

TOPIC 7: GEOMETRIC CONSTRUCTION

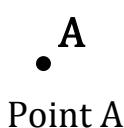


Points and lines

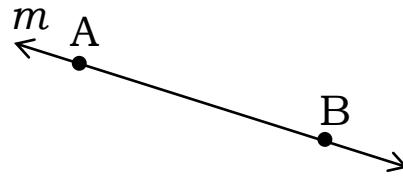
In mathematics, a point is represented by a dot (.) and is used to tell the exact location in space. It does not have any length, width or height. A point is usually named using upper case (capital) letters.

When two or more points are connected, they form a line.

A line is defined by two points. It can be marked with a single letter in lower case or by two capital letters. A line has no thickness and can extend indefinitely in both directions as shown in the figures below.



Point A



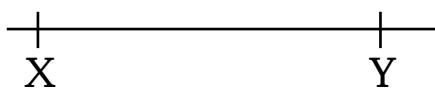
Line AB or Line m

A ray and a line segment

A ray is a part of a line that has a fixed starting point but one end point. It can extend infinitely in one direction as shown below



A line segment is part of a straight line that is bounded by two distinct end points.



This is line segment XY or YX. It has two end points X and Y whose length is the distance between its ends points X and Y.

Drawing / constructing and measuring line segments

Revision exercise

1. Draw the following line segments.

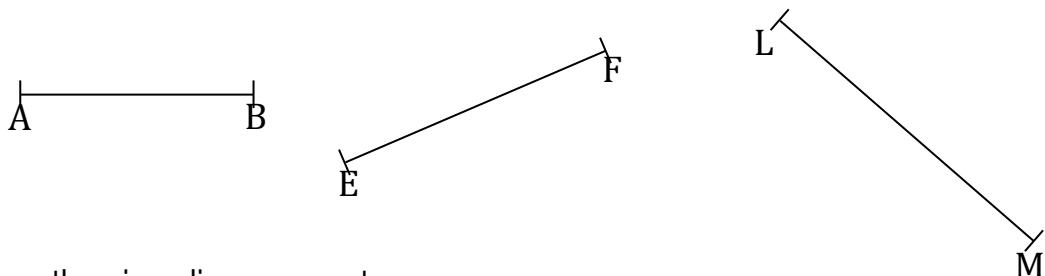
i) AB = 3cm	iv) XP = 7.5cm
ii) XY = 4cm	v) KL = 5.3cm
iii) MT = 5cm	vi) PQ = 49cm
2. Using a ruler, a pencil and of compasses only, construct the following lines.

a) 6.5cm	e) 5.6 cm
b) 7cm	f) 9.1cm
c) 8.4cm	g) 5.5cm
d) 4.4 cm	h) 6.8cm

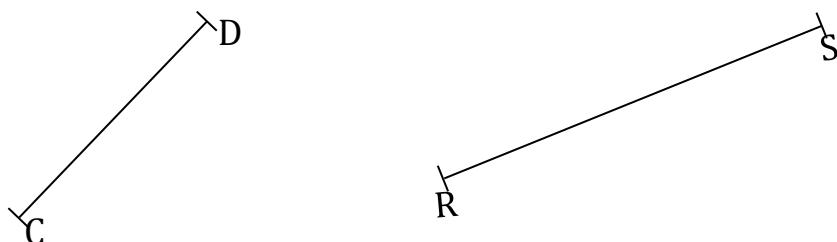
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3. Measure the length of the given line segments.



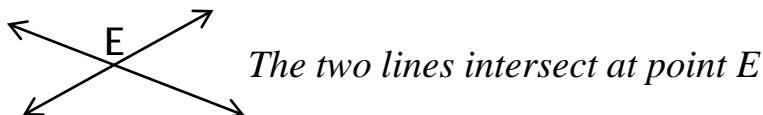
4. Copy the given line segments



Identifying intersecting lines, parallel lines and skew lines

Intersecting lines

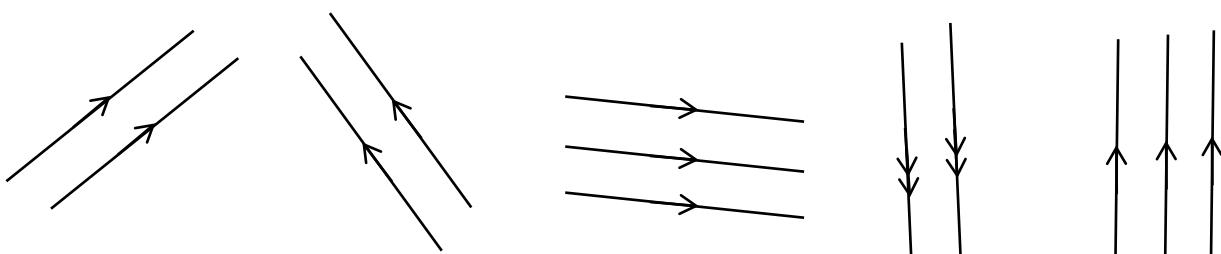
When two or more lines cross each other in a plane, they are called intersecting lines.



