is $60cm^2$ and has width of 4cm.




L x W = Area

L x W = $60cm^2$

$4cmL = \frac{60cm}{4cm} \times \frac{15}{} cm$

L = 15cm

**Perimeter.**

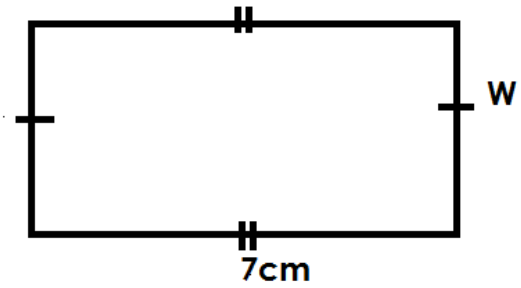
P = L x W x L x W

P = 15cm + 4cm + 15cm + 4cm

= 38cm

**Activity**

1. Find the perimeter of a rectangle below whose area is $28cm^2$ and length is 7cm.




3. Find the perimeter of a rectangle whose area is $40cm^2$ and width is 5cm.

(a) Find the L

3. Given area of a rectangle is $126cm^2$ its width is 9cm. Find its length.

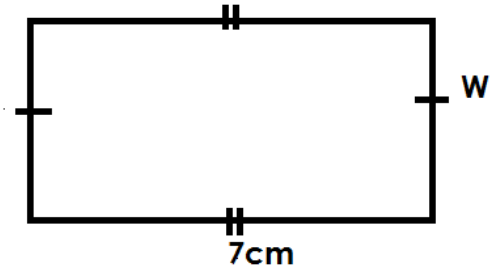
(b) Find its perimeter.

4. The area of a rectangle is $50cm^2$ and its width is 5cm. Find its perimeter.

Finding one side and area given perimeter.

## FINDING ONE SIDE AND AREA GIVEN PERIMETER.

1. The perimeter of a rectangle below id 24cm. Find its area.



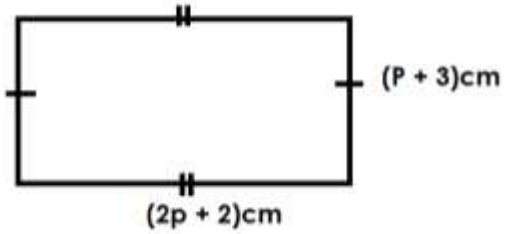

7cm + W + 7cm + W = 24cm
7cm + 7cm + W + W = 24cm
14cm + 2w = 24cm
14cm – 14cm + 2w = 24cm - 14cm

$\frac{2w}{2} = \frac{10cm}{2}$

W = 5cm

**Area = L x W**
= 7cm x 5cm
= $35cm^2$

2. The perimeter of the figure below is 46cm.




Find the value of P.

L + W + L + W = P

2P + 2 + P + 3 + 2P + 2 + P + 3 = 46cm

2P + P + 2P + P + 2 + 3 + 2 + 3 = 46cm

6P + 10 = 46cm

6P + 10 - 10 = 46 cm - 10

$\frac{6P}{6} = \frac{36}{6}$

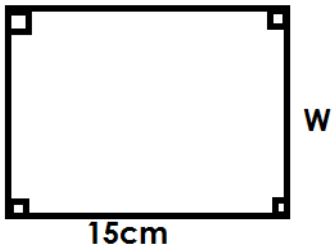
P = 6cm

(b) Find its area

| length | width | Area |
|---|---|---|
| (2P + 2)cm<br>(2 x 6 + 2)cm<br>(12 + 2)cm<br>14cm | P = 3<br>(6 + 3)cm<br>9cm | = L x W<br>= 14cm x 9<br>= 126cm$^2$ |

**Activity**

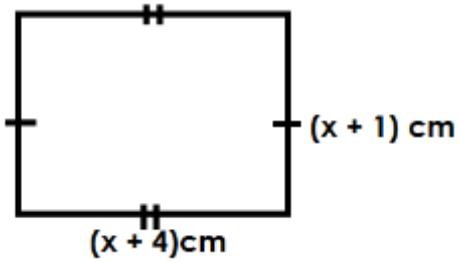
1. The perimeter of a rectangle is 38cm.




(a) Find the value of W.

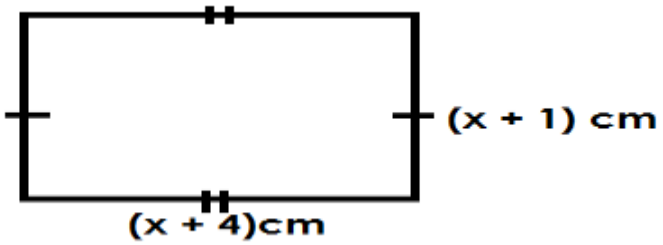
(b) Find the area of the rectangle.

2. The perimeter of the figure below is 34cm. find the value of x.




(b) Find its area.

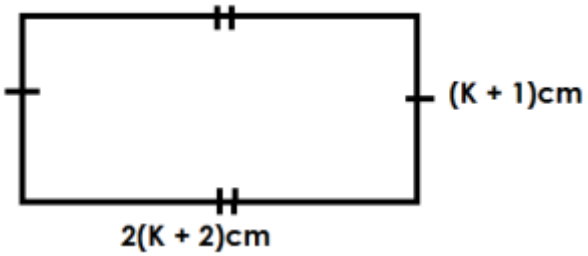
3. The perimeter of a rectangle below is 30cm.




a) Find the value of P.

(b) Find its area.

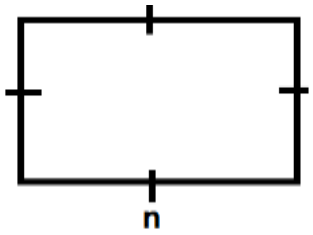
4. The perimeter of a rectangle is 28cm.




Find its area.

**Finding one side of a square given area.**

1. The area of a square garden is 36cm$^2$. Find one side of a square.




side x side = Area

n x n = 36

$\sqrt{n^2} = \sqrt{36}$

n = 6cm

2. The area of a square garden is 225dm$^2$. Find one side of a square.

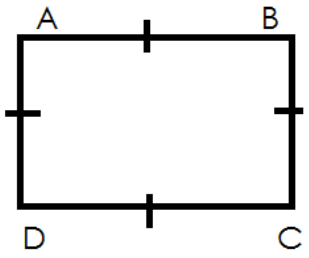
**Let one side be K.**

K x K = 225

$\sqrt{K^2} = \sqrt{225}$

K = 15cm

3. The area of a square garden is $6.25dm^2$. Find the length of AB.




soln

Let one side be r

$r \times r = 6.25$

$\sqrt{r} = \sqrt{6.25}$

$\sqrt{r^2} = \sqrt{\frac{6.25}{100}}$

$r = \frac{25}{2 \times 5}$

$= \frac{2(5)}{10}$

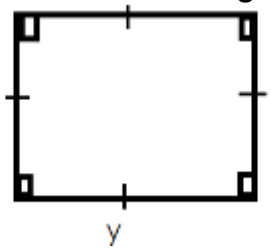
$r = 2.5cm$

| | |
|---|---|
| 5 | 625 |
| 5 | 125 |
| 5 | 25 |
| 5 | 5 |
| | 2 |

| | |
|---|---|
| 2 | 100 |
| 2 | 50 |
| 2 | 25 |
| 5 | 5 |

**Activity**

1. If the area of the figure below is $49cm^2$. Find the length of one side.



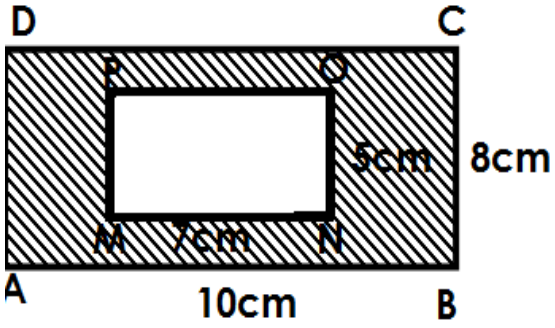

2. If the area of a square below is $144cm^2$. Find one side of a square.
3. The area of a square is $400cm^2$. Find one side of a square.
4. The area of square garden is $0.009dm^2$. Find one side of the garden.
5. The area of a square swimming pool is $1.69cm^2$. Find one side of the swimming pool.

## FINDING AREA OF SHADED PARTS OF THE A RECTANGLE.

**Note.**

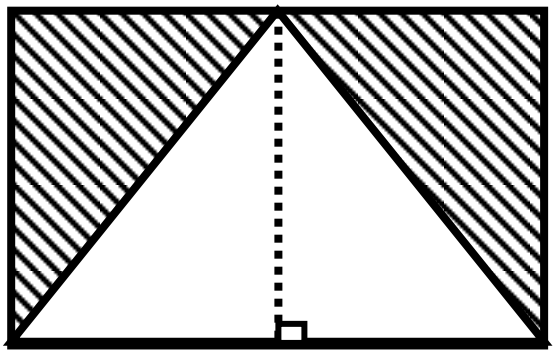
Area of the shaded part = Area of the outer figure **–** Area of the inner figure.

1. Find the area of the shaded part in the figure below.



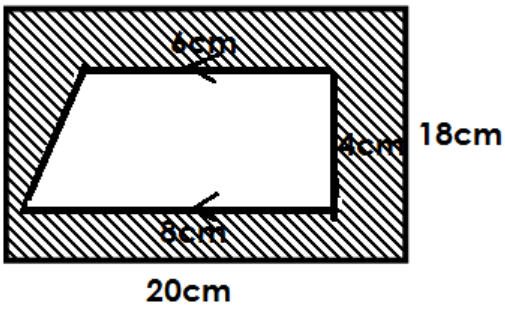

| Area of outer figure | Area of inner figure | shaded part |
|---|---|---|
| Area = L x W<br>= 10cm x 8cm<br>= $80cm^2$ | Area = L x W<br>= 7cm x 5cm<br>= $35cm^2$ | $\cancel{8}^{7}10\ cm^2$<br>$-\ 35\ cm^2$<br>$45\ cm^2$ |

2. Find area of shaded part in the figure below.




| Area of outer | Area of inner | Shaded part |
|---|---|---|
| A = L x W<br>= 10cm x 6cm<br>= $60cm^2$ | $A = \frac{1}{2} \times b \times h$<br>$= \frac{1}{\cancel{2}_1} \times \cancel{10}^{5}cm \times 6cm$<br>$= 30cm^2$ | $60cm^2$<br>$-\ 30cm^2$<br>$30cm$ |

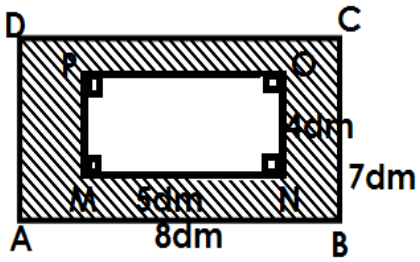
3. Find the area of the shaded part in the figure below.




| Area of outer | Area of inner | Area of shaded |
|---|---|---|
| Area = L x W<br>= 20cm x 18cm<br>= $360cm^2$ | A = $\frac{1}{2}$ x h (a + b)<br>= $\frac{1}{2}$ x 4cm (6cm + 8cm)<br>= $\frac{1}{2}$ x 4cm x 14cm<br>= $28cm^2$ | $360cm^2$<br>- $28\ cm^2$<br>$332cm$ |

**Activity**

1. Study the figure below and answer question.

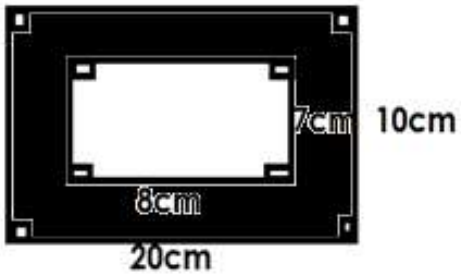



(a) Find the area of the outer figure.

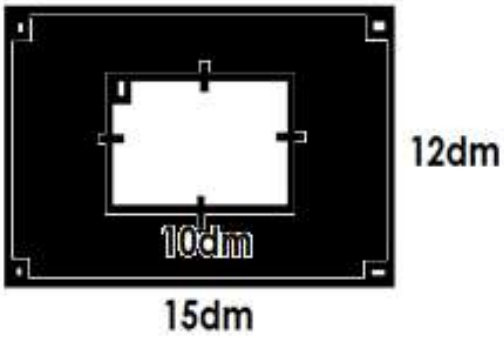
(b) Find the area of the inner figure.

(c) Find the area of the shaded part.

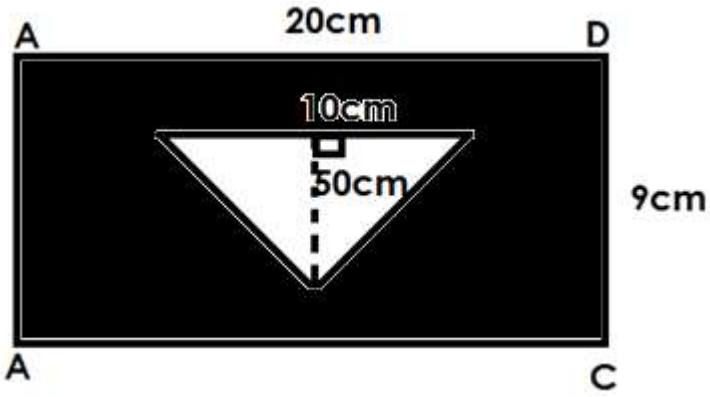
2. Find the area of the shaded part.



3. Find the area of the shaded part.



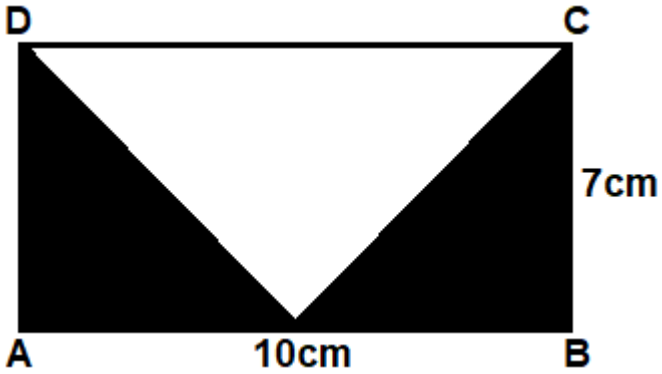

4. Study the diagram below and answer questions.




(a) Find the area of the inner figure.

(b) Calculate the area of the shaded part.

5. Study the figure below and answer questions.




(a) Calculate the area of the outer figure.

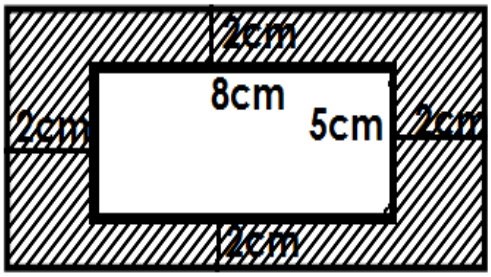
(b) Find the area of the unshaded part.

(c) Calculate the area of the shaded.

## MORE ABOUT CALCULATING AREA OF THE SHADED PART

**Examples.**

1. Study the figure below and answer questions.




(a) Find the length and width of the outer figure.

| Length | Width |
|---|---|
| 8cm + 2m + 2cm<br>12cm | 5cm + 2cm + 2cm<br>9cm |

(b) Find the area of the outer figure.

Area = L x W

= 12cm x 9cm

= $108cm^2$

(c) Find the area of the inner figure

A = L x W

= 8cm x 5cm

= $40cm^2$

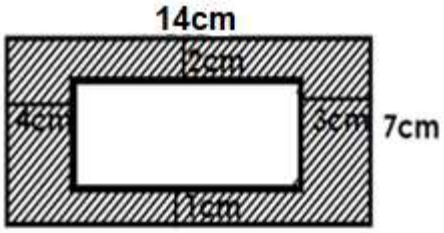
(d) Calculate the area of the shaded part.

$108cm^2$

\- $40cm^2$

$68cm^2$

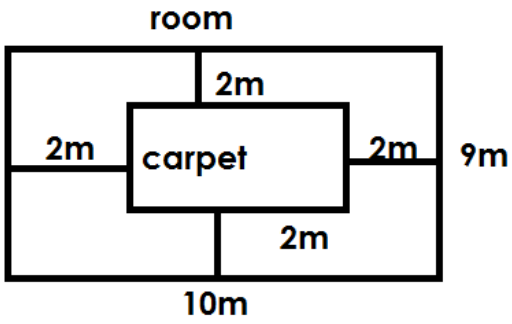
2. Find the area of the shaded part.




| Inner length | Inner width | Inner Area | Outer Area | Shaded Area |
|---|---|---|---|---|
| 14cm- (4cm+3cm)<br>14cm- 7cm<br>7cm | 7cm-(2cm+1cm)<br>7cm-3cm<br>4cm | A=LxW<br>=7cmx4cm<br>=28cm$^2$ | A=LxW<br>=14cmx7cm<br>=98cm$^2$ | 9 8cm$^2$<br>- 2 8cm$^2$<br>7 0cm$^2$ |

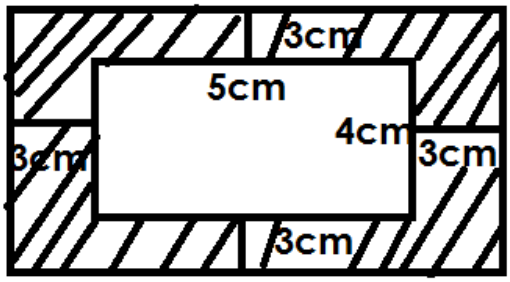
**Activity.**

1. A rectangle room 10m by 9m is covered by a carpet in the centre, such that 2m width is left uncovered all round find the area of the uncovered part.




2. A rectangular from is 30m by 20m a photo is placed centrally leaving 3m long the length and 2.

3. Study the figure below and answer questions.




(a) Find the length and width of the outer rectangle.

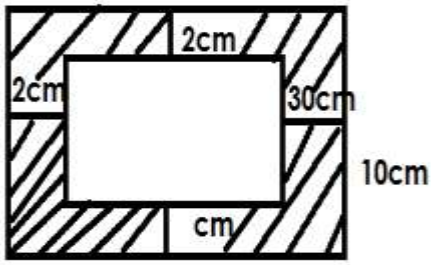
(b) Find the area of the outer figure.

(c) Find the area of the inner figure.