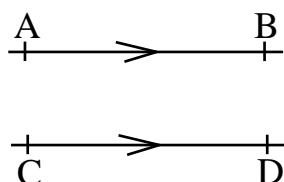
Note: Intersecting lines share a common point called the point of intersection.

Parallel lines

Parallel lines are straight lines with a constant distance between them. Parallel lines can also be defined as two or more lines in the same plane which are at equal distance from each other and never meet. Below are of parallel lines.



Study the figure below.



From the figure line AB is parallel to CD, this can also be written as $AB \parallel CD$

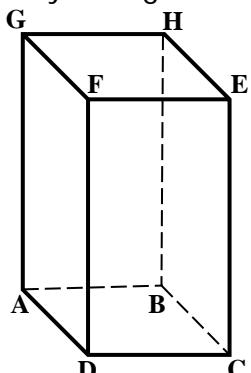
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Skew lines

In three dimensional geometry, skew lines are two lines that do not intersect and are not parallel. Two lines that both lie in the same plane must either cross each other or be parallel, so skew line can only exist in only three or more dimensions.

Study the figure below.



From the figure, the line through segment AD and Segment BH are skew lines because they are not in the same plane.

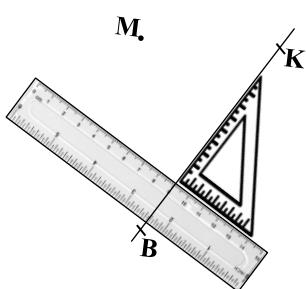
Drawing parallel lines

Example

Draw a line parallel to line BK through M using a ruler and a set square.

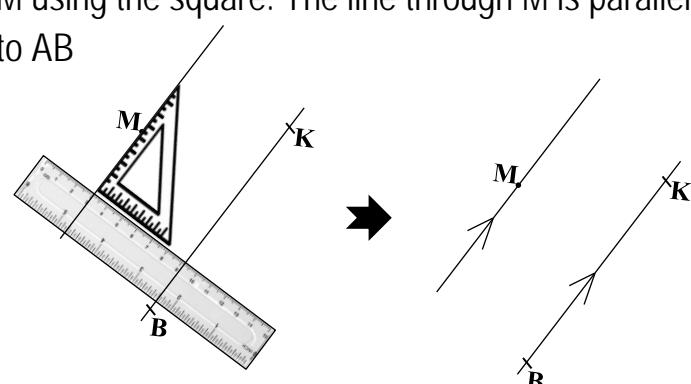
Step 1

Place the 60° set squares along the given line BK as shown.



Step 2

Holding the ruler firmly, slide the set square along the ruler to touch point M and draw a line through M using the square. The line through M is parallel to AB



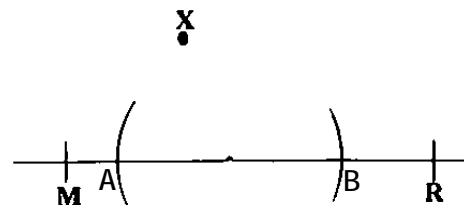
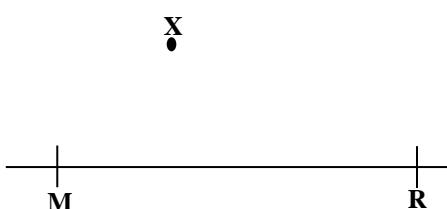
Constructing parallel lines

Example.

Using a ruler, a pencil and a pair of compasses only, construct a line parallel to MR through point X.

Step 1

Mark any two points, say A and B on line MR.

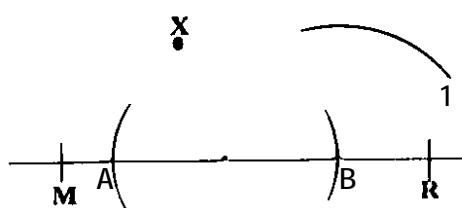


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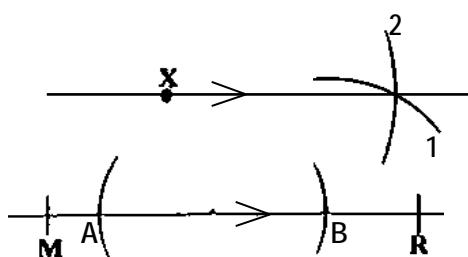
Step 2