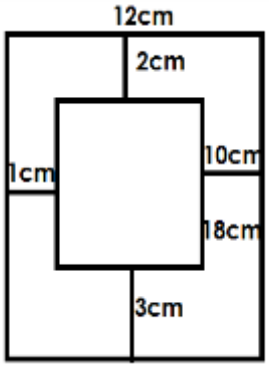
(d) Calculate the area of the shaded part.

2. Find the area of the shaded parts.

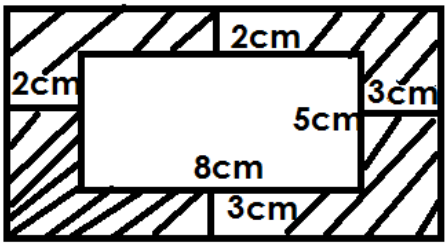
(a)



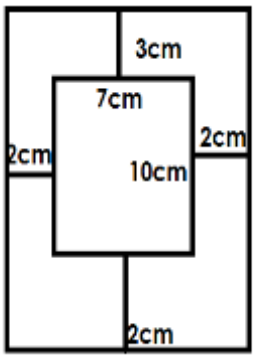

(b)




(c)




(d)

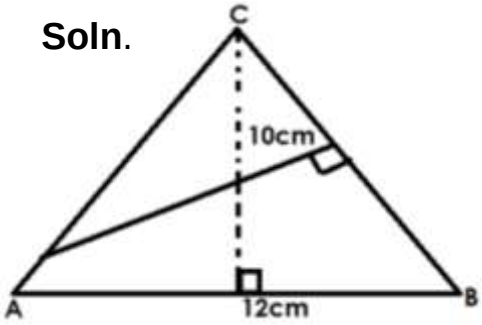



## FINDING BASE OR HEIGHT OF TRIANGLE AND A PARALLELOGRAM BY COMPARAING AREAS

### Examples.

1. Find the length of BC in the figure below.

**Soln**.




Area = Area

$\frac{1}{2} \times b \times h = \frac{1}{2} \times b \times h$

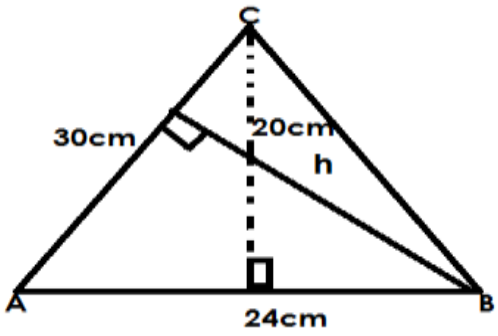
$\frac{1}{\cancel{2}_{1}} \times B \times \cancel{8cm}^{4} = \frac{1}{\cancel{2}_{1}} \times \cancel{12cm}^{6} \times 10cm$

$4cmB = 60cm^2$

$\frac{\cancel{4cm}\ B}{\cancel{4cm}} = \frac{\cancel{60cm}^{15} \times \cancel{cm}}{\cancel{4cm}}$

$B = 15cm$

2. Find the value of n in the figure below.




Area = Area

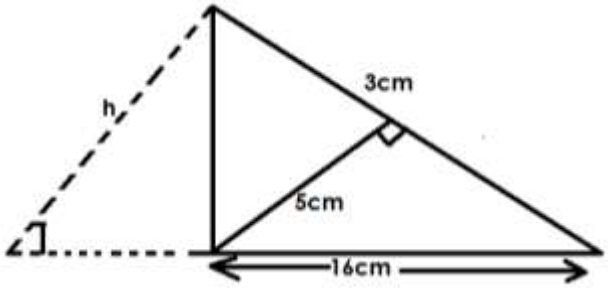
$\frac{1}{2} \times B \times H = \frac{1}{2} \times b \times h$

$\frac{1}{2} \times 32cm \times h = \frac{1}{2} \times 24cm \times 20cm$

$16cm\ h = 12cm \times 20cm$

$h = 15cm$

3. Use the figure below to find the value of h.




**Soln.**

Area = Area

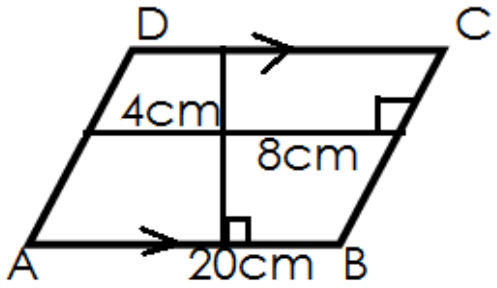
$\frac{1}{2} \times b \times h = \frac{1}{2} \times b \times h$

$\frac{1}{2} \times 16cm \times h = \frac{1}{2} \times 32cm \times 5cm$

$8cm\ h = 16cm \times 5cm$

$h = 10cm$

4. below is a parallelogram, use it to find length BC




**Soln.**

Area = Area

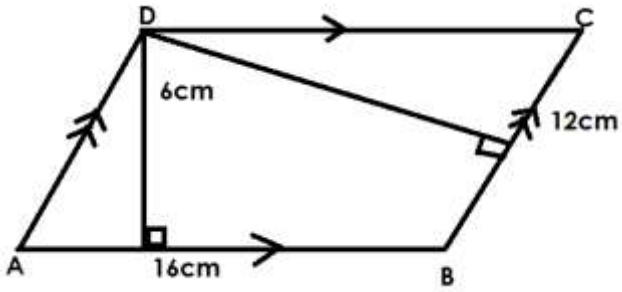
B x 4 = B x H

B x 4cm = 20cm x 8cm

$\frac{4cmB}{4cm} = \frac{20cm \times 8cm^{2}}{4cm}$

B = 40cm

5. Find the value of h in the figure below.




Area = Area

$\frac{1}{2} \times B \times h = \frac{1}{2} \times B \times 4$

$\frac{1}{2_1} \times \frac{6}{12cm} \times h = \frac{1}{2_1} \times \frac{8}{16cm} \times 6cm$

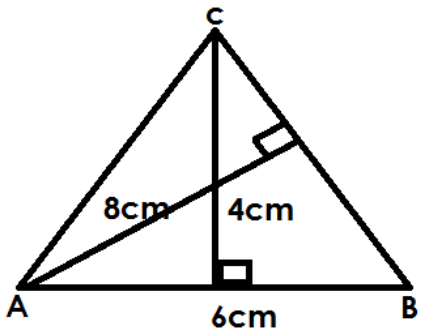
$\frac{6cm\ h}{6cm} = \frac{8cm \times 6cm^{1}}{6cm}$

h = 8cm

**Activity**

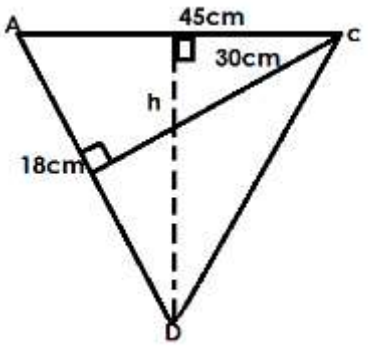
Use the figures below to answer questions that follow.

a.



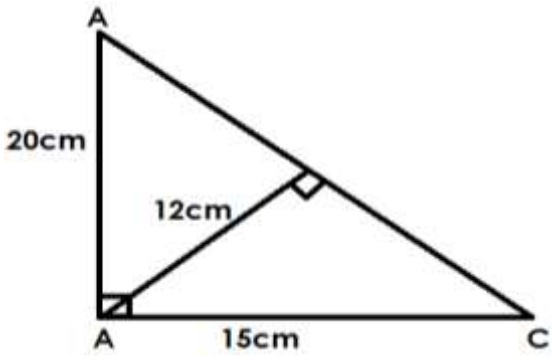

Find length BC

b.



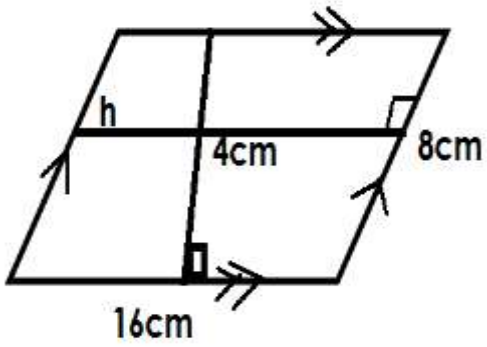

Find h.

c.




Find AC

d.




Find h.

**CHANGING $KM^2$ to $M^2$**

**Note**:

**1km = 1000m**

1. Change $4km^2$ to $m^2$

**Soln.**

1km = 1000m

$1km^2 = 1000m \times 1000m$

$4km^2 = 4 \times 1000m \times 1000m$

$= 4000000m^2$

2. Chang $0.2km^2$ to $m^2$

1 km = 1000m

$1km^2 = 100m \times 100m$

$0.2km^2 = 0.2 \times 1000m \times 100m$

$= \underline{2} \times 1000m \times 1000m$

$10^2$

$= 200{,}000m^2$

3. Convert 24.56km2 to m2

$1km = 100cm$

$1km^2 = 1000cm \times 1000m$

$24.56km^2 = 24.56 \times 1000m \times 1000m$

$= \frac{24.56}{100} \times 1000m \times 1000m$

$= 24{,}560{,}000m^2$

**Activity**

Convert the following $km^2$ to $m^2$

(a) $10km^2$

(b) $0.3km^2$

(c) $0.3km^2$

(d) $40km^2$

(e) $120.3km^2$

**Converting $M^2$ to $Km^2$**

**Note:**

$1{,}000{,}000m^2 = 1km^2$

1. Convert $3{,}040{,}000m^2$ to $km^2$

**Soln.**

$1{,}000{,}0000m = 1km^2$

$1m^2 = \left(\frac{1}{1000{,}000}\ km^2\right)$

$3{,}040{,}000m^2 = \frac{1}{1000{,}000} \times 3{,}040{,}000km^2$

$= \frac{3.04}{100}km^2$

$= 3.04km^2$

2. Convert 90700$m^2$ to $km^2$

**Soln.**

$1{,}000{,}000m^2 = 1km^2$

$1m^2 = \left(\frac{1}{1000{,}000}\right) km^2$

$340{,}000m^2 = \frac{1}{1{,}000{,}000} \times 340{,}000km^2$

$= \frac{34}{100} km^2$

$= 0.34km^2$

3. Convert 340,000$m^2$ to $km^2$

**Activity**

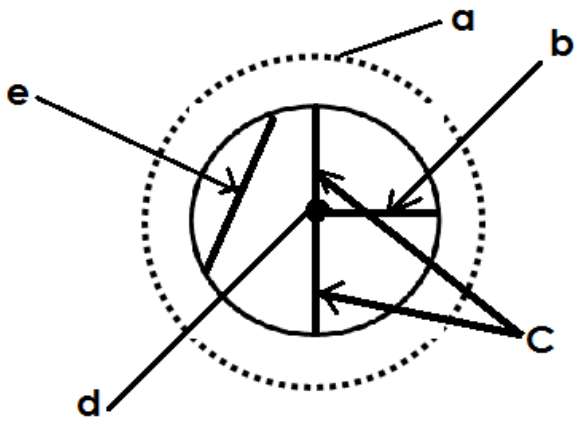
1. Convert the following $m^2$ to $km^2$

(a) 2,000,000$m^2$ (c) 350,000$m^2$ (e) 990, 000$m^2$

(b) 340000$m^2$ (d) 4,000,000$m^2$ (f) 403$m^2$

## CIRCLES

## PARTS OF A CIRCLE




a – Circumference

b – radius

c – diameter

d – centre

e – chord

## CIRCUMFERENCE

Circumference is the total distance round a circular object / circle.

## DIAMETER

Diameter is straight line running from the circumference through the centre to the circumference of the circle.

Diameter is the twice radius (D =2r)

It is the longest chord of the circle.

**RADIUS**

Radius is the line of a running from the center of the circle to the circumference.

Radius is a half of diameter.

**CHORD**

Chord is the line running from circumference to circumference of a circle.

Is the line joining one arc to another arc of the circle.

**PI (TT)**

PI is the quotient of the circumference and diameter of a circle.

The value of PI is taken as $\frac{22}{7}$, $3\frac{1}{7}$ or 3.14

Use PI as $\frac{22}{7}$ or $3\frac{1}{7}$ if diameter or radius or height is a multiple of 7.

Use PI as 3.14 if diameter or radius is not a multiple of 7.

**FINDING RADIUS OR DIAMETER OF ACIRCLE.**

Diameter = r + r

= 2r

Radius = $\frac{D}{2}$ or D ÷ 2

**Examples.**

Find the diameter of a circle whose radius is 14cm.

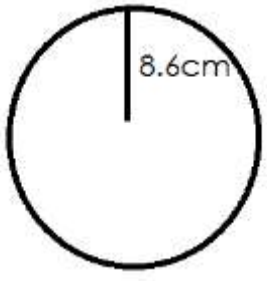
**Soln.**

D = r + r

= 14cm + 14cm

= 28cm

2. Find the diameter of a circle below.




D = r + r

= 8.6cm + 8.6cm

= 17.2cm

3. Find the diameter of a circle whose radius is $7\frac{1}{2}$ cm

**Soln**.

D = r + r

$= 7\frac{1}{2}$ cm + $7\frac{1}{2}$ cm

$= \frac{15}{2}$ cm + $\frac{15}{2}$ cm

$= \frac{15cm + 15cm}{2}$

$= \frac{30}{2}$cm

= 15cm

4. Find the radius of a circle whose diameter is 20cm.

**Soln.**

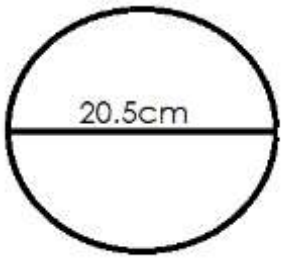
$r = \frac{D}{2}$

$= \frac{10}{\cancel{20}}$cm

$\cancel{2}\ 1$

=10cm

5. Below is a circle. Find its radius.




Soln.

R = D ÷ 2

= 20.5 ÷ 2

$= \frac{205}{10} \div 2$

$= \frac{205}{10} \times \frac{1}{2}$

10 or 5

$= \frac{\cancel{205}}{\cancel{20}\ 1}$

$= 10\ \frac{\cancel{5}\ 1}{\cancel{20}\ 4}$

= 10.25

6. Find the radius of a circle whose diameter is $30\frac{1}{2}$ cm

**Soln**.

$r = d \div 2$

$= 30\frac{1}{2} \div 2$

$= 61 \div 2$

$= 61 \times \frac{1}{2}$

$= \frac{15 \text{ r } 1}{4}$

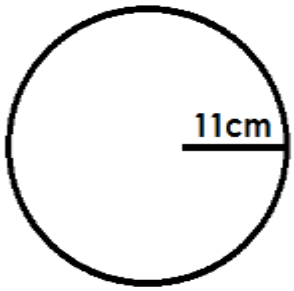
$= 15\frac{1}{4}$ cm

## Activity

1. Find the radius of a circle whose diameter is

a. 6cm
b. 20.4cm
c. 10cm
d. 40.4cm
e. 20cm
f. $20\frac{1}{2}$cm
g. 45cm
h. 6.5cm

2. Find the diameter of the circle below




3. Find the diameter of a circle whose radius is

(a) 4cm
(b) $3\frac{1}{2}$cm
(c) $17\frac{1}{2}$cm
(d) 20cm
(e) 15cm
(f) $10\frac{1}{2}$
(g) $22\frac{1}{2}$ cm

## FINDING CIRCUMFERENCE AND AREA OF A CIRCLE

Circumference = $\pi D$

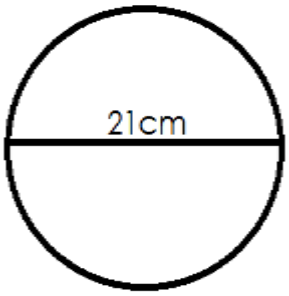
Area = $\pi r^2$

Where $\pi$ = Pi ($\frac{22}{7}$ **or** 3.14)

D = Diameter

R = Radius

1. Find the circumference of the circle below.

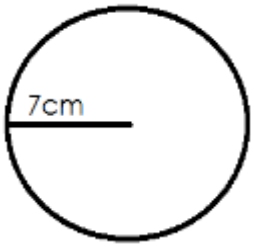



$C = \pi D$

$= \frac{22}{\cancel{7}_{1}} \times \frac{\cancel{21}^{3}}{}$

$= 66cm$

2. Use the circle below to answer question




a. Find its circumference

$C = \pi D$ but $D = r + r$

$= \frac{22}{\cancel{7}_{1}} \times \frac{14\cancel{cm}^{2}}{}$ $= 7cm + 7cm$

$= 44cm$ $= 14cm$

(b) Find its area

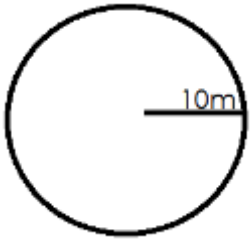
Soln.

Area = $\pi r^2$

$= \frac{22}{\cancel{7}_{1}} \times \frac{\cancel{7cm}^{1}}{} \times 7cm$

$= 154cm^2$

3. Use the figure below to answer questions.




(a) Calculate its area

**Soln.**

Area = $\pi r^2$

= 3.14 x 10m x 10m

= $\frac{314}{100}$ x 10m x 10m

= $314m^2$

(b) Work out its perimeter

**Soln.**

C = $\pi D$

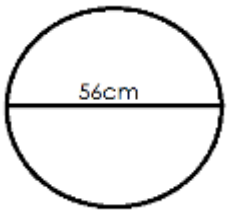
C = 3.14m x 20m

= $\frac{3.14m}{100}$ x 20m

= $\frac{6\ 28}{10}$

= 62.8 m

4. Use the figure below to answer question




a. Calculate its area

Area = $\pi r^2$

= $\frac{22}{7}$ x $\frac{24}{28}$cm x 28cm

= 88cm x 28cm

= $2464cm^2$

b. Find its circumference

$C = \pi D$

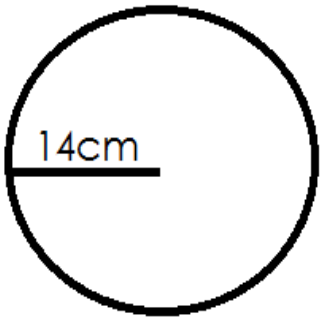
$= \frac{22}{7} \times \overset{8}{\cancel{65}}\text{cm}$

$= 88\text{cm}^2$

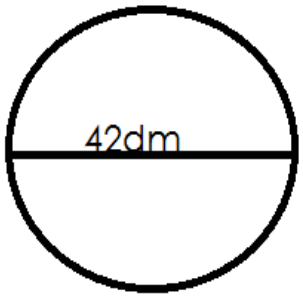
**Activity**

Find the area of and circumference of the following

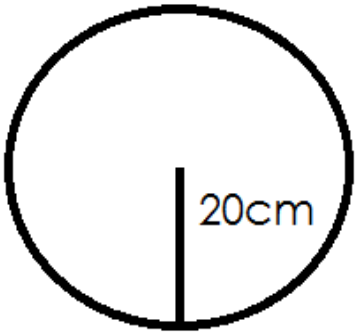
(1)



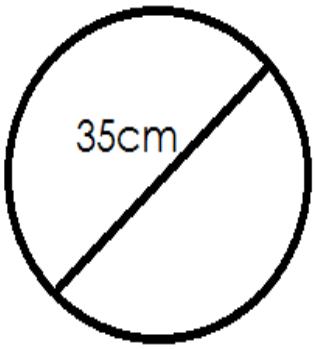

2.