With radius AX and centre B, construct arc 1



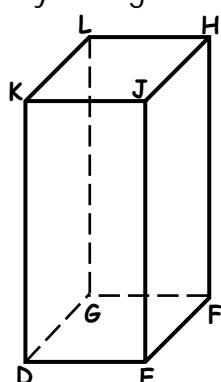
Step 3

With radius AB and centre X construct the second arc 2. Join point X to the point of intersection of the two arcs



Exercise

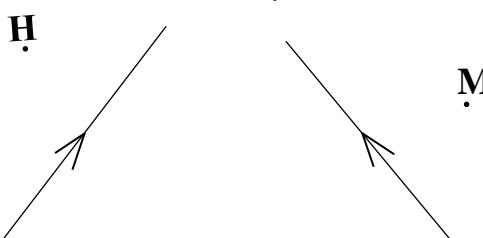
1. Study the figure below and use it to answer questions that follow.



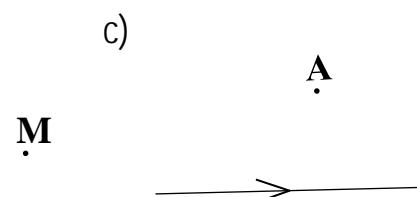
- a) Identify skew lines to the following lines from the figure
 - i) HF
 - ii) DE
 - iii) LG
- b) State whether they are parallel, skew or intersecting lines.
 - i) LH and KJ
 - ii) FE and EJ
 - iii) FE and EJ
 - iv) DE and HF
 - v) GF and JE
 - vi) KD and GL

2. Using a ruler and a set square, draw lines parallel to the given lines through the given points.

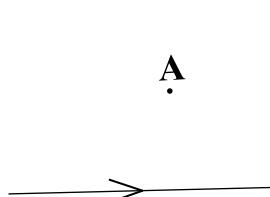
a)



b)



c)



d)

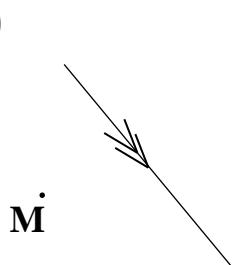


3. Construct parallel lines through the given points.

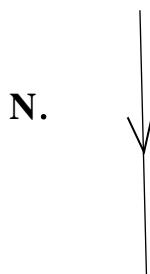
a)



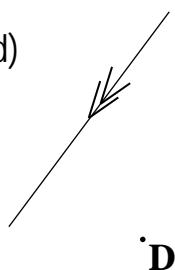
b)



c)



d)



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4. Using a ruler, a pair of compasses and a pencil only, construct parallel lines
- a) 3cm apart
 - b) 2cm part
 - c) 3.5cm a part
 - d) 4cm apart
 - e) 5.5cm apart
 - f) 4.6cm apart
5. Using a pair of compasses, a ruler and a pencil only, construct the following parallel lines.
- a) AB and CA = 4cm apart
 - b) KL and WP = 4.3cm apart
 - c) DK and WP = 5.1cm apart
 - d) RN and BD = 4.8cm apart
 - e) XM and YZ = 5.3cm apart
 - f) AR and MT = 6.9cm apart
 - g) TQ and MY = 4.7cm apart
 - i) PR and ST = 3.8cm apart

Bisecting lines segments

Bisecting means dividing into two equal parts (halves)

Example

Using a ruler, a pencil and a pair of compasses only, bisect line PQ below.