3.




4.




5. A circular plate has a diameter of 14cm. Calculate its circumference.
6. The radius of a car tyre is 20m. Calculate its area.
7. A circular bottom of a mug has a radius of 7cm. Find its area.

## FINDING RADIUS OR DIAMETER OF A CIRCLE GIVEN CIRCUMFERENCE

1. The circumference of a circle is 22cm. Find its diameter.

**Soln.**

$\pi D = C$

$\frac{22D}{7} = 22cm$

$\frac{22D}{7} \times \frac{1}{7} = 22cm \times 7$

$\frac{22D}{22} = \frac{22cm \times 7}{22}$

$D = 7cm$

(b) Calculate its area

**Soln.**

$Area = \pi r^2$

$= \frac{22}{7} \times \frac{7}{2} \times \frac{7cm}{2}$

$= \frac{77cm}{2}$

$= 38\frac{1}{2} cm^2$

2. Find area of a circle whose circumference is 440cm.

**Soln.**

$\pi D = C$

$\frac{22D}{7} = 440cm$

$\frac{22D}{7} \times 7 = 440cm \times 7$

$\frac{22D}{22} = \frac{440cm \times 7}{22}$

$D = 140cm^2$

$= r = D$

$r = \frac{140cm}{2}$

$= 70cm^2$

$Area = \pi r^2$

$= \frac{22}{7} \times 70cm \times 70cm$

$= 220cm \times 70cm$

$= 15400cm^2$

## Activity

1a. The circumference of a circle is 88cm. Find its radius.

(b) Find its area.

2. The circumference of a circle is 220cm.

(a) Find its radius

(b) Find its area

3. The circumference of a circle is 44cm. Find its area.

4. Find the diameter of a circle whose circumference is 264cm.

## VOLUME, CAPACITY AND TOTAL SURFACE AREA OF PRISMS

- A prism is a closed sided figure with two common ends.

**Examples of prism.**

- Cube (square based prism)
- Cuboid (rectangular based prism)
- Cylinder (circular based prism)
- Trapezoidal prism (Trapezium based prism)

## VOLUME, CAPACITY AND TOTAL SURFACE OF A CUBE.

- Volume is the amount of space occupied by an object.
- Volume is measured in cubic units.

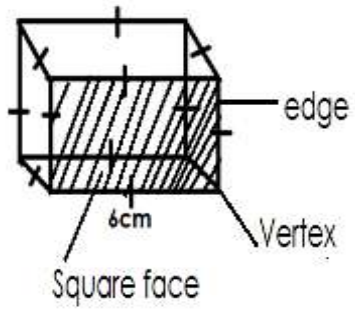
## CAPACITY

- Capacity is the amount of content that a given container can accommodate.
- - capacity $= \left(\frac{\text{volume}}{1000\text{cm}^3}\right)$ L

## Cube

- A cube is a prism made up of 6 square faces.

**Illustration**



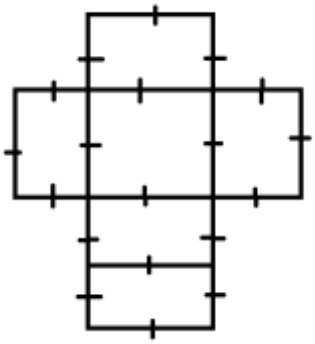

**is made up of: -**

6 faces
8 vertices
12 edges

T ube is;

**Volume = S x S x S**

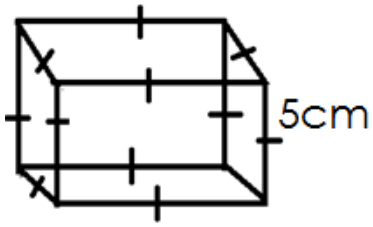
**The net of a cube.**



**Therefore, T.S. A = $6S^2$**

**Examples.**

Below is a cube. Use it to answer questions that follow.




(a) Find its volume

V = S x S x S

= 5cm x 5cm x 5cm

= $125cm^3$

(b) Calculate its T.S.A

T.S.A = $6S^2$

= 6 x 5cm x 5cm

= $150cm^2$

(c) How many litres of water does it hold when completely full?

capacity = $\left(\frac{\text{Volume}}{1000cm^3}\right)$ L

$= \left(\frac{125cm^3}{1000cm^3}\right)$ L

= 0.125L

2. Find T.S.A of a cube of side 7m.

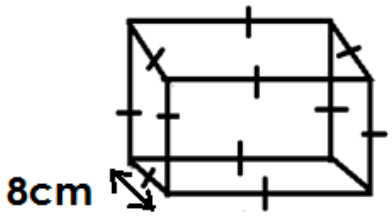
**Soln.**

T.S.A $= 6S^2$

$= 6 \times 7m \times 7m$

$= 294m^2$

3. Find volume, capacity and T.S.A of the figure below.




(a) Volume = S x S x S

$= 8cm \times 8cm \times 8cm$

$= 512cm^3$

(b) T.S.A $= 6S^2$

$= 6 \times S \times S$

$= 6 \times 8cm \times 8cm$

$= 384cm^2$

(c) Capacity

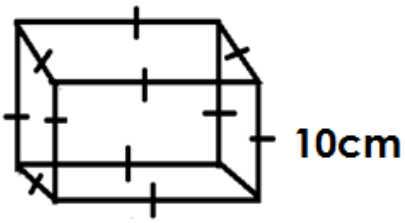
**Soln.**

$$\left(\frac{\text{Volume}}{1000cm^3}\right) L$$

$$\left(\frac{512\ cm^3}{1000cm^3}\right) L$$

0.512L

2. Use the figure below to answer questions that follow.




a. Find its volume.

Volume = S x S x S x S

= 10cm x 10cm x 10cm

= $1000cm^3$

b. Find its total surface area

T.S.A = $6S^2$

= 6 x S x S

= 6 x10cm x 10cm

= $600cm^2$

c. Find its capacity

Capacity = $\left(\frac{\text{Volume}}{1000cm^3}\right)$ L

= $\left(\frac{1000cm^3}{1000cm^3}\right)$ L

= 1L

3. Find the volume of a cube whose side is 20cm.

**Soln.**

Volume = S x S x S

= 20cm x 20cm x 20cm

= $8000cm^3$

4. Find the T.S.A of a cube whose side is 15cm.

T.S.A = 6S2

= 6 x 15cm x 15cm

= 90cm x 15cm

= $1350cm^2$

**Activity**

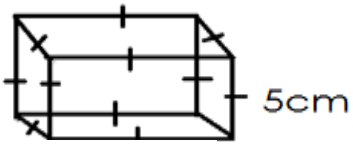
1. Use the figures below to find;

(i) Volume

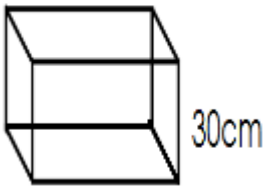
(ii) T.S.A

(iii) Capacity of the following.

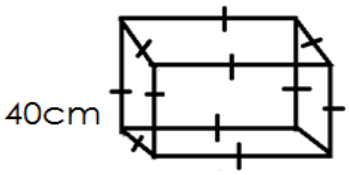
(a)




(b)




3.

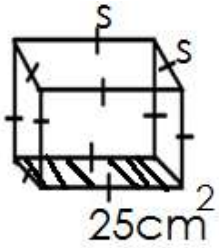



4. Find the T.S.A of a cube whose side is 5cm.

5. Find the capacity of a cube whose side is 120cm.

**FINDING LENGTH OF EACH SIDE OF A CUBE GIVEN BASE AREA OR T.S.A.**

1. The base area of a cube is $25cm^2$. Find its volume




$S \times S = A$

$S = 25$

$S = 5cm$

Volume = S x S x S

Volume = (5cm x 5cm x 5cm)

$= 25cm^2 \times 5cm$

$= 125cm^3$

2. The T.S.A of a cube is $29cm^2$. Find the length of each side.

$6S$ = T.S.A

$6S = 294$

(b) Calculate its volume.

$$S \times S \times S$$

$$= 7cm \times 7cm \times 7cm$$

$$= 49cm \times 7cm$$

$$= 343cm^3$$

3. The base area of a cube is 400cm2. Find the length of each side.

**Soln.**

$$S \times S = 400$$

$$S^2 = 400$$

$$\sqrt{S^2} = \sqrt{400}$$

$$S = 20cm$$

(b) Find its volume

$$\text{Volume} = S \times S \times S$$

$$= 20cm \times 20cm \times 20cm$$

$$= 400cm^2 \times 20cm$$

$$= 8000cm^3$$

4. The T.S.A of a cube is 2400cm2. Find one side of the cube.

**Soln**.

$$6S \times S = T.S.A$$

$$\frac{6S^2}{6} = \frac{2400}{6}$$

**Activity.**

1. The base area of a cube is $100cm^2$.

(a) Find the length of one side.

(b) Find its volume.

2. The base area of a cube is $81cm^2$. Find its volume.

3. The base area of a cube is $36cm^{2.}$ Find its T.S.A.

4. The T.S.A of a cube is $96cm^2$.

(a) Find one side of a cube.

(b) Find its volume.

5. The T.S.A of a cube is $150cm^2$.
   Find its volume.

6. The T.S.A of a cube is $216cm^2$. Find its volume.

7. The T.S.A of a cube is $1014cm^{2.}$ Find its capacity.

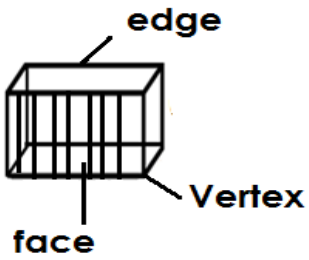
## VOLUME, CAPACITY AND T.S.A OF ACUBOID

A cuboid is a rectangular based prism.

It made of up of:

- 6 faces
- 8 vertices
- 12 edges

**Illustration**




**Note:**

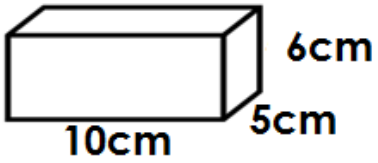
Volume = L x W x H

T.S. A= 2(L x W) + 2(L x H) + 2(W x H)

Capacity= $\frac{\textbf{Volume}}{\textbf{1000}}$ litres

**Examples.**

1. Use the figure below to answer questions that follow.




a) Find its volume.

**Soln.**

Volume = 10cm x 5cm x 6cm

= $300cm^2$

b) Find the capacity of the figure

**Soln.**

$$\text{capacity} = \left(\frac{\text{Volume}}{1000\text{cm}}\right)$$

$$= \frac{300\text{cm}^3}{1000\text{cm}^3}$$

$$= 0.3\text{L}$$

c) Find its T.S.A

**Soln.**

$$\text{T.S.A} = 2(\text{L} \times \text{W}) + 2(\text{L} \times \text{h}) + 2(\text{W} \times \text{h})$$

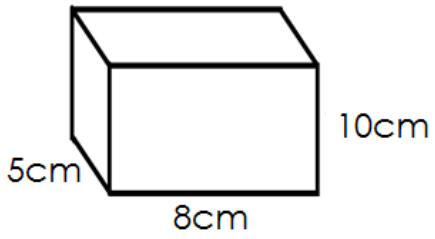
$$= 2(10\text{cm} \times 5\text{cm}) + 2(10\text{cm} \times 6\text{cm}) + 2(5\text{cm} \times 6\text{cm})$$

$$= 2 \times 50\text{cm}^2 + 2 \times 60\text{cm}^2 + 2 \times 30\text{cm}^2$$

$$= 100\text{cm}^2 + 120\text{cm}^2 + 60\text{cm}^2$$

$$= 280\text{cm}^2$$

2. Below is a cuboidal tin, use it to answer questions that follow.




(a) Find the volume of the figure

**Soln.**

$$\text{Volume} = \text{L} \times \text{W} \times \text{H}$$

$$= 8\text{cm} \times 5\text{cm} \times 10\text{cm}$$

$$= 40\text{cm}^2 \times 10\text{cm}^2$$

$$= 400\text{cm}^2$$

(b) How many litres does it hold when completely full?

**Soln.**

$$\text{Capacity} = \left(\frac{\text{Volume}}{1000\text{cm}}\right)$$

$$= \frac{400\text{cm}^3}{1000\text{cm}^3}$$

$$= 0.4\text{L}$$

(c) Find the T.S.A of the figure

**Soln.**

$$\text{T.S.A} = 2(\text{L} \times \text{W}) + 2(\text{L} \times \text{h}) + 2(\text{W} \times \text{h})$$

$$= 2(8\text{cm} \times 5\text{cm}) + 2(8\text{cm} \times 10\text{cm}) + 2(5\text{cm} \times 10\text{cm})$$

$$= 2 \times 40\text{cm}^2 + 2 \times 80\text{cm}^2 + 2 \times 5\text{cm}^2$$

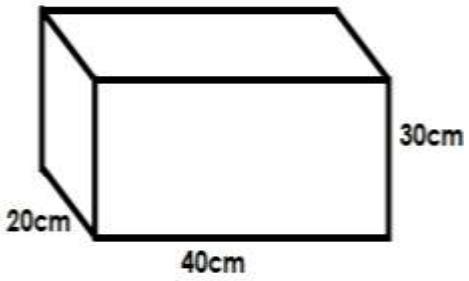
$$= 80\text{cm}^2 + 160\text{cm}^2 + 100\text{cm}^2$$

$$= 340\text{cm}^2$$

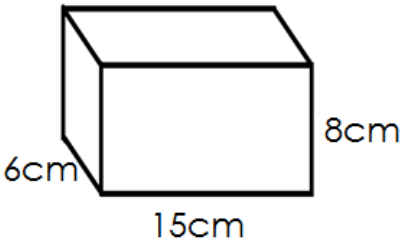
**Activity**

Find the volume capacity and T.S.A of the following.

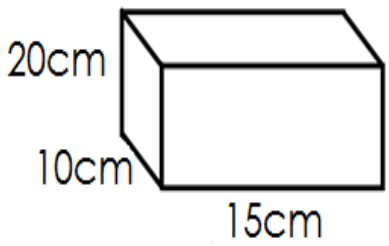
1.



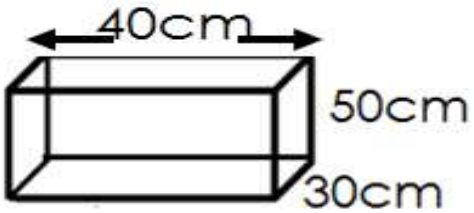

2.




3.



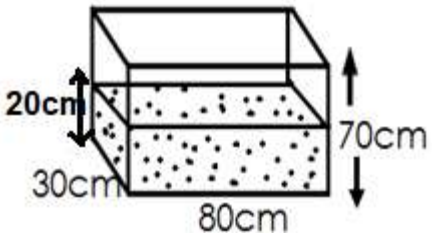

4.



## MORE ABOUT VOLUME AND CAPACTY

**Examples.**

1. The tank below is holding some water. Use it to answer questions.




(a) How many litres of water are in the tank?

$$\text{Volume} = L \times W \times H$$

$$= 80\text{cm} \times 30\text{cm} \times 20\text{cm}$$

$$= 48000\text{cm}^3$$

$$\text{Capacity} = \left(\frac{\text{Volume}}{1000\text{cm}^3}\right)$$

$$= \frac{48000\text{cm}^3}{1000\text{cm}^3}$$

$$= 48\text{L}$$

(b) How many litres are needed to fill the tank?

Height needed

70cm - 20cm

50cm

$$\text{Volume} = L \times W \times H$$

$$= 8\text{cm} \times 30\text{cm} \times 50\text{cm}$$

$$= 120000\text{cm}^3$$

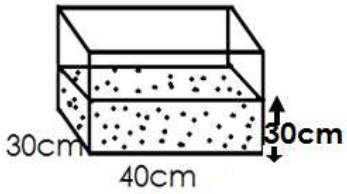
L

$$\text{Capaclity} = \left(\frac{\text{Volume}}{1000\text{cm}^3}\right)$$

$$= \frac{120.000\text{cm}^3}{1000\text{cm}^3}$$

$$= 120\text{L}$$

2. The tank below is holding some water.




(a) How many litres of water are in the tank?

**Soln.**

Volume = L x W x H

= 40cm x 30cm x 30cm

= $36000cm^3$

(b) Find its capacity

$$\text{Capacity} = \left(\frac{\text{Volume}}{1000cm}\right)$$

$$= \frac{36000cm^3}{1000cm^3}$$

= 36L

(c) If the tank is $\frac{2}{3}$ full of water. How many litres of water can it hold when completely full.

**Soln.**

Let its capacity be n.

Let its capacity be n

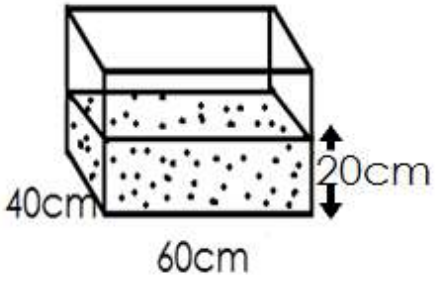
$$\frac{2}{3} \times m = 36L$$

$$\frac{2m}{\cancel{3}_1} \times \cancel{3} = 36 \times 3$$

$$\frac{\cancel{2}^1 m}{\cancel{2}} = \frac{\cancel{36}^{18} \times 3}{\cancel{2}}$$

$$m = 54L$$

2. The tank below is $\frac{3}{4}$ full of water.




How many litres of water can the tank hold when completely full.

**Soln.**

Volume = L x W x H

= 60cm x 40cm x 20cm

= $48000cm^3$

$$\text{Capacity} = \left(\frac{\text{Volume}}{1000cm}\right) L$$

$$= \frac{43.000cm^3}{1000cm^3}$$

= 48L

Let the capacity be n

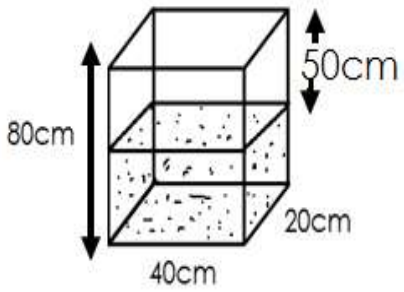
$$\frac{3}{4} \times n = 48$$

$$\frac{3n}{4_1} \times \frac{1}{4} = 48 \times 4$$

$$\frac{3n}{3} = \frac{16}{\cancel{48}} \times 4$$

n = 64L

3. The tank below is holding some water




a) How many litres of water are in the tank.

**Soln**.

Volume = L x W x H

= 40cm x 20cm x 30cm

= $24000cm^3$

Capacity

1000cm = 1 L

1cm = $\frac{1}{1000}$

24000cm = $\frac{1}{1000}$ x $24\cancel{000}$

= 24litres

(b) How many litres are needed to fill the tank.

**Soln.**

Volume = L x W x H

= 20cm x 4cm x 5cm

= $40{,}000cm^3$

$1000cm^3 = 1\ L$

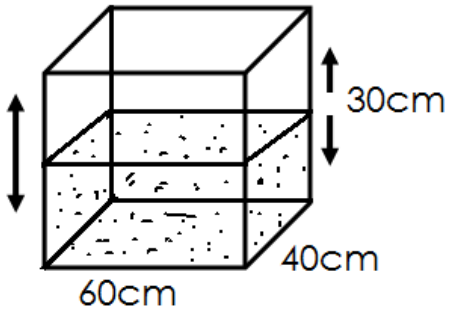
$1cm^3 = \left(\frac{1}{1000}\right) L$

$40{,}000cm^3 = \left(\frac{1}{100} \times 40{,}000\right) L$

= 40 L

**Activity**

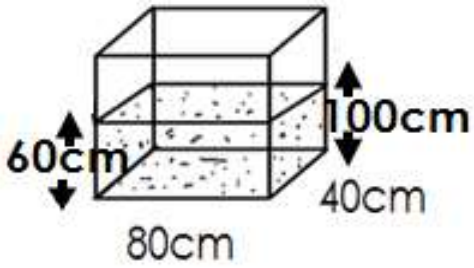
1. The tank below is holding some water.




(a) How many litres are in the tank

(b) How many litres are needed to fill the tank.

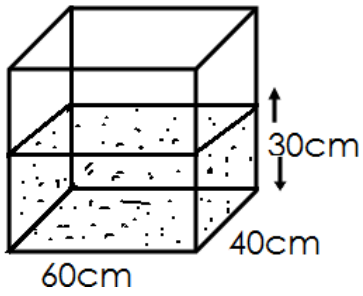
2. Below is a water tank.




(a) How many litres of water are in the tank?

(b) How many litres are needed to fill the tank?

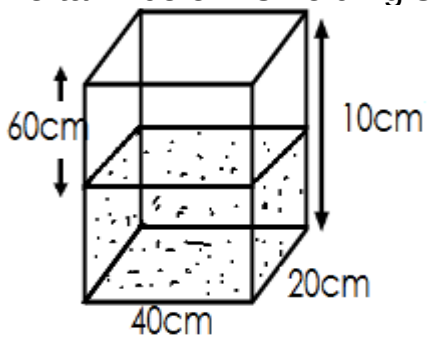
3. The tank below is holding some water.




(a) How many litres of water are in the tank?

(b) If the tank is $\frac{1}{3}$ full of water. How many litres of water can the tank hold when completely full.

4. The tank below is holding some water.

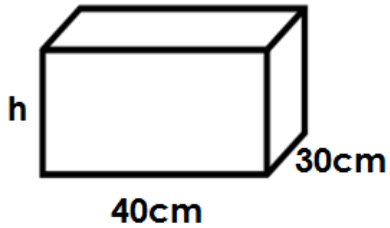



(a) How many litres are in the tank?

(b) How many litres are needed to fill the tank?

## FINDING UNKNOWN SIDE OF A CUBOID GIVEN CAPACITY OR T.S.A

1. Below is a tank holding 48litres




$1 \text{ litre} = 1000\text{cm}^3$

$48\text{L} = 48 \times 1000\text{cm}^3$

$= 48000\text{cm}^3$

a) Find the value of h.

$L \times W \times H = V$

$40\text{cm} \times 30\text{cm} \times h = 4800\ \text{cm}^3$

$$\frac{40\text{cm} \times 30\text{cm}}{40\text{cm} \times 30\text{cm}} = \frac{\overset{12}{\cancel{4800}} \times \text{cm} \times \cancel{\text{cm}} \times \cancel{\text{cm}}}{40\cancel{\text{cm}} \times 30\text{cm}}$$

$n = 40\text{cm}$

b) Find the total surface area of the figure.

T.S. A $= 2(L \times W) + 2(L \times H) + 2(W \times H)$

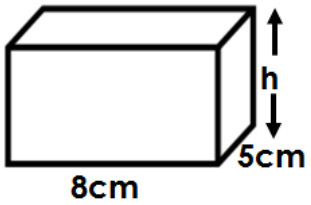
$= 2(40\text{cm} \times 30\text{cm}) + 2(40\text{cm} \times 40\text{cm}) + 2(30\text{cm} \times 40\text{cm})$

$= 2 \times 1200\text{cm}^2 + 2 \times 1600\text{cm}^2 + 2 \times 1200\text{cm}^2$

$= 2400\text{cm}^2 + 3200\text{cm}^2 + 24000\text{cm}^2$

$= 8000\text{cm}^2$

2. T.S. A of the figure below is $340cm^2$.




a) Find its height.

$2(L \times W) + 2(L \times W) + 2(W \times H) = T.S.A$

$2(8cm \times 5cm) + 2(8cm \times h) + 2(5cm \times h) = 340cm^2$

$2 \times 40cm + 2 \times 8cm\,h + 2 \times 5cmh = 340cm^2$

$80cm^2 + 16cm + 10cmh = 340cm^2$

$80cm^2 + 26cm + 10cmh = 340cm^2$

$80cm^2 - 80cm^2 + 26cmh = 340cm^2 - 80cm^2$

$\frac{\cancel{26cm}h}{\cancel{26cm}} = \frac{\cancel{260}cm \times cm}{\cancel{26}cm}$

$h = 10cm$

b) Find the volume

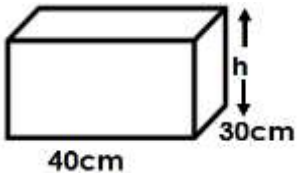
Soln

$Volume = L \times W \times H$

$= 80cm \times 5cm \times 10cm$

$= 400cm^3$

3. The tank below is holding 36litre of water. Use it to answer questions.




a) Find its height

$1\ L = 1000cm^3$

$36L = 36 \times 1000cm^3$

$= 36000cm^3$

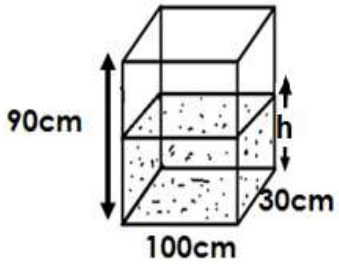
$L \times W \times H = Volume$

$40cm \times 30cm \times H = 36000cm^3$

$\frac{\cancel{40cm} \times \cancel{30cm} \times H}{\cancel{40cm} \times \cancel{30cm}} = \frac{\overset{30}{\cancel{36000}}cm \times \cancel{cm} \times \cancel{cm}}{\cancel{40}cm \times \cancel{30cm}}$

$H = 30cm$

3. The tank below is holding 120litres.




Soln

$1L = 1000cm^3$

$120L = 120 \times 1000cm^3$

$= 120,000cm^3$

a) Find the value of h.

$L \times W \times H = Volume$

$100cm \times 30cm \times H = 120,000cm$

$$\frac{\cancel{100cm} \times \cancel{30cm} \times H}{\cancel{100cm} \times \cancel{30cm}} = \frac{\overset{40}{\cancel{120,000}}cm \times \cancel{cm} \times \cancel{cm}}{1\cancel{00}cm \times 3\cancel{0}\cancel{cm}}$$

$H = 40cm^3$

(b) How many litres of water are needed to fill the tank above?

**Soln**.

$90cm - 40cm$

$= 50cm$

$Volume = L \times W \times H$

$= 100cm \times 30cm \times 50cm$

$= 150,000cm^3$

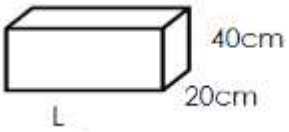
$$Capacity = \left(\frac{Volume}{1000cm}\right) L$$

$$= \frac{150,\cancel{000}cm^3}{\cancel{100}cm^3}$$

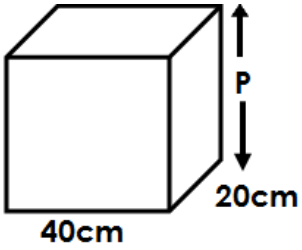
$= 150L$

**Activity**

1. The tank below is holding 72litres of water.

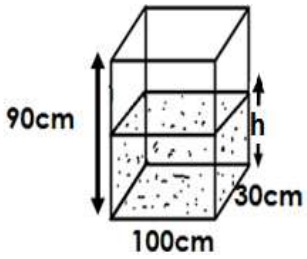



Find the value of L

2. 

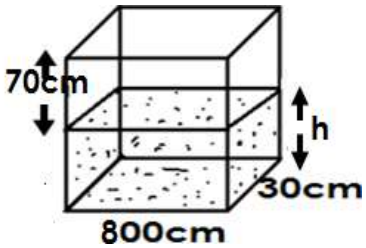

If the tank is holding 48litres. Find the value of P.

3. The tank below is holding 120litres.



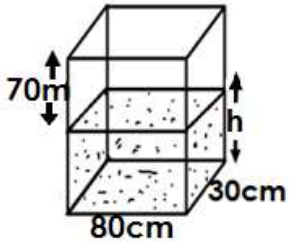

(a) Find the value of h.
(b) How many litres of water are needed to fill the above tank?

4. The tank below is holding 40 litres.




(a) Find the level of water in the tank.
(b) How many litres of water are needed to fill the tank?

5. The tank below is holding 36litres of milk.




(a) Find h.
(b) How many litres are needed to fill the tank?

## VOLUME AND CAPACITY OF CYLINDER (CIRCULAR BASED PRISM)

**Note.**

A Cylinder is made of up of 2 faces i.e.

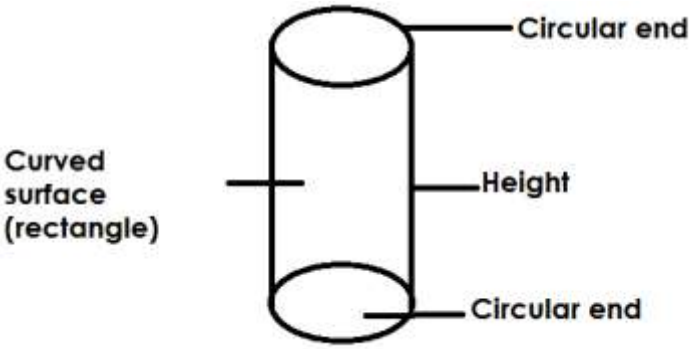
- The 2 circular ends
- Curved surface (rectangle surface)

**Volume = $\pi r^2$ x h**

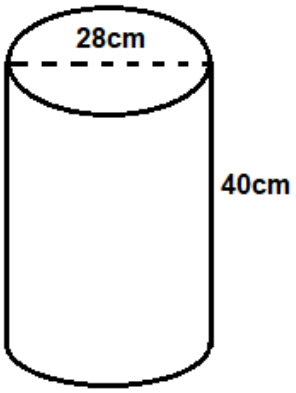
**Where, r = radius**

**h = height**

**illustration.**




1. Below is a cylinder use it to answer questions.




(a) Calculate its volume

Volume = $\pi r^2$x h

$$= \frac{22}{7} \times \frac{2}{14}\text{cm} \times 14\text{cm} \times 40\text{cm}$$

$$= 22 \times 2\text{cm} \times 14\text{cm} \times 14\text{cm}$$

$$= 2464\text{cm}^3$$

(b) How many litres of water can it hold when completely full?

$1000cm^3 = 1\ L$

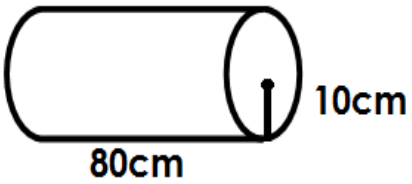
$1cm^3 = \left(\frac{1}{1000}\right)L$

$24640cm^3 = \left(\frac{1}{1000} \times 24640\right)\ L$

$= 24.64L$

2. Below is a cylinder. Use it to answer questions.

(a) Find its volume.




Volume = $\pi r^2 h$

$= 3.14 \times 10cm \times 10cm \times 80cm$

$= \frac{314}{100} \times 10cm \times 10cm \times 80cm$

$= 25120cm^3$

(b) Find its capacity.

$1000cm^3 = 1L$

$1cm^3 = \left(\frac{1}{100}\right) L$

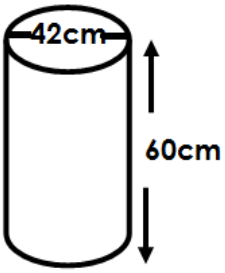
$25120cm^3 = \left(\frac{1}{1000} \times 25120\right) L$

$= 25.12L$

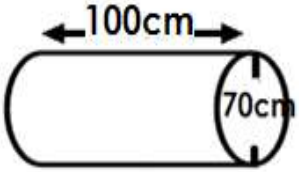
**Activity**

1. Find the volume and capacity of the following.

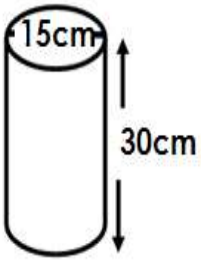
(a)



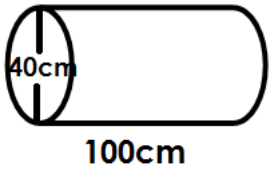

(b)



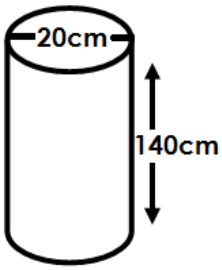

(c )




(d)




(e




TOPIC 11

# INTEGERS

**LESSON 1**

**Subtopic:** Integers on a number line

Content:
- Describe integers
  - (i) Positive
  - (ii) Zero (neutral integer)
  - (iii) Negative
- Opposites/inverses of integers
- Inverse property

Example: (i) Write down the inverse of:

(a) $^{-}4$

Inverse is $^{+}4$

(b) What is the additive inverse of $^{+}5$

Let inverse be x

But $x + {}^{+}5 = 0$

$X + 5 - 5 = 0 - 5$

$X = {}^{-}5$

Inverse $= {}^{-}5$

(c) Work out: (Use inverse property)

$+6 \; - \; 6$

N.B An integer plus its opposite gives zero.

i.e $^{+}6 - 6 = 0$

(b) $-3t + 3t$

Answer is 0

**Activity**

Pupils will do exercise 9 : 1, 9:3 from page 195 of A New MK pupils' BK 6 pages 195.

**Remarks**

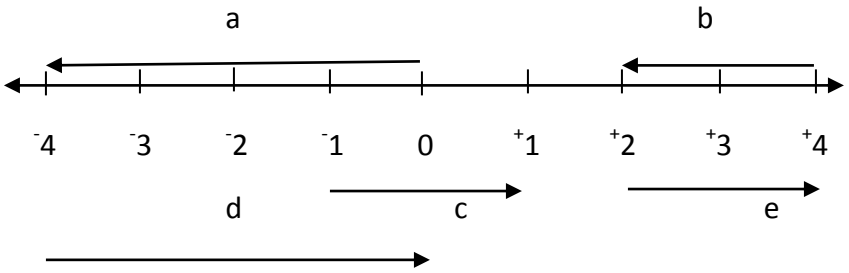
_____

**LESSON 2**

Subtopic: Represent Integers using arrow.

Content:
- Name arrows on number lines
- Draw arrows to represent integers

Examples: (a) Which integers is represented by each arrow?

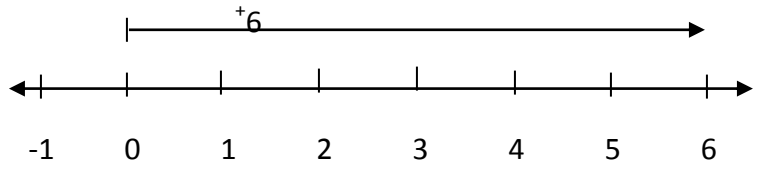



(a) a = $^{-}3$ b = $^{-}2$ c = $^{+}2$ d = $^{+}4$ e = $^{+}2$

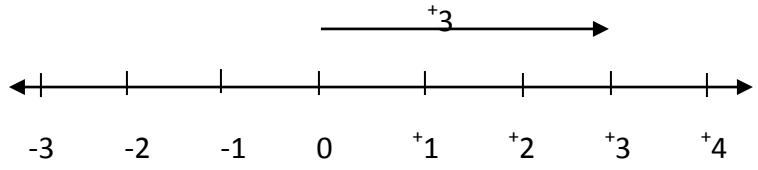
(b) Draw a number line showing each of:

(i) $^{+}6$ (ii) $^{+}3$ (iii) $^{+}2$ (iv) $^{-}4$

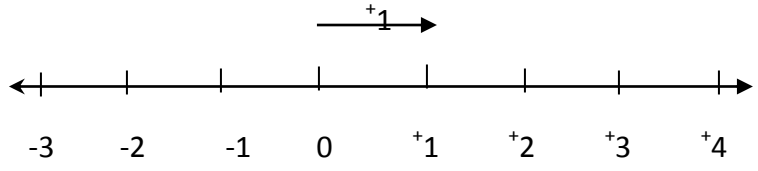
(i)



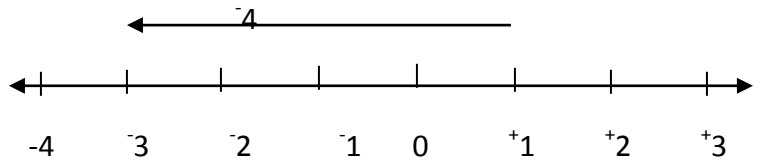

(ii)




(iii)



(iv)




**Activity**

The pupils will do exercise 9:4 on page 196 from A New MK BK 6 page 196.