Step 1

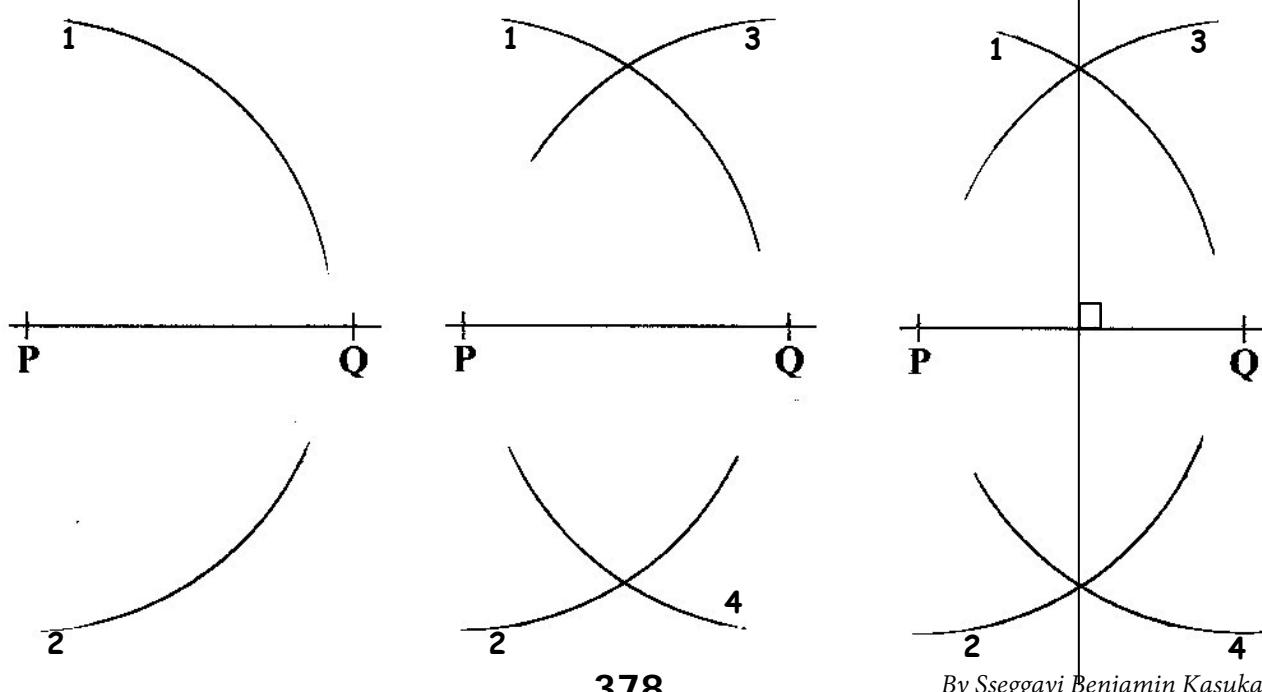
Place the compass at point p and adjust it slightly longer than half of the line segment PQ. Mark arcs 1 and 2.

Step 2

Using the same radius, place the compass at point Q and mark the arcs 3 and 4.

Step 3

Draw a straight line through the points of intersection of the arcs 1,3

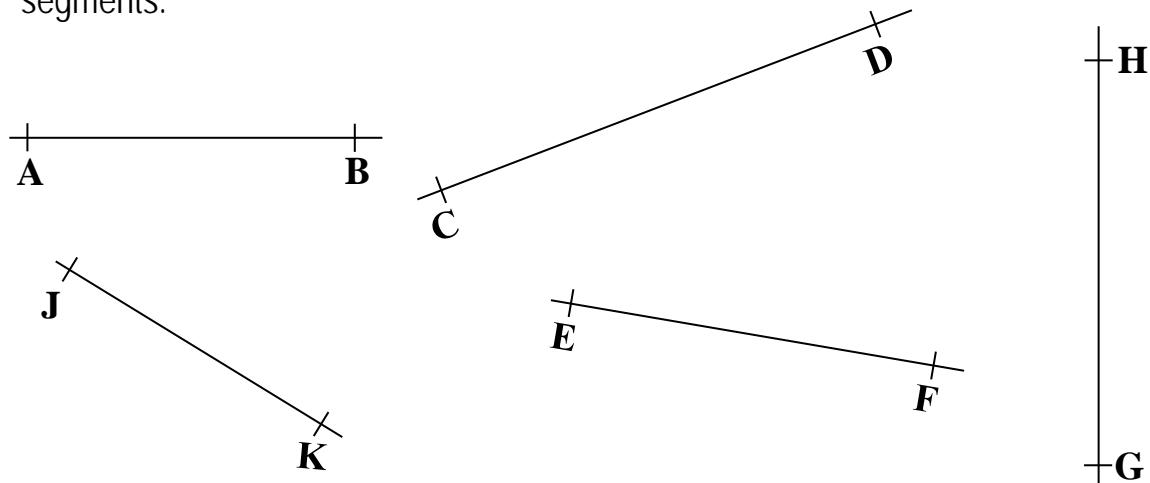


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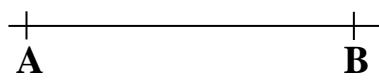


Exercise

1. Using a pair of compasses, a sharp pencil and a ruler only, bisect the following line segments.



2. Using a ruler, a pair of compasses and a pencil only

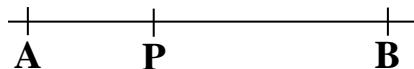


- a) Construct a line that bisects line AB at P
b) Measure line AP in cm.

Drawing perpendicular lines.