**Remarks** _____

**LESSON 3**

Subtopic: Ordering integers

Content:
- Compare integers
- Arrange in ascending order
- Arrange in descending order

Examples: (i) **Use >, < or = to compare**

(a) $^{+}2$ ---------- $^{-}2$

$^{+}2 > {}^{-}2$

(b) $^{-}20$ ------- $^{+}11$

$^{-}20 < {}^{+}11$

(c) 0 ------- -4

$0 > {}^{-}4$

(d) $^{-}100$ ----- 0

$^{-}100 < 0$

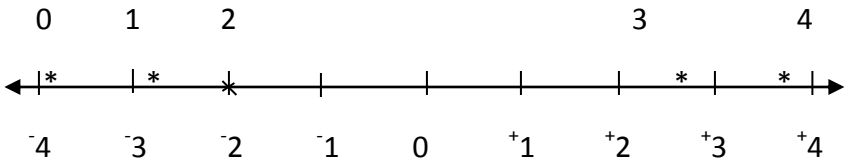
(e) -y --- $^{+}$ y

<

(f) 12 ----- $^{+}12$

=

(ii) Arrange {$^{-}2$, 3, $^{-}3$, 2} in ascending order




Order: {$^{-}3$, $^{-}2$, 2, 3}

(iii) Put {$^{-}12$, $^{-}20$, $^{-}34$, 0, 6} in descending order

$3^{rd}$ $4^{th}$ $5^{th}$ $2^{nd}$ $1^{st}$

Order is {6, 0, -12, $^{-}20$, $^{-}34$}

**N.B** Integers on the right are greater and all those on the left one less.

**Activity**

The pupils will do exercise 9:7 from page 197 from A New MK pupils' BK 6 page 197.

**Remarks** _____

**LESSON 4**

Subtopic: Operation on integers

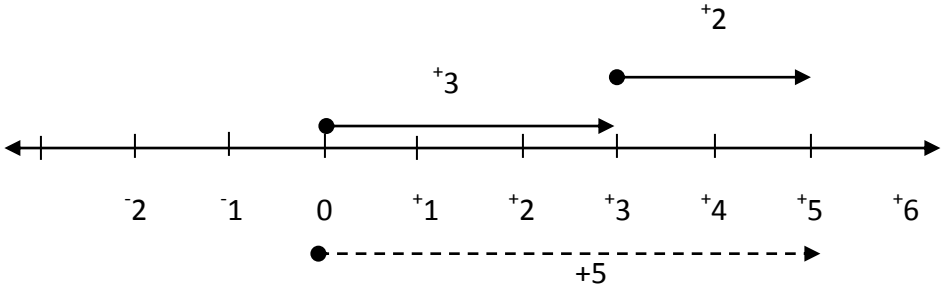
Content: Addition of

(i) Positive integers
(ii) Positive and negative integers
(iii) Negative and negative integers

On a number line

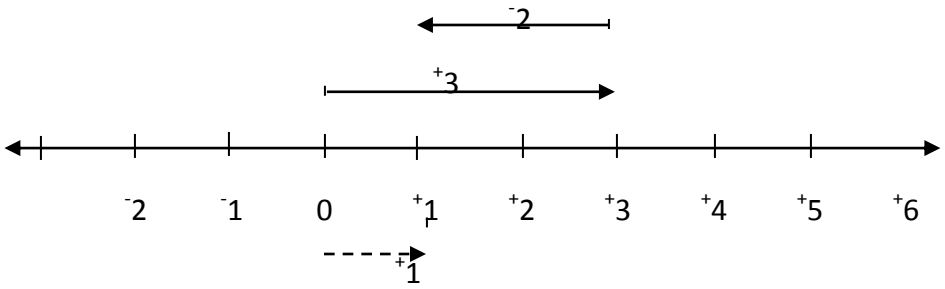
- Write sentences of addition on number lines.

Examples: (a) Add $^{+}3 + {}^{+}2$



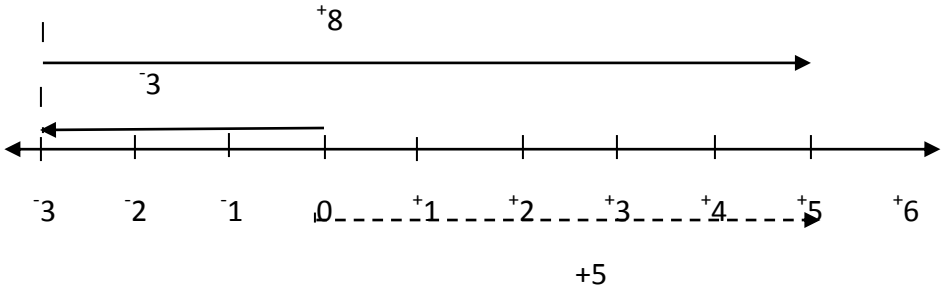

$\therefore$ $^{+}3 + {}^{+}2 = {}^{+}5$

(b) Work out: $^{+}3 + ^{-}2$



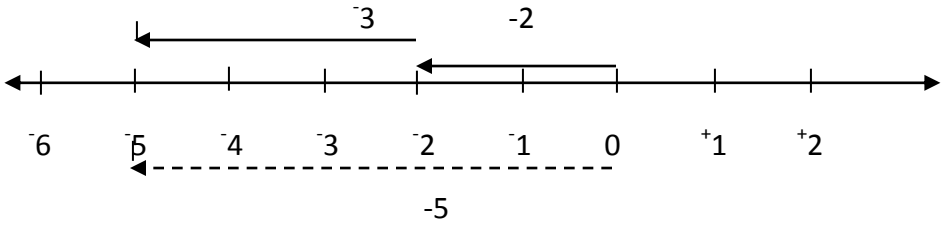

$\therefore\ ^{+}3 + ^{-}2 = ^{+}1$

(c) $-3 + ^{+}8 =$




$\therefore\ ^{+}3 + ^{+}2 = ^{+}5$

(d) $^{-}2 + ^{-}3 =$




$\therefore\ ^{-}2 + ^{-}3 = ^{-}5$

**Activity**

Pupils will do exercise 9:8 page 198 using <u>number line</u> only and exercise 9:11 page 199

A New MK Bk 6 page 198 – 199.

**Remarks** _____

**LESSON 5**

Subtopic: Operation on integers

Content: Addition of integers

Examples: (i) Add: $^{+}6 + ^{-}6$ (inverse)

$+ 6 - 6$

$= 0$

(c) $^{+}8 + ^{-}4$

means

$^{+}8 - 4 = ^{+}4$

(b) $+5 + + 2$

$= ^{+}7$

(d) $-12 + - 16$

$= ^{-}28$

(ii) $-2y + ^{+}2y$

Means

$^{-}2y + 2y$

$= 0$

**Activity**

The pupils will do exercise 9:8, 9:9, 9:10 on page 198. A New primary MTC BK 6 pages 198.

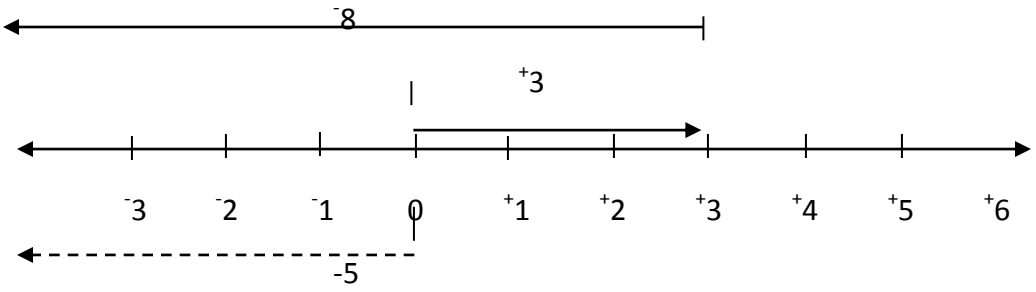
**Remarks** _____

**LESSON 6**

Subtopic: Operations on integers

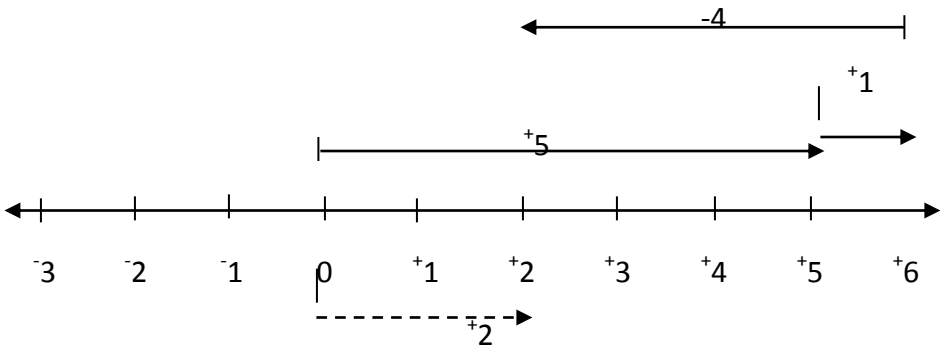
Content: Subtraction on number line

Example: (i) Write the subtraction sentences gives



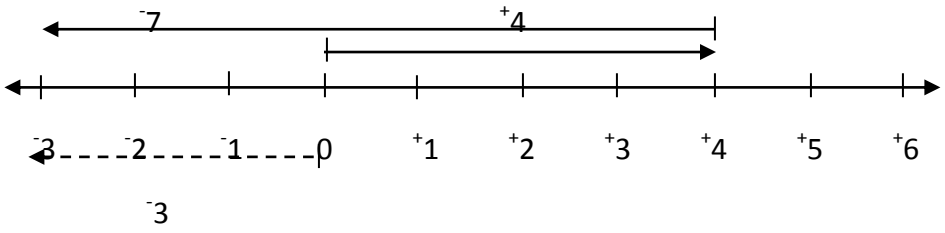

Sentence: = $^{+}3 - 8 = {}^{-}5$

-




Sentence: $^{+}5 + {}^{+}1 - 4 = {}^{+}2$

(iii) Show on a number line




$^{+}4 - 7 = {}^{-}3$

**Activity**

The pupils will do exercise 9:15 page 204. A New MK pupils BK 6 pages 203/4

**Remarks**

**LESSON 7**

SUBTOPIC: Operations on integers

Content: Subtraction of:

(i) positive and positive integers
(ii) positive and negative integers
(iii) negative and negative integers

Examples: (i) Work out: (Use the inverse of 2nd integer in qn (ii)

(a) $7 - 5$ (b) $^{+}7 - {}^{+}5$ (c) $^{-}7 - {}^{+}5$

$= 2$ means means

$+7 - 5$ $-7 - 5$

$= 2$ $= {}^{-}12$

(ii) Evaluate

(a) $4 - {}^{-}2$ (b) $+7 - (^{-}3)$ (c) $-8 - (^{-}10)$

Means inverse is $^{+}3$ inverse is $^{+}10$

$4 + 2$ $^{+}7 + 3$ $^{-}8 + 10$

$= 6$ $= {}^{+}10$ $^{+}2$

**Activity**

The pupils will do exercise 9:12, 9:13 without using a number line.

A New MK Bk 6 pages 201.

**Remarks** _____

**LESSON 8**

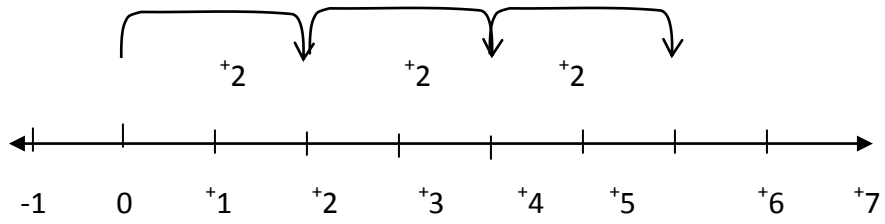
Subtopic: Operations on integers

Content: Multiplying integers on a number line

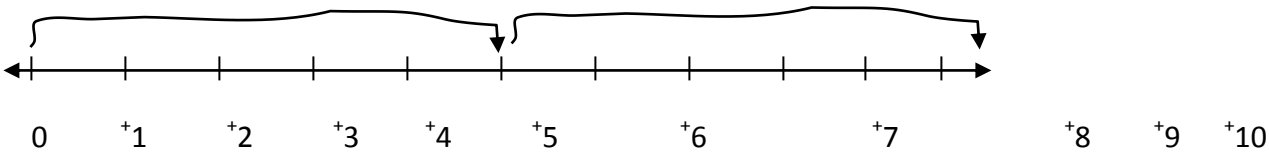
+ x + = + + x - = - - x - = + - x + = -

Without a number line.

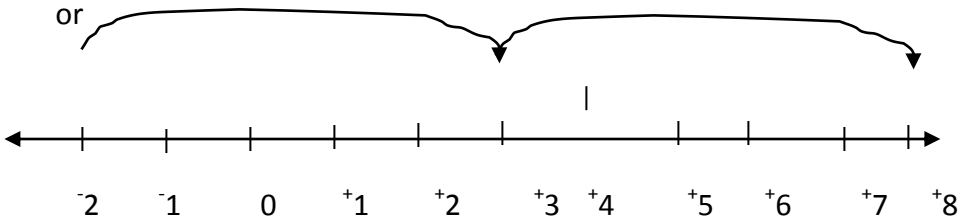
Example: (i) Show: +3 x + 2 below (3 groups of 2)




$\therefore {}^{+}3 \times {}^{+}2 = {}^{+}6$




$^{-}2x - 5 = {}^{+}10$




**Activity**

Pupils will do exercise 12:14 page 112 from A New Mk 2000 BK 6 page 112.

**Remarks** _____

**LESSON 9**

Subtopic: Operations on integers

Content: Division of integers

Emphasize:

(a) + ÷ + = +

(b) + ÷ - = -

(c) - ÷ + = -

(d) - ÷ - = +

Examples: (a) Divide $^{+}10 \div {}^{+}2$

**N.B** + ÷ + = +

10 ÷ 2 = 5

Answer is $^{+}5$

(b) $^{-}8 \div {}^{+}2$

– ÷ + = –

– 8 ÷ 2 = $^{-}4$

Answer = $^{-}4$

(c) – 48 ÷ – 8

– ÷ – +

48 ÷ 8 = 6

Answer = $^{+}6$

(d) – 16 ÷ – 4

– ÷ – = +

16 ÷ 4 = 4

Answer = $^{+}4$

**Activity**

The pupils will do exercise 12 : 15 page 112 from A New MK Primary MTC pupils BK 6.

**Remarks**

_____

**LESSON 10**

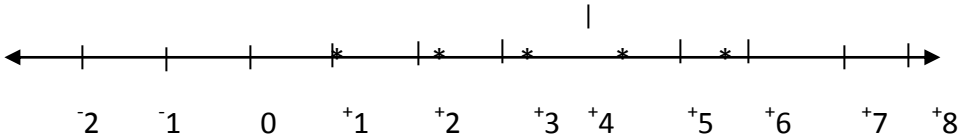
Subtopic: Sets on a number line.

Content:
- Interpreting sets of integers on a number line.
- Representing sets of integers on a number line.

Examples: (i) Write the set y shown below.

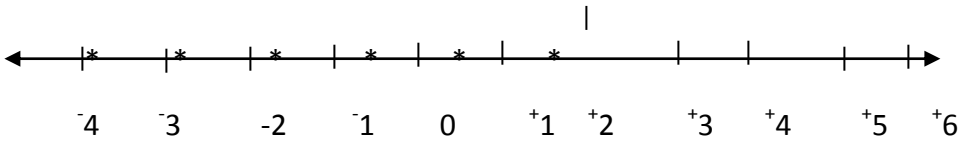
Set Y = {$^{-}1$, 0, $^{+}1$, $^{+}2$, $^{+}3$, $^{+}4$, $^{+}5$, $^{+}6$, ---------)

(ii) Find set P



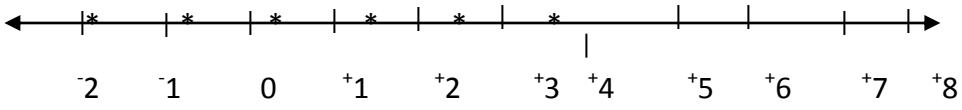

Set P = {$^{+}1$, $^{+}2$, $^{+}3$, $^{+}4$, $^{+}5$}

(iii) Find the set shown




{------- -4, -3, -2, -1, 0, $^{+}1$}

(iv) Represent X = {$^{-}2$, $^{-}1$, 0, 1, 2, 3, } on a number line




**Activity**

The pupils will do exercises 13:1 and 13:2 pages 114/3. A New MK 2000 BK 6 (Old edn)

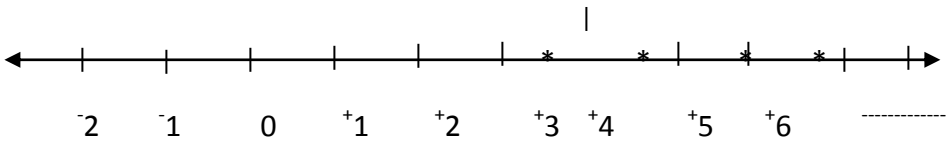
**Remarks** _____

**LESSON 11**

Subtopic: Find the solution sets.

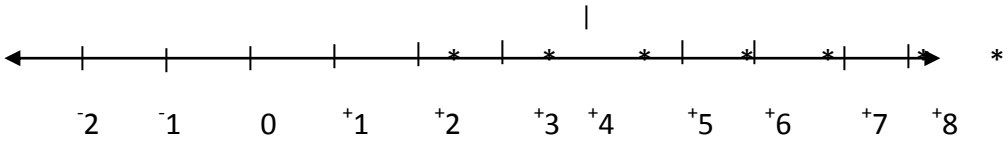
Content: Give the solution sets using a number line.

Examples: (i) If X > 2 find possible values of X



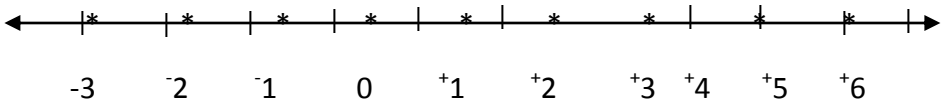

X = {+3, +4, +5, +6, ----------)

(ii) If X ≥ 2 find the solution set for X.



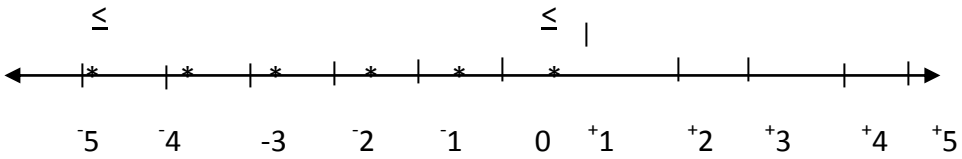

X = {2, 3, 4, 5, 6, 7, ----------}

(iii) -2 < X < +6




X = {1, 0, 1, 2, 3, 4, 5}

(iv) $-5 \leq q \leq 0$




q = {-5, -4, -3, -2, -1, 0}

**Activity**

The pupils will do exercises 13:3 and 13: 4 page 115.

A new MK BK 6 (Old Edn)

**Remarks** _____

**LESSON 12**

Subtopic: Inequalities

Content:
- Solve inequalities
- Find solution sets.

Example: (a) Solve $2x > 8$

Soln: $\frac{2x}{2_1} > \frac{8}{2_1}$

**$X > 4$**

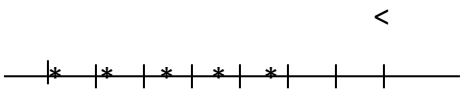
(b) Solve and give the solution set:

$3x + 2 < 8$

$3x + 2 - 2 < 8 - 2$

$\frac{{}^{1}\cancel{3}x}{{}_{1}\cancel{3}} < \frac{{}^{2}\cancel{6}}{{}_{1}\cancel{3}}$

$X < 2$



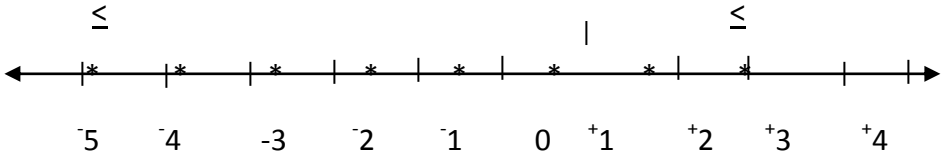
Solution set $\bar{5}\ \bar{4}\ \bar{3}\ \bar{2}\ \bar{1}\ 0\ {}^{+}1\ {}^{+}2$

$X = \{\text{------}\ \bar{3}, \bar{2}, \bar{1}, 0\ {}^{+}1\}$

(c) Solve: $-10 < 2x < -4$

$\frac{\bar{10}^{5}}{{}_{1}\cancel{2}} \leq \frac{{}^{1}2x}{{}_{1}\cancel{2}} \leq \frac{\bar{4}^{2}}{2_{1}}$

$\bar{5} \leq x \leq {}^{+}2$




X = {-5, -4, -3, -2, -1, 0, 1, 2}

**REVISION WORK ON INTEGERS**

1. Evaluate
   (a) $8 - {}^{-}3$ (b) ${}^{-}9 - 6$
   (c) Decrease ${}^{+}7$ by ${}^{-}7$
2. Work out:
   (a) ${}^{-}3 \times 0$ (b) $0.8 \times (\bar{4})$
3. Use a number line to add:
   (a) $\bar{6} + 4$ (b) $4 - {}^{+}7$
   (c) Find the additive inverse of ${}^{+}6$.
   (d) Add: $\bar{6} + 6$ (e) ${}^{+}14 - 14$
4. Work out:
   (a) ${}^{+}8 - {}^{-}8$ (b) $\bar{10} - {}^{+}15$ (c) ${}^{+}9 \div {}^{+}3$

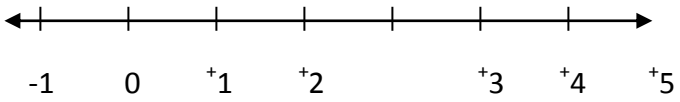
(d) $^{-}6 \times {}^{+}2$ (e) $^{-}12 \div {}^{-}3$

5. The temperature of ice fell from $-3^0$C by $5^0$C. Find the temperature of ice.

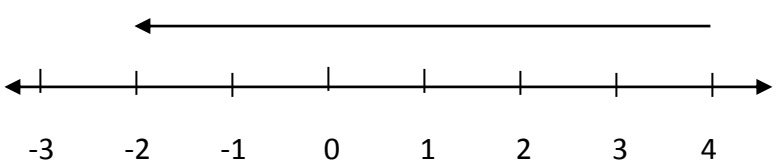
(b) Umeme men are to plant an electric pole 650cm. If 80 cm goes below the ground level. What is the height of the pole seen?

6. Write the expression shown on the number line

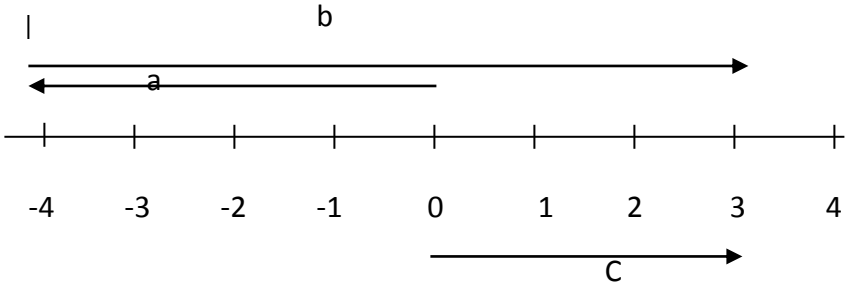
(a)




(b)



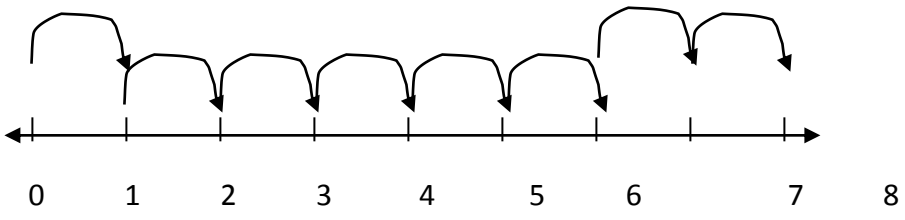

(c) Give the sentence shown




a = _____ b = _____ c = ____

sentence: _____

(ii)

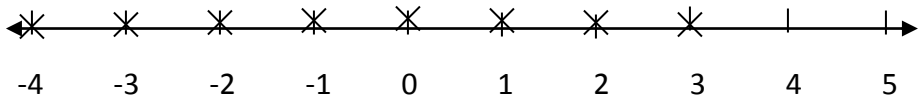



_____ x _____ = _____

7. Solve: $2y > 4$ and give the solution set.

(b) Give a set of integers for which: $2x + 3 \geq 5$

(c) Find the set T shown below




(d) Represent $W = \{^{-}3, ^{-}2, ^{-}1, 0\ ^{+}1, ^{+}2, ^{+}3, ^{+}4\}$ on a number line

8. (a) Solve for X in $^{-}3x + 5 < 8$

(b) Find the sum of $^{-}2$ and 12.

(c) Temperature on top of a mountain is $30^0$ at noon. It drops by $-10^0$C. What is the new temperature?

(d) Find **r** if $(^{-}2) + \mathbf{r} = 0$

9. (a) If X = {even numbers between 10 and 20}.
Find the solution set of $10 < x < 20$.

(b) Jie walked 4 metres. He remembered he had left some money behind and made 7 steps back to pick the money. Show it on a number line.

(c) I think of a number, multiply it by 3 and subtract 4 from it, the answer is greater than 14. Find the number.

10. Simplify: $\frac{2}{3} \times 6$ (b) $^{-}2\ (^{-}y + 1)$

(c) Solve: $3 \geq 3x \geq 9$ (d) $-4p \leq {}^{-}8$

11. Add: (a) $^{+}20 + {}^{-}8$ (b) $^{-}8 + -20$ (c) $^{+}8 + {}^{+}60$

12. Arrange the following integers.

(a) $\{^{-}2, 4, 8, 3, ^{-}1, 0\}$ in ascending order

(b) $\{^{+}10, ^{-}15, 3, 9, 0, ^{-}1\}$ in descending order

(c) Use >, < or = to compare.

(i) $^{-}20$ ---------- $^{+}8$ (ii) $^{-}2$ ---------- $^{-}10$

(iii) $^{+}4$ ---------- $^{-}400$ (iv) 0 ---------- $^{-}1$

13. $n - {}^{-}3 = 3$ find the value of n.

(b) What is the sum of $^{-}3y$ and $^{+}7y$?

(c) Work out y: If y = {prime numbers less than 10}

14. Study the date below:
$(^{-}2, ^{+}3, ^{+}4, ^{-}2, ^{-}5, ^{+}2)$

(a) Find their mode. (b) Work out their range

(c) What is the median?

15. A rat climbs a pole of 50 m high. It climbs 10m and slides 2m down. What distance from the ground level will it be after sliding 6 times?

TOPIC:12

# ALGEBRA

Algebra is the branch of mathematics dealing with symbols or unknowns to represent quantity of something.

## COLLECTING LIKE TERMS

1. Simplify: m + m + m

   = 4m

2. Simplify: 3k + 4k + k

   = 8k

3. Simplify: 6m + 10 + m + 4

   = 6m + m + 10 + 4

   = 7m + 14

4. Simplify: 4y – 8 + y + 3

   = 4y + y + 3 – 8

   = 5y – 5

5. Simplify: 2a x + 3mn + 5ax - 2mn

   = 2ax + 5ax + 3mn - 2mn

   = 7ax + mn

6. Simplify: m + 5k – 4m + 2k

   = m – 4m + 5k + 2k

   = -3m + 7k

## Activity

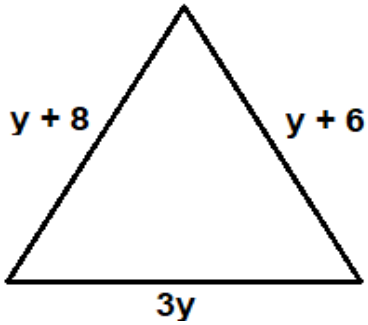
1. Simplify: K + 2K + 3K
2. Simplify: 3m – m + 2m
3. Simplify: 3k – 2m + 2k + 5m
4. Simplify the following

(a) 3Km – 2Km + 3W - 5W

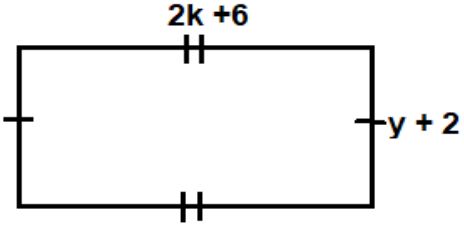
(b) 3P – 6 – 2P + 8

(c) 4xy – 2m – ab +2k

5. Below is a triangle. Find its perimeter.




6. Below is a rectangle. Find its perimeter.




## SUBSTITUTION

To substitute is to replace.

1. Given that a = 6, b = 4 and c=2

   Find the value of;

(i) a + b + c

6 + 4 + 2

12

(ii) a b c

**Soln.**

a x b x c

6 x 4 x 2

24 x 2

48

(iii) $\frac{abc}{4a}$

**Soln.**

$\frac{abc}{4b}$

(iv) $a^2 + b^2 + c^2$

$a^2 + b^2 - c^2$

(a x a) + (b x b) - (c x c)

(6 x 6) + (4 x 4) - (2 x 2)

36 + 16 - 4

52 - 4

48

(2) Given 2a = 6, b = 3 and c= 4

(a) Find the value of

b + 3

$\frac{a \times b \times c}{4 \times b}$

$\frac{6 \times 4 \times 2}{4 \times 4}$

$\frac{12}{4}^{3}$

3

= 3 + 3

= 6

(b) 2ab

= 2a x b

= 6 x 3

= 18

**Activity**

Given m = 3, n =3 and k = 2

Find the value of

(i) 2m + 3m

(ii) mk - nk

(iii) mkn

(iv) k (m + n)

(v) $\frac{k^2 + 2k}{4}$

2. Given a = 4, 12y = 6 and m = 4

Find:

(i) a + ya

(ii) 3a - my

(iii) $\frac{ay}{M}$

(iv) y (am + y)

## MORE ABOUT SUBSTITUTION

1. Given that a = -4 b= -3, c= 2

Find (i) a + b

$= {}^{-}4 + {}^{-}3$

$= {}^{-}7$

(ii) a – b $= {}^{-}4 - {}^{-}3$

$= {}^{-}4 - ({}^{-}3)$

$= {}^{-}4 + 3$

$= {}^{-}1$

(iii) $\frac{ab}{c}$

$\frac{ab}{c} = \frac{a \times b}{c}$

$= \frac{{}^{-}4 \times {}^{-}3}{2}$

$= \frac{\cancel{12}^{6}}{\cancel{2}}$

$= 6$

(iv) $a^2 - b^2$

$a^2 - b^2 = (a \times a) - (b \times b)$

$= ({}^{-}4 \times {}^{-}4) - (3 \times 3)$

$= 16 - (9)$

$= 7$

(v) abc

$abc = a \times b \times c$

$= (-4 \times -3) \times 2$

$= 12 \times 2$

$= 24$

(vi) $c^2 - b$

$c^2 - b = c^2 - b$

$= (c \times c) - (b)$

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

$= 4 - (-3)$

$= 4 + 3$

$= 7$

(viii) $\frac{a \times b}{4}$

$\frac{a \times b}{4} = \frac{-4 \times -3}{4}$

$= \frac{12}{4} 3$

$= 3$

**Activity**

If a = b = 4 and c = -2

(a) Find

(i) a + b

(ii) abc

(iii) $a^2 + c^2$

(iv) $a^2 - c$

(v) $\frac{a \times b}{-2}$

(vi) 2bc

(vii) 2(b – c)

2. Given that P = -8, Q = -2 and y = 4 find

(i) PQ + 4

(ii) P – Q

(iii) $Q^2 – y$

3. Given that a = b = 4 and c= -6

Find (i) a + b – c

(ii) b - c

(iii) 2ac

(iv) $c^2 + b$

## OPENING BRACKETS

**Note**:

- While opening bracket, multiply the figure immediately before brackets by all terms inside brackets.
- A negative sign outside brackets changes all signs outside brackets while a positive sign does not change signs inside brackets.
- On the third step there is a check point about integers.

1. Simplify: 4 (m + 2)

   **Soln.**

   4 x m + 4 x 2

   4m + 8

2. Simplify: 2(2p – 3k)

   **Soln.**

   2 x 2p – 2 x 3k

   4p - 6k

3. Simplify: -6 (m - 2)

   **Soln.**

   -6 x m + 2 x 6

   - 6m + 12

4 Simplify the following

a. 4(m + 6)

   **Soln.**

   4 x m + 6 x 4

   4m + 24

b. -3(-7a - 2b)

   -3 x -7 + 2b x 3

   21a + 6b

### Activity

Simplify the following.

1. 3(k - 2)
2. 5(x + 4)
3. -2 (y + 4)
4. ˉ4 (m – 6)
5. -4(2p – 4)
6. -3 (k + 5)
7. ˉ2(ˉ2 + k)

## MORE ABOUT REMOVING BRACKETS

### Examples

1. $(x + 1) + (2x + 3)$

   $x + 1 + 2x + 3$

   $x + 2x + 1 + 3$

   $3x + 4$

2. $2(y + 2) + 3(y – 2)$

   $2 \times y + 2 \times 2 + 3 \times y – 2 \times 3$

   $2y + 4 + 3y – 6$

   $2y + 3y + 4 – 6$

   $5y – 2$

3. $5(q + 3) + 3(q – 1)$

   $5 \times q + 3 \times 5 + 3 \times q – 1 \times 3$

   $5q + 15 + 3q – 3$

   $5q + 3q + 15 – 3$

   $8q + 12$

4. $(9x – 4) + (x + 1)$

   $9x - 4 + x + 1$

   $9x – x + 1 – 4$

   $8x – 3$

### Activity

1. $5(p + 2) + 2(p – 4)$
2. $3(k – 4) + 2(k + 3)$
3. $4(y – 6) + 2(y – 4)$
4. $3(y – 4) + 2(y - 2)$
5. $3(k – 4) + 2(k + 3)$
6. $5(k – 4) + 2(k + 1) + 3(k + 2)$

## OPENING BRACKETS INVOLVING A NEGATIVE SIGN OUTSIDE BRACKET

1. Simplify: 5(n – 4) – 3(n – 4)

**Soln.**

5 x n – 4 x 5 – 3 x n + 4 x 3
5n – 20 – 3n +12
5n – 3n + 12 – 20
2n – 8

2. Simplify: 7(p + 4) – 5 (p + 2)

7 x p + 4 x 7 – 5 x p – 5 x 2
7p + 28 – 5p – 10
7p – 5p + 28 – 10
2p + 18

3. Simplify: 7(y – 4) – 3 (y – 6)

7 x y – 4 x 7 – 3 x y + 6 x 3
7y - 28 – 3y + 18
7y - 28 - 3y + 18
7y - 3y + 18 – 28
4y - 10

4. Simplify: 3(m – 4) – 2 (m +2)

3 x m – 4 x 3 – 2m – 2 x 2
3m – 12 – 2m - 4
3m – 2m – 12 – 4
m – 16

**Activity**

1. Simplify: (9x – 4) – (x – 1)

**Simplify the following**

(a) 3(3x + 2) – 2 (x + 1)
(b) (7m – 1) + (m – 6)
(c) 8(m + 2) – 5 (m – 3)
(d) 4(n – 2) – 2 (n + 4)
(e) 5(p + 2) – 3 (p + 4)
(f) (5k – 6) – (3k – 4)

## SUBTRACTION OF COMPOUND TERMS

**Note:**

- While dealing with compound terms first introduce brackets.
- Follow instructions governing opening of brackets

**Examples.**

1. Subtract: (3k + 4) from (5k – 6)

   (5k – 6) – (3k + 4)
   5k – 6 – 3k – 4
   5k – 3k – 6 – 4
   2k -10

2. Subtract: p + 4 from 4p – 3

   (4p – 3) – (p + 4)
   4p – 3 – p – 4
   4p – p – 3 – 4
   3p – 7

3. Subtract 2m + 2 from (5m – 6)

   (5m – 6) – (2m + 2)
   5m – 6 – 2m – 2
   5m – 2m – 6 – 2
   3m - 8

4. Subtract 2(4n – 6) from (n – 4)

   (n – 4) – 2 (4n – 6)
   n – 4 – 2 x 4n + 6 x 2
   n – 4 – 8n + 12
   n – 8n + 12 – 4
   -7n + 8

**Activity**

Subtract the following

1. (t – 3) from (4t + 4)
2. (4n – 3) from (7n + 2)
3. 6k + 3 from 10k + 7
4. 5(x – 5) from 4(x – 4)
5. x – 1 from -2 (9 x -4)
6. (K – 2) from 3(K + 2)

## OPENING BRACKETS INVOLVING FRACTIONS

**Examples.**

1. Simplify: $\frac{3}{4}(8k - 12)$

$\frac{3}{4}(8k - 12)$

Soln

$\frac{3}{\cancel{4}} \times \cancel{8k}^{2} - \cancel{12}^{4} \times \frac{3}{\cancel{4}}$

$6k - 12$

2. Simplify: $\frac{1}{4}(8m - 16)$

$\frac{1}{4}(8m - 16)$

Soln

$\frac{1}{\cancel{4}} \times \cancel{8m}^{2} - \cancel{16}^{4} \times \frac{1}{\cancel{4}}$

$2m - 4$

3. Simplify: $\frac{2}{3}(2m - 6n)$

$\frac{2}{3}(2m - 6n)$

$\frac{2}{3} \times 2m - \cancel{6}^{2}n \times \frac{2}{\cancel{3}}$

$\frac{4m}{3} - 4n$

### Activity

1. Simplify the following

(a) $\frac{1}{4}(8k + 4)$

(b) $\frac{4}{5}(15y + 20)$

(c) $\frac{1}{3}(9 + 12x)$

(d) $\frac{2}{3}(6x + 15y)$

(e) $\frac{6}{7}(14m - 21)$

(f) $\frac{1}{4}(20k - 12p)$

## SOLVING SIMPLE EQUATIONS

1. Solve the following equation

(a) K + 4 = 8

**Soln.**

K + 4 – 4 = 8 – 4

K = 4

(b) 2m – 6 = 12

**Soln.**

2n - 6 + 6 = 12 + 6

2m = 18

$\frac{2m}{2} = \frac{18}{2}$ 9

m = 9

(c) Solve: 3d + 7 = 14

soln

3d + 7 - 7 = 14 - 7

$\frac{3d}{3} \quad \frac{-7}{3}$ 2 r1

$d = 2\frac{1}{3}$

**Activity**

Simplify the following equation.