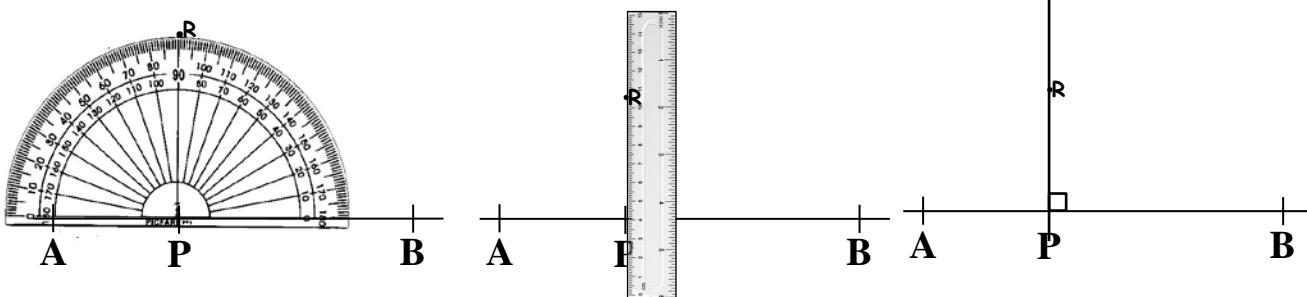
Example

Draw a perpendicular line at P using a protractor, a ruler and a pencil only.



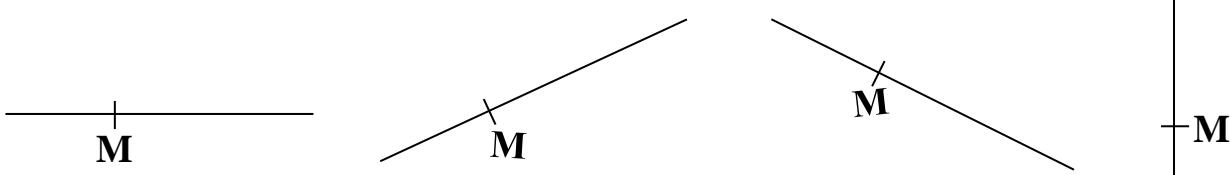
Steps

- Place the central point of your protractor at P.
- Let line 0° to 180° lie on AB and mark point D .
- Remove the protractor and use a ruler to draw line PR.



Exercise

Draw a perpendicular line at point M using a protractor and a ruler.



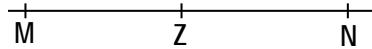
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Constructing perpendicular lines

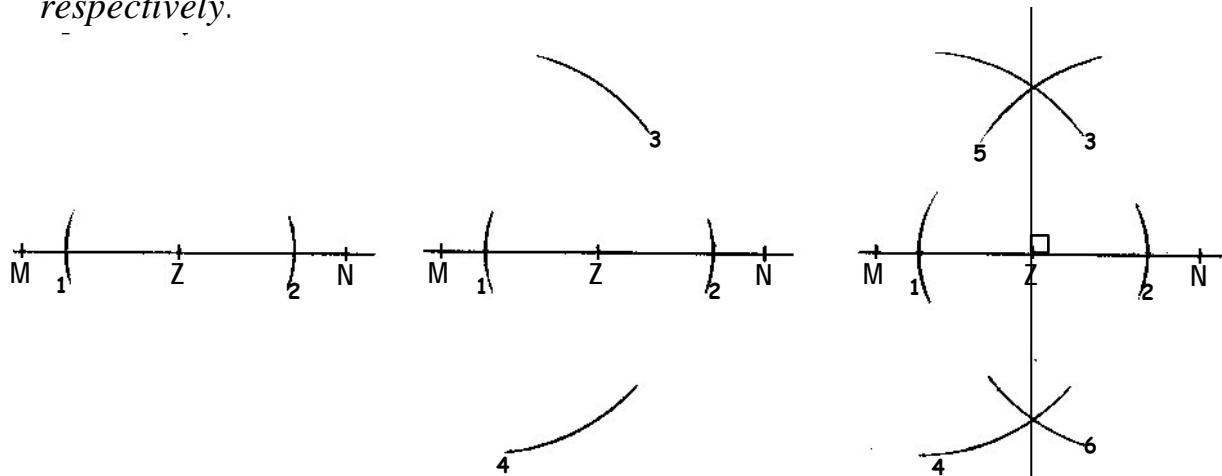
Example

Using a ruler and a pair of compasses only, construct a line perpendicular to MN at Z.



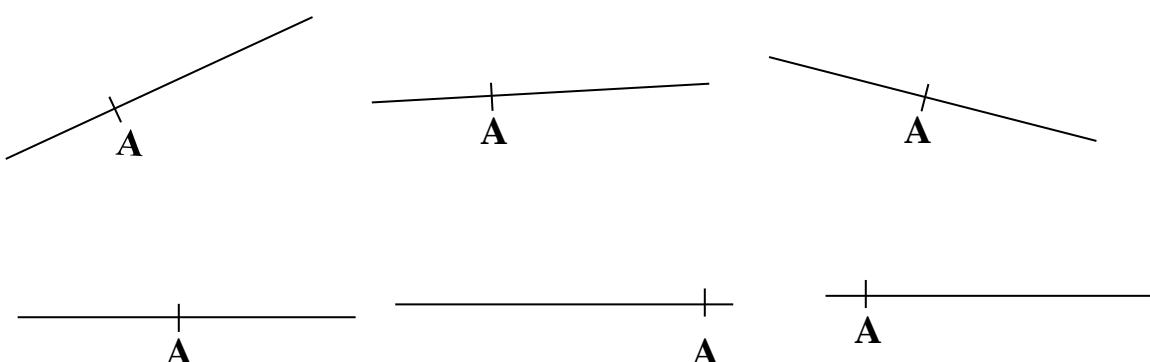
Steps

- i) Place the compass at Z and adjust it to a reasonable radius. Mark arcs 1 and 2 on line MN
- ii) Place the compass at the point where arc 1 intersects line MN. Adjust the compass towards arc 2. Construct arcs 3 and 4.
- iii) Using the same radius, place the compass at the point where arc 2 intersects line MN. Construct arcs 5 and 6.
- iv) Draw a straight line through the points of intersection of the arcs 3,5 and 4,6 respectively.



Exercise

1. Using a ruler, a pencil and a pair of compass only, construct a perpendicular line at point A on the given lines.



2. Draw the following lines, construct a perpendicular line at P using a ruler, a pencil and a pair of compasses only.

- | | |
|----------|---------|
| i) WPS | iv) APE |
| ii) PQS | v) QRP |
| iii) BOP | vi) PEM |

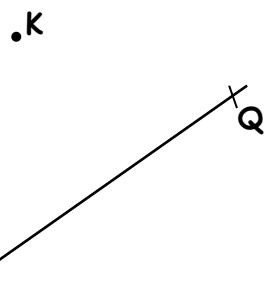
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Dropping a perpendicular line

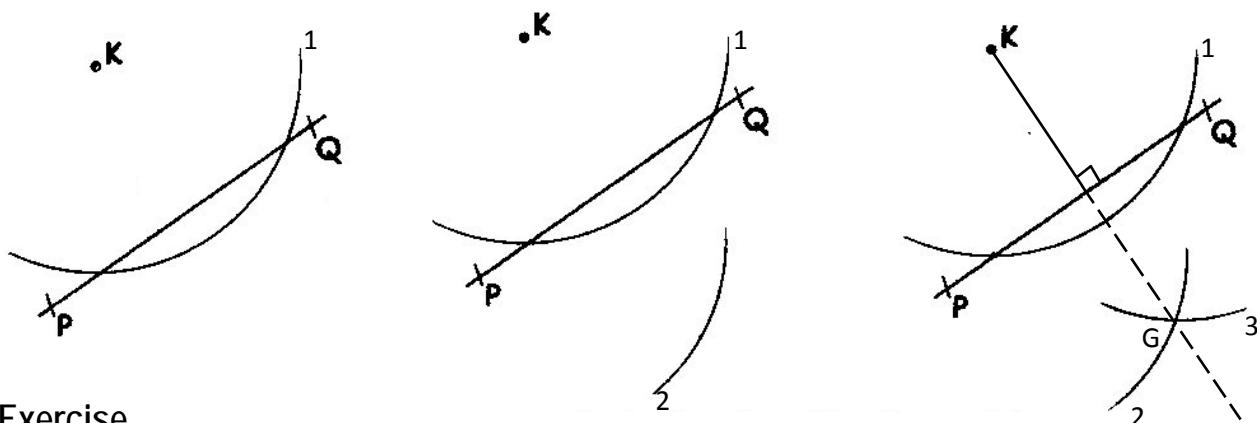
Example

Drop a perpendicular line from point K to meet line PQ



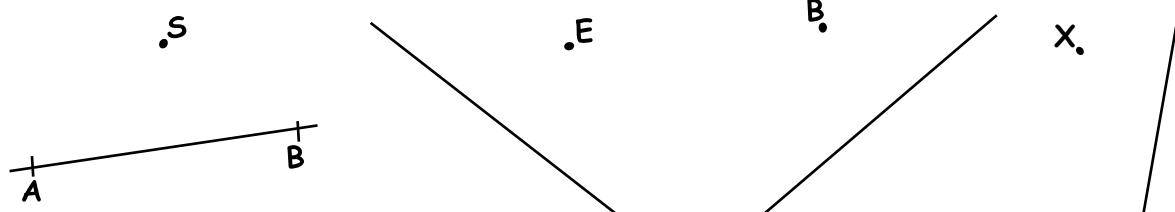
Steps

- Set the needle of the compass at K and strike an arc 1 intersecting PQ at E and F
- With E and F as centres and any radius larger than half of EF, strike arcs 2 and 3 intersecting at G. Join KG perpendicular to PQ.