(a) m + 3 = 11

(b) P – 5 = 9

(c) 7y + 4 = 18

(d) 3p – 2 = 7

(e) 4 + 3y = 16

(f) 3 + 4p = 27

(g) 12 - 2n = 4

(f) 1 – 5k = 11

(d) Solve: 5 + 7k = 26

5 + 7k = 26

Soln

5 - 5 + 7k = 26 - 5

$\frac{7k}{7} = \frac{21}{7}$ 3

K = 3

(e) Solve: 5 – 4m = 25

5 - 4m = 25

5 - 5 - 4m = 25 - 5

$\frac{-4m}{-4} = \frac{-20}{-4}$ -5

m = 50

## SOLVING EQUATION INVOLVING BRACKETS

1. Solve the following equations

(a) Solve: 2(k + 4) = 20

Soln

2 x K + 4 x 2 = 20

2k + 8 = 20

2k + 8 - 8 = 20 - 8

2k = 12

$\frac{2k}{2} = \frac{12^{6}}{2_{1}}$

k = 6

(b) Solve: 3(y – 2) = 9

3(y - 2) = 9

Soln

3 x y -2 x 3 = 9

3y - 6 = 9

3y - 6 + 6 = 9 + 6 (0)

3y = 15

$\frac{3y}{3} = \frac{15^{5}}{3_{1}}$

(c) Solve: 3(k – 4) = 18

3(k - 4) = 18

Soln

3 x k = -4 x 3 = 18

3k - 12 = 18

3k = 30

$\frac{3k}{3} = \frac{30^{10}}{3_{1}}$

k = 10

**Activity**

Solve the following equation

(a) 3(m + 2) = 21

(b) 5(k + 2) = 20

(c) 4(k + 2) = 30

(d) 2(y – 3) = 8

(e) 2(x – 2) = 6

(f) 7(m – 1) = 0

## SOLVING EQUATION INVOLVING UNKNOWNS ON BOTH SIDES

Solve the following equations

(a) Solve: $2p + 4 = p + 12$

$2P + 4 = P + 12$

Soln

$2P + 4 - 4 = P + 12 - 4$

$4 - 4 = 0$

$2P - P = P + 8$

$2P - P = P - P + 8$

$P = 8$

(b) Solve: $4(y - 1) = 2(y + 6)$

$4(y - 1) = 2(y + 6)$

Soln

$4 \times y - 1 \times 4 = 2 \times y + 2 \times 6$

$4y - 4 = 2y + 12$

$4y - 4 + 4 = 2y + 12 + 4$

$4y = 2y - 16$

$2y = 16$

$\frac{2y}{2} = \frac{16}{2}$

$y = 8$

(c) Solve: $3(n + 2) = 2(n + 8)$

Soln

$3 \times n + 2 \times 3 = 2 \times n + 2 \times 8$

$3n + 6 = 2n + 16$

$3n + 6 - 6 = 2n + 16 - 16$

$3n = 2n + 10$

$3n - 2n = 2n + 10$

$3n - 2n = 2n - 2n + 10$

$n = 10$

(d) Solve: $4(m - 2) = 3(m + 2)$

$4(m - 2) = 3(m + 2)$

Soln

$4 \times m - 2 \times 4 = 3 \times m + 2 \times 3$

$4m - 8 = 3m + 6$

$4m - 8 + 8 = 3m + 6 + 8$

$4m = 3m + 14$

$4m - 3m = 3m - 3m + 14$

$m = 14$

### Activity

Solve the following equations

(a) $3p + 6 = p + 14$

(b) $4y - 2 = y + 10$

(c) $5n - 6 = 2n + 6$

(d) $3(w + 2) = 2(w + 5)$

(e) $5(y + 1) = 2(y + 6)$

(f) $3(m - 2) = 2(m + 4)$

(g) $2(k - 2) = k + 4$

## COMPARING SIDES OF A RECTANGLE.

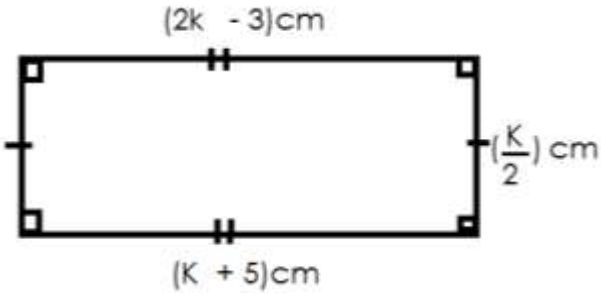
**NOTE**:

Opposite sides of a rectangle are equal. That is to say.

(i) Length = Length

(ii) Width = Width

1. Below is a rectangle, use it to answer questions that follow.




(a) Find the value of K.

$2k - 3 = k + 5$

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

$2k = k + 8$

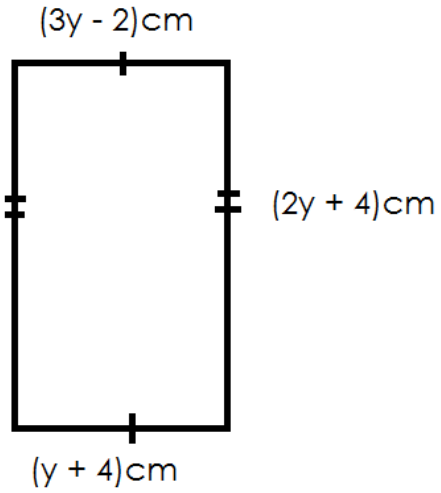
$2k - k = k - k + 8$

$k = 8$

(a) Find its area

| Length | Width | Area |
|---|---|---|
| (k + 5cm)<br>(8 + 5)cm<br>13cm | $\frac{k}{2}$ cm<br>$\left(\frac{4}{1}\right)$kcm<br>4cm | Area = L x w<br>= 13cm x 4cm<br>= $52cm^2$ |

2. Use the figure below to answer questions that follow.




(a) Find the value of y.

Width = Width

$3y = y + 6$

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

$2y = 6$

$\frac{2y}{2} = \frac{6^{3}}{2_{1}}$

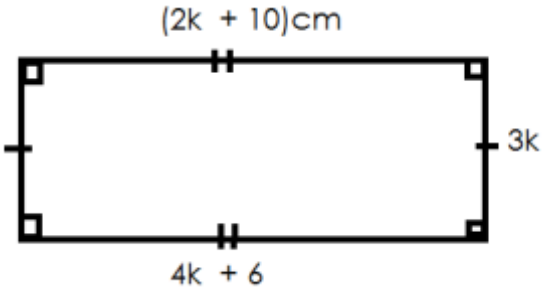
$y = 3$

(b) Calculate its area.

| Length | Width | Area |
|---|---|---|
| (2y + 4)cm | (y + 4) cm | Area = L x W |
| (2 x 3) + 4cm | ( 3 + 4) cm | = 10cm x 7cm |
| (6 + 4) cm | 7cm | $= 70cm^2$ |
| 10cm | | |

## Activity

1. Below is a rectangle. Use it to answer question.

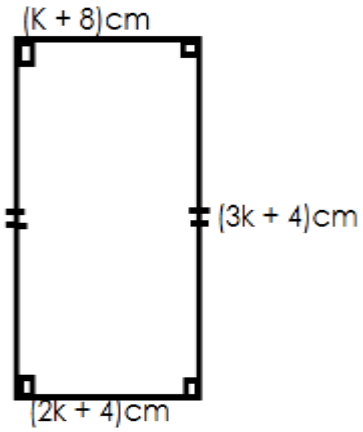



(a) Find the value of K.

(b) Find its area.

(c) Find its perimeter

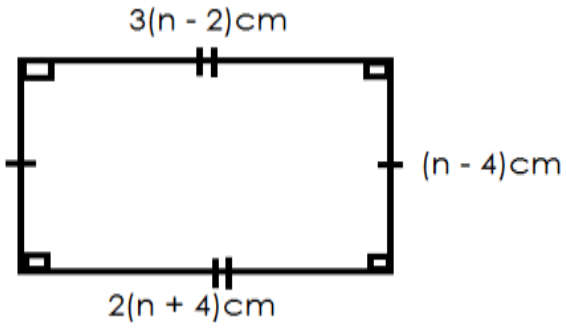
2. Study the figure below and answer questions.



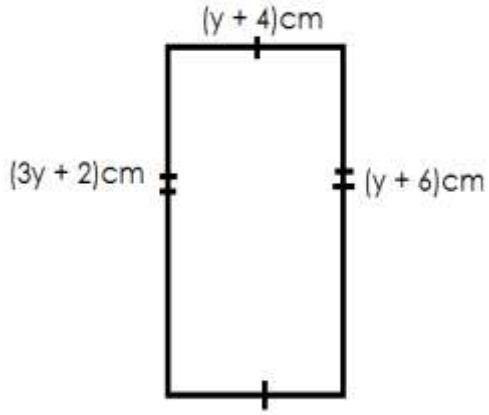

(a) Find the value of k.

(b) Find its area.

3. Find the area of the figure below.



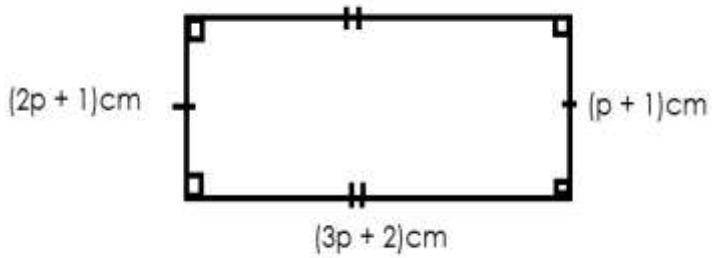
4. Study the figure below and answer questions.




(a) Find the value of y.

(b) Find its perimeter.

5. Study the figure below and answer question.

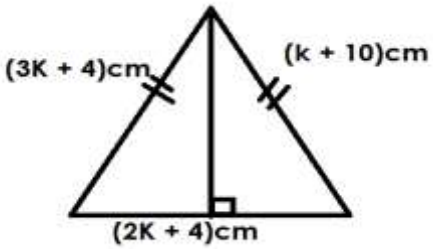



(a) Find the value of P.

(b) Find its area.

## COMPARING SIDES OF ISOSCELES TRIANGLE.

Below is a triangle use it to answer questions.




(a) Find the value of k.

Side = side

$3k + 4 = k + 10$

$3k + 4 - 4 = k + 10 - 4$

$3k = k + 6$

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

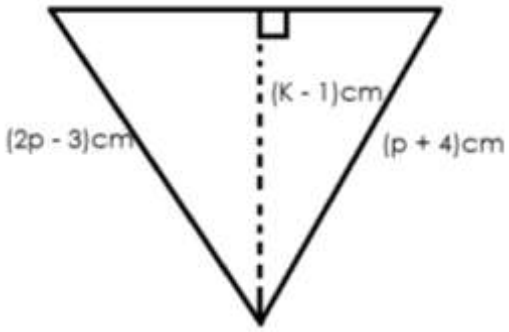
$\frac{2k}{2} = \frac{6}{2}^{3}_{1}$

$k = 3$

(b) Find its area

| Base | Height | Area |
|---|---|---|
| (2k + 4)cm<br>(2 x 3 ) + 4 cm<br>( 6 x 4)cm<br>10cm | 8cm | Area = $\frac{1}{2}$ x b x h<br>=40cm $^2$ |

2. Use the figure below to answer questions that follow.




(a) Find the value of P.

Soln

Side = side

$2p - 3 = p + 4$

$2p - 3 + 3 = p + 4 + 3$

$2p - p = p - p + 7$

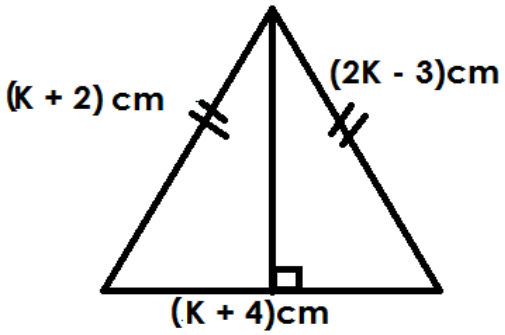
$p = 7$

(b) Find the area of the triangle

| Base | Height | Area |
|---|---|---|
| (2p - 4)cm<br>(2 x 7) - 4cm<br>(14 - 4) cm<br>10cm | (k - 1)cm<br>(7 - 1)cm<br>$6cm^2$ | Area = $\frac{1}{2}$ x b x h<br>= $\frac{1}{2}$ x 10cm x 6cm<br>= $30cm^2$ |

**Activity**

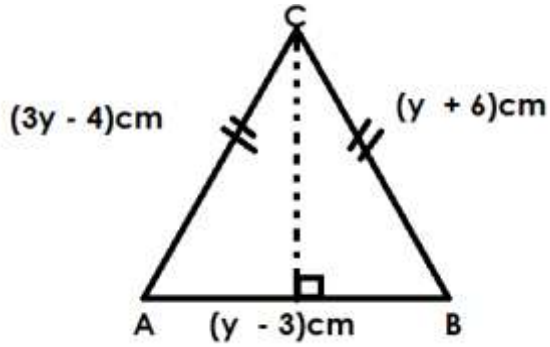
1. Use the figure below to answer questions that follow.




(a) Find the value of k.

(b) Find the area of the triangle.

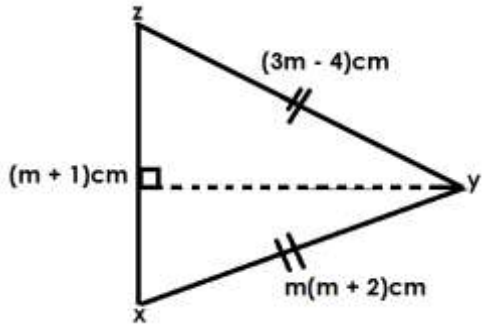
2. Below is a triangle, use it to answer questions that follow.




(a) Find the value of y.

(b) Calculate the area of the figure.

3. Use the triangle below to answer questions that follow.

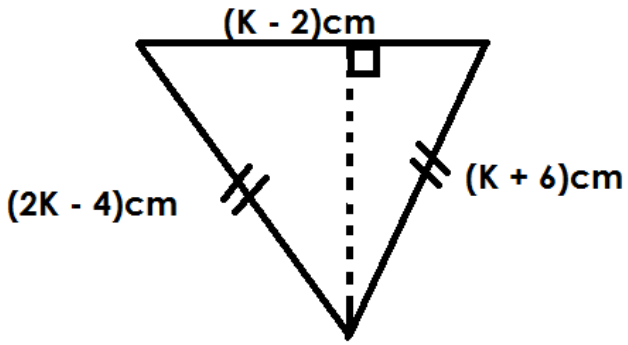



(a) Find the value of m

(b) Find the area of the figure XYZ

(c) Find the perimeter of the figure.

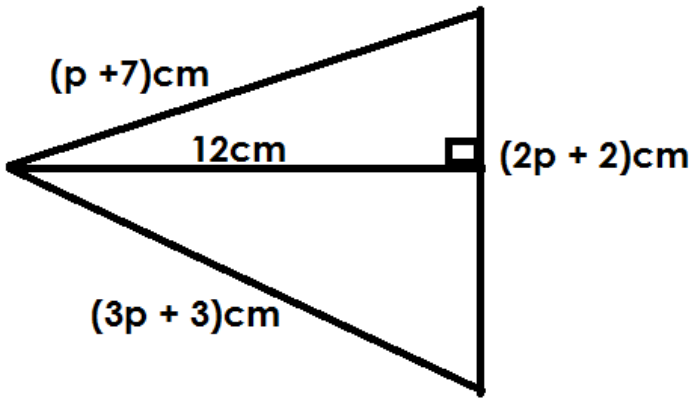
4. Below is a figure, use it to answer questions that follow.




(a) Find the value of k.

(b) Find the area of the figure.

5. Use the figure below to answer questions that follow.




(a) Find the value of p.

(b) Find the area of the figure.

(c) Find the total distance around the figure.