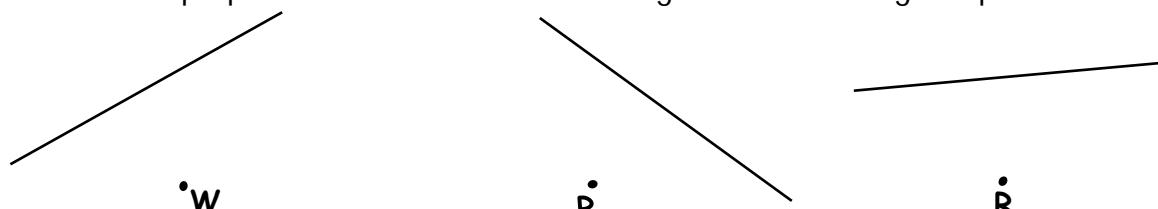


Exercise

- In the given drawings, drop perpendicular lines from the given points.

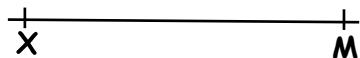


- Construct a perpendicular line onto the line segments from the given points.



- Using a ruler, a pencil and a pair of compasses only.

- Drop a perpendicular from R to intersect line XM at A.
- Measure length RA in centimetres.

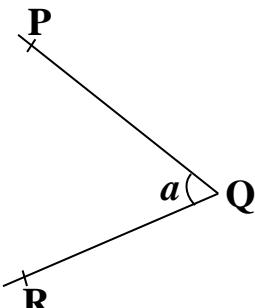


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ANGLES

An angle is formed when two lines meet or intersect at a point / vertex. The measure of rotation in degrees ($^{\circ}$) from one line segment to the other is an angle as shown in the figure below.



From the figure, we have two line segments PQ and QR which meet at a common point Q.

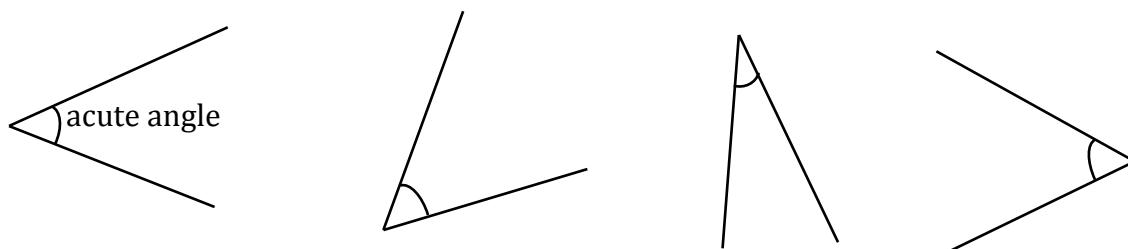
Angle a is formed at point Q, we can name the marked angle as angle PQR / $\angle PQR$ or angle RQP / $\angle RQP$.

Main types of angles

Acute angles

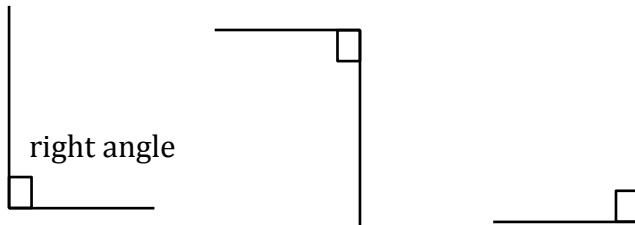
These are angles which are greater than 0° but less than 90° e.g. $1^{\circ}, 2^{\circ}, 15^{\circ}, 48^{\circ}, 85^{\circ}, 89^{\circ}, 75^{\circ}$ etc.

Drawings showing acute angles



Right angles

These are angles formed by two lines perpendicular to each other.

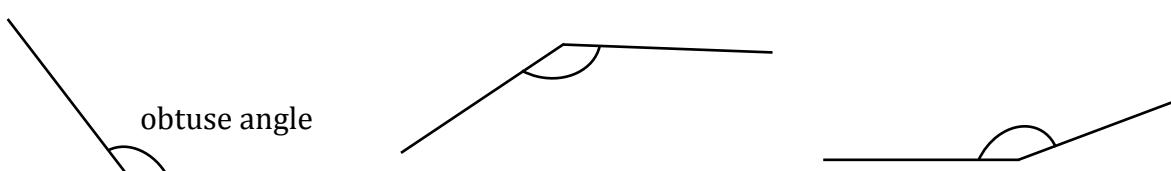


A right angle measures 90°

Obtuse angles

These are angles which are greater than 90° but less than 180°

They are angles between 90° and 180° e.g. $91^{\circ}, 124^{\circ}, 175^{\circ}, 189^{\circ}, 160^{\circ}$ etc.