## SOLVING EQUATIONS INVOLVING TWO BRACKETS

1. Solve : $2(p + 2) + 3(p + 2) = 20$

Soln

$2 \times p + 2 \times 2 + 3 \times p + 2 \times 3 = 20$

$2p + 3p + 6 + 4 = 20$

$5p + 10 = 20 - 10$

$\frac{5p}{5} = \frac{10}{5}^{2}$

$p = 2$

2. Solve: $2(y + 2) + 2(y – 4) = 12$

$2 \times y + 2 \times 2 + 2 \times y - 4 \times 2 = 12$

$2y + 4 + 2y - 8 = 12$

$2y + 2y + 4 - 8 = 12$

$4y - 4 = 12 + 4$

$4y = 16$

$\frac{4y}{4} = \frac{16}{4}^{4}$

$y = 4$

3. Solve for k : $3(k - 2) - 2(y + 4) = 10$

Soln

$3 \times k - 2 \times 3 - 2 \times y - 2 \times 4 = 0$

$3k - 6 - 2y - 8 = 0$

$y - 14 = 0 + 14$

$y = 14$

4. Solve: $2(2y - 8) - 2(y - 3) = 4$

$2 \times 2y - 8 \times 2 - 2 \times y - 3x - 2 = 4$

$4y - 16 - 2y + 6 = 4$

$4y - 2y - 16 + 6 = 4$

$2y - 10 = 4 + 10$

$2y = 14$

$\frac{\cancel{2}^{1}y}{\cancel{2}_{1}} = \frac{\cancel{14}^{7}}{\cancel{2}_{1}}$

$y = 7$

5. Solve: $3(c – 2) – 2(c – 2) = 3$

Soln

Solve for c : $3 \times c - 2 \times 3 - 2c + 4 = 3$

$3c - 6 - 2c + 4 = 3$

$3c - 2c + 4 - 6 = 3$

$c - 2 = 3$

$c - 2 + 2 = 3 + 2$

$c = 5$

**Activity**

1. **Solve the following**

(a) $3(k + 1) + 2(k + 2) = 17$

(b) $2(m + 2) + 2(m + 2) = 20$

(c) $2(n + 4) + 3(k – 6) = 5$

(d) $7(m + 2) + 3(m – 4) = 18$

(e) $3(y – 4) – 2(y – 4) = 7$

(f) $7(k – 4) – 3(y – 6) = 10$

(g) $4(m- 2) – 2(m + 3) = 4$

(h) $2(p – 3) – (p – 5) = 0$

## SOLVING EQUATIONS INVOLVING FRACTIONS

1. Solve: $\frac{2k}{3} = 2$

Soln

$\frac{2k}{3} \times 3 = 2 \times 3$

$\frac{2k}{2} = \frac{6}{2}$

$K = 3$

2. Solve: $2p + 2 = 4$

Soln

$\frac{2p + 2}{4} \times 4 = 4 \times 4$

$2p + 2 = 16$

$2p + 2 - 2 = 16 - 2$

$\frac{2p}{2} = \frac{14}{2}$

$p = 7$

3. Solve for p $\frac{2p - 3}{4} = 3$

Soln

$\frac{2p}{4} - 3 \times 4 = 3 \times 4$

$2p - 3 = 12$

$2p - 3 + 3 = 12 + 3$

$2p = 15$

$\frac{2p}{2} = \frac{15}{2}$ (7 r 1)

$p = 7\frac{1}{2}$

4. Solve: $\frac{(p+2)}{4} + \frac{(p+6)}{5}$

Soln

$5(p+2) = 4(p+6)$

$5 \times p + 2 \times 5 = 4 \times p + 6 \times 4$

$5p + 10 = 4p + 24$

$5p + 10 - 10 = 4p + 24 - 10$

$5p = 4p + 14$

$5p - 4p = 4p - 4p + 14$

$p = 14$

5. Soln

$\frac{(m-2)}{3} = \frac{(m+2)}{4}$

$4(m-2) = 3(m+2)$

$4 \times m - 2 \times 4 = 3 \times m + 2 \times 3$

$4m - 8 = 3m + 6$

$4m - 8 + 8 = 3m + 6 + 8$

$4m = 3m + 14$

$4m - 3m = 3m - 3m + 14$

$m = 14$

6. Solve for $k = \frac{(k-3)}{2} = \frac{(k-5)}{3}$

Soln

$3(k-3) = 2(k-5)$

$3 \times k - 3 \times 3 = 2 \times k - 5 \times 2$

$3k - 9 = 2k - 10$

$3k - 9 + 9 = 2k - 10 + 9$

$3k = 2k - 1$

$3k - 2k = 2k - 2k - 1$

$K = -1$

## ACTIVITY

1. Solve the following

(a) $\frac{y}{3} = 2$

(b) $\frac{2m}{5} = 4$

(c) $\frac{2m + 6}{3} = 4$

(d) $\frac{y - 4}{2} = 0$

(e) $\frac{2k + 4 + 2}{3} = 8$

$\frac{P + 3 - 3}{2} = 6$

(g) $\frac{K + 1}{3} = \frac{K + 4}{4}$

## APPLICATION OF ALGEBRA

1. I think of a number, add 6 to it and the result is 20. What is the number?

Let the number be K.

$K + 6 = 20$

$K + 6 - 6 = 20 - 6$

$K = 14$

2. James and Peter shaded 30 mangoes. If Peter got 18 mangoes. How many mangoes did James get?

Soln

Let Jame's mangoes be n

$n + 18 = 30$

$n + 18 - 18 = 30 - 18$

$n = 12$

3. Richard is 6 years older than Manda, if their total age is 25years. How old is each of them.

| Mande | Richard | Total |
|---|---|---|
| r | r + 6 | 28 |

$r + r + 6 = 28$

$\frac{2r}{2} + 6 - 6 = 28 - 6$

$r = \frac{22}{2}$

$r = 11$

| Mande | Richard |
|---|---|
| r | r + 6 |
| 11 | 11 + 6 |
| 11 | 17yrs |

Esther is 12 years older than Anisha. If their old age is 40 year. How old is each of them.

| Anisha | Esther | Total |
|---|---|---|
| K | K t 12 | 40 |

$K + K + 12 = 40$

$2K + 12 = 40$

$2K + 12 - 12 = 40 - 12$

$\frac{2K}{2} = \frac{28}{2}$

$K = 14$

| Anisha | Esther |
|---|---|
| K | K t 12 |
| 14 | 14 + 12 |
| 14 | = 26 |

Ronald and Musa shared 24mangoes if Ronald got 4 more mangoes than Musa. How man mangoes did Musa get?

| Anisha | Esther | Total |
|---|---|---|
| r | r + 4 | 24 |

$r + r + 4 = 24$

$2r + 4 = 24$

$2r + 4 - 4 = 24 - 4$

$\frac{2r}{2} = \frac{20}{2}$

$r = 10$

Osako picked mangoes for three days consecutively. He was picking 2 more mangoes than the previous day. If he picked a total of 36 mangoes. How many mangoes did he on the first day?

**Soln.**

Let the first day be r.

| 1st day | 2nd day | 3rd day | Total |
|---|---|---|---|
| r | r + 2 | r + 2 + 2 | = 36 |
| r | r + 2 | r + 4 | = 36 |

$r + r + 2 + r + 4 = 36$

$r + r + r + 2 + 4 = 36$

$3r + 6 = 36$

$3r + 6 - 6 = 36 - 6$

$\frac{3r}{3} = \frac{30}{3}$

$= 10$

## Activity

1. Amoti is 5 years older than Mr. Bin if their total age is 35 years. How old is each of them?
2. Drake is 10 years older that Lillian, if their total age is 40 years. How old is Drake?
3. Oundo and Tonny shared 36 sweets. If Tonny got 2 more sweets than Oundo. How many sweets did each get?
4. In a market, a cow costs sh. 200,000 more than a goat. If Mercy bought two animals at sh. 800,00. How much is a goat?

## More about application of Algebra

Omara is 6 years younger than Derrick. If their total age is 18. How old is Omara?

Let Derrick's age be n.

| Derrick | Omara | Total |
|---|---|---|
| n | n – 6 | 18 |

$$n + n - 6 = 18$$

$$2n - 6 = 18$$

$$2n - 6 + 6 = 18 + 6$$

$$\frac{2n}{2} = \frac{24}{2}$$

$$n = 12$$

Omara = n – 6

= 12 – 6

= 6 years.

2. Mandela is 8 years younger than Nabata. If their total age is 34 years. How old is each of them?

**Soln.**

| Mandela | Nabata | Total |
|---|---|---|
| **K – 8** | **K** | **34** |

$K - 8 + K = 34$

$K + K - 8 = 34$

$2K - 8 + 8 = 34 + 8$

$\frac{2K}{2} = \frac{42}{2} = 21$

$K = 21$

| Mandela | Nabata |
|---|---|
| K – 8<br><br>21 – 8<br>13yrs | K<br>21years |

3. At the supermarket. A shirt costs sh. 2000 less than a dress. A trader bought both at sh. 6000. How much is a dress?

| Dress | Shirt | Total |
|---|---|---|
| b | b - 2000 | Sh. 6000 |

$b + b - 2000 = 6000$

$2b - 2000 = 6000 + 2000$

$2b - 2000 + 2000 = 8000$

$\frac{2b}{2} = \frac{8000}{2}$

$b = 4000$

The dress costs shs 4000

## Activity

1. Martha is 9 years younger than her mother. If their total age is 41. How old is Martha?
2. Kafulu is 12yrs younger than Kakare. If their total age is 40 years. How old is each of them?
3. Sarah is 20 years younger than Oluka. If their total age is 52years. How old is each of them?
4. Solo bought 4 less sweets that Nelson if they both bought a total of 30 sweets. How many sweets did Nelson buy?
5. A hen costs sh. 5000 less than a turkey if they cost of both is sh. 65,000. Find the cost of a hen.

## MORE APPLICATION OF ALGEBRE INVOLVING AGE.

### Examples.

1. Mbaluma is twice as old as Musa. If their total age is 36 years.

How old is each of them now?

Let Musa's age be r

| Mbaluma | Musa | Total |
|---|---|---|
| 2 x r | r | |
| 2r | r | 36 |

$$\frac{3r}{3} = \frac{36^{12}}{3}$$

$$r = 12 \text{ years}$$

| **Mbaluma** | **Musa** |
|---|---|
| 2r | r |
| 2 x 12 | 12 |
| 24yeara | 12years |

2. Wasswa is 4 times as old as Kato. If their total age is 60 years. How old is Wasswa?

**Soln.**

Let Kato's age be n

| **Kato** | **Wasswa** | **Total** |
|---|---|---|
| n | 4 x n | 60 |
| n | 4n | 60 |

$$n + 4n = 60$$

$$\frac{5n}{5} = \frac{60}{5} \quad 12$$

$$n = 12$$

Wasswa = 4n

= 4 x 12

= 43 years.

3. Mane is 3 times as old as Bob, the difference in their age is 40 years. How old is each?

| **Mane** | **Bob** | **difference** |
|---|---|---|
| 3K | K | 40 |

$$3K - K = 40$$

$$\frac{2K}{2} = \frac{40}{2} \quad 1$$

$$K = 20$$

| Mane | Bob |
|---|---|
| = 3 x k<br>= 3 x 20<br>= 60 years | = k<br>= 20 years |

4. Osako is 4 times as old as Odur, the difference in their age is 36 years. How is Osako?

| Osako | Odur | Difference |
|---|---|---|
| 4n | N | 36 |

$$4n - n = 36$$

$$\frac{3n}{3} = \frac{36^{12}}{3_1}$$

$$n = 12$$

$$\text{Osako} = 4n$$
$$= 4 \times 12$$
$$= 48$$

5. James is twice as old as John. In ten years' time, heir total age will be 80 years. How old is each of them?

**Soln.**

Let John's age be h

| Time | James | John | Total |
|---|---|---|---|
| Now | 2 x h | h | |
| Future | 2h + 10 | h + 10 | 80 |

$$2h + 10 + h + 10 = 80$$

$$2h + h + 10 + 10 = 80$$

$$3h + 20 = 80$$

$$3h + 20 - 20 = 80 - 20$$

$$\frac{3h}{3} = \frac{60^{2}}{3_1}$$

$$h = 20 \text{ years}$$

| James | John |
|---|---|
| 2h | H |
| 2 x 20 | |
| 40 | 20 years |

**Activity**

1. Sandra is three times as old as Annet. If their total age is 48 years. How old is Annet?
2. A mother is 4 times as old as her daughter. Their total age is 30 years. Find the daughter's age.
3. Anna is 2 years than Eva. Their total age is 15 years. Find Eva's age.

## INEQUALITIES AND SOLUTION SETS

Inequality is a relationship between two expression that are not equal. It is often written in the form of an equation but with the symbols > or <.

**Symbols used**

| | |
|---|---|
| $>$ | **is greater than** |
| $\geq$ | **is greater than or equal to** |
| $<$ | **is less than** |
| $\leq$ | **is less than or equal to** |

**Solution set**

Is a set of all possible values and integers that satisfy a given inequality.

**Forming solution sets**

1. Given that K < 5. Find the solution set for y.

**Soln.**

K < 5

K = {4, 3, 2, 1, 0, -1, …)

2. Given the solution set that satisfies m > 4.

**Soln.**

M > 4

M = {5, 6, 7, 8, 9, …)

3. Find the saluting set for $\leqslant$ 6

**Soln.**

P $\leqslant$ 6

P = {6, 5, 4, 3, 2, 1, …}

4. Write the solution set for y $\geqslant$ .0

**Soln.**

y $\geqslant$ 110

Y = {10, 11, 12, 13, 14, …}

5. Find the solution set for x if is a prime number $\geqslant$ 1

Soln.

X $\geqslant$ 1

{1, 2, 3, 4, 5, 6, 7, 8, …}

X = {2, 3, 5, 7, …}

**Activity**

1. Write the solution set for the following inequalities.

(a) x > 8

(b) m > 11

(c) 4 < K

(d) P < 9

(e) 10 > W

(f) x $\leqslant$ 3

(g) Q $\geqslant$ 7

(i) r < -7

(j) z > - -1

(k) h $\geqslant$ - -3

2. If m $\geqslant$ 8, give a solution set for m if m is positive number.

3. If y $\leqslant$ 11, give a solution set for y if y is an even number.

## SOLVING INEQUATION AND FINDING SOLUTION SET

1. Solve and give a solution set for the inequality $2x < 8$

$$\frac{2x}{2} < \frac{8^{4}}{2_{1}}$$

$$x < 4$$

$$x = \{3, 2, 1, 0, -1, \ldots\}$$

2. Solve and find a solution set for $3m > 18$.

$$\frac{3m}{3} > \frac{18}{3}$$

$$m > 6$$

$$m = \{7, 8, 9, 10, 11, \ldots\ldots\}$$

3. Solve and find a solution set for $2K \leqslant 16$ where K is a multiple a positive multiple of 2.

Soln

$$\frac{2K}{2} \leqslant \frac{16}{2}$$

$$K \leqslant 8$$

$$K = \{8, 6, 4, 2\}$$

4. Solve and form a solution for $2p - 3 \geqslant 11$

Soln

$$2P - 3 \geqslant 11$$

$$2P - 3 + 3 \geqslant 11 + 3$$

$$2P \geqslant 14$$

$$\frac{2p}{2} \geqslant \frac{14^{7}}{2_{1}}$$

$$P = \{7, 8, 9, 10, 11, \ldots\}$$

5. Solve and form a solution set for $3K + 2 \leqslant -4$

Soln

$3K + 2 - 2 < -4 - 2$

$3K < -6$

$\frac{3K}{3} < \frac{-6}{3}$

$K < -2$

$K = \{-3, -4, -5, -6, -7, .....\}$

6. Solve and form a solution set for $13 \leqslant 2P - 3$ where P is an even number.

Soln

$13 \geqslant 2P - 3$

$13 + 3 \geqslant 29 - 3 + 3$

$16 \geqslant 2P$

$\frac{16}{2} \geqslant \frac{2P}{2}$

$8 \geqslant P$

$P = \{8, 6, 4, 2, 0\}$

**Activity.**

1. Solve the following inequalities and form a solution set for each.

(a) $4K > 16$

(b) $21 \leqslant 3m$

(c) $2F \leqslant -12$

(d) $-18 < 3K$

2. Solve and form a solution set for each inequality below.

(a) $2m - 5 > 7$

(b) $3 + P < 11$

(c) $4P + 3 \geqslant 19$

(d) $35 \geqslant 3y + 5$

(e) $2x - 4 < 0$

(f) $P + 5 < 7$

(q) $2y + 3 \leqslant 15$

(i) $3x - 3 \leqslant 12$

3. If $3x - 2 \leqslant 10$, form a solution set for the inequality where x is a prime number.

4. Form a solution set for $2y + 4 \geqslant 26$. Where y is an odd number.

## SOLVING INEQUALITIES AND FORMING A SOLUTION SET INVOLVING A NEGATIVE COEFFICIENT

**NOTE**:

When a negative coefficient is divided on both sides of the inequality, the sign changes to its opposite.

1. Solve form a solution for $-2K > 6$

Soln

$-2K > 6$

$\frac{-2K}{-2} < \frac{6}{2}^{-3}_{1}$

$k < -3$

2. Form a solution set for m if $-3m \leqslant -15$ where m is an even number.

Soln

$-3m \leqslant -15$

$\frac{-3m}{-3} \geqslant \frac{-15}{3}^{5}_{1}$

$m \geqslant 5$

3. Write down all the possible positive values of m for $^{-}2m - 3 \geqslant {}^{-}3$

Soln

$-2m - 3 \geqslant -13$

$-2m - 3 + 3 \geqslant -3 + 3$

$-2m \geqslant -10$

$\frac{-2m}{-2} \leqslant \frac{-10^{5}}{-2_{1}}$

$m \leqslant 5$

$m = \{5, 4, 3, 2, 1\}$

4. Solve and write a solution set for $2 - 3K \leqslant 20$.

Soln

$2 - 3K \leqslant 20$

$2 - 2 - 3K \leqslant 20 - 2$ ($2 - 2 = 0$)

$\frac{-3K}{-3} \geqslant \frac{18^{-6}}{-3}$

$K \geqslant -6$

$K = \{{}^{-}6, {}^{-}5, -4, {}^{-}3, {}^{-}2, {}^{-}1, 0, .....\}$

**Activity**

1. Solve and form a solution set for the following inequality.

(a) $-4K > -8$

(b) $-14 > -2y$

(c) $-3x \geqslant 12$

(d) $-21 \geqslant -3P$

(e) $-2m + 1 > 9$

(f) $5 - 3K \geqslant 20$

(g) $2 - 2P \leqslant -18$

2. Form a solution for $4 - 5K \geqslant 24$ where K is a positive integer.

3. If $-17 \geqslant -2m + 3$ and m is a multiple of 20 less than 100, Write all the possible values of m.