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Straight angles

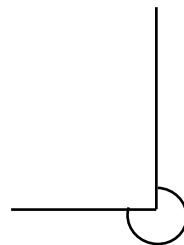
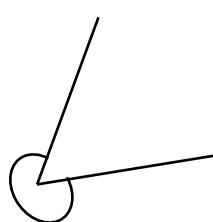
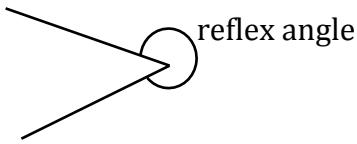
A straight angle measures 180°



Note: Angles on a straight line add up to 180° .

Reflex angles

These are angles which are greater than 180° but less than 360° e.g. 210° , 190° , 181° , 300° , 350° , 359° , 348° etc.



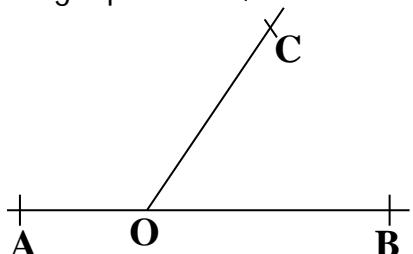
Angles at a point

Angles at a point add up to 360° .

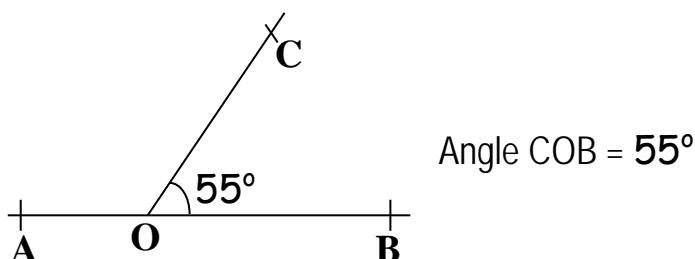
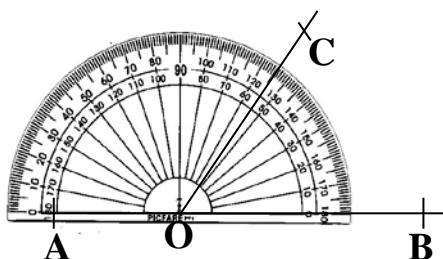
Measuring angles using a protractor.

Example

Using a protractor, measure angles COB

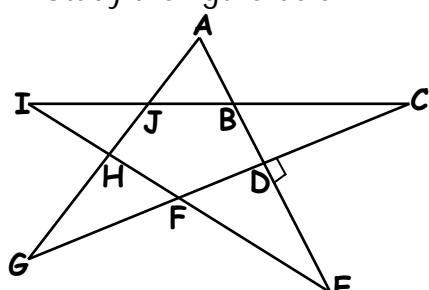


*To measure the angle, place the protractor on line **AB** such that its centre exactly covers the vertex of the angle at **O** and measure using the inner scale as shown below.*



Exercise

1. Study the figure below.



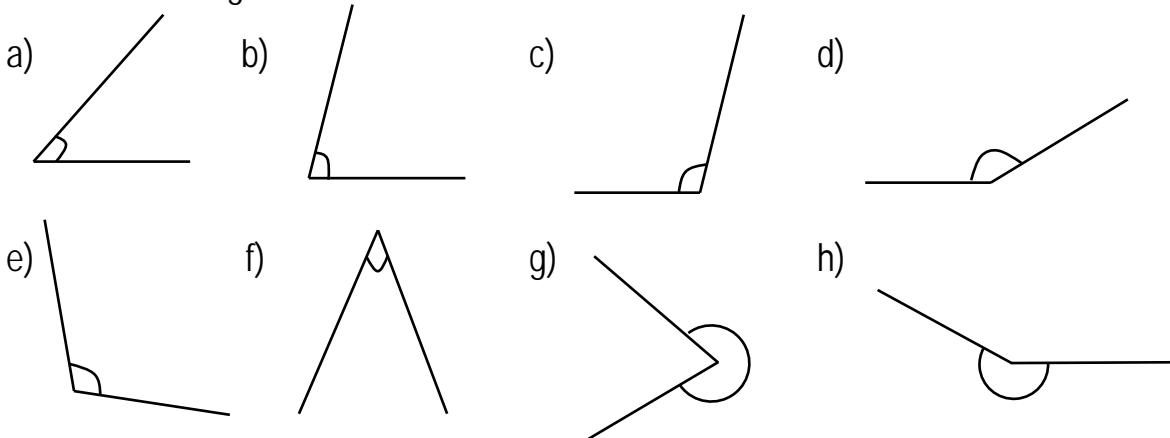
Use acute angle, right angle, obtuse angle and reflex angles to describe the following angles.

- i) $\angle ADC$ iv) $\angle FHA$ vii) $\angle GFE$
- ii) $\angle GFE$ v) $\angle GFD$ viii) $\angle FDE$
- iii) $\angle IFD$ vi) $\angle BCD$ ix) $\angle FED$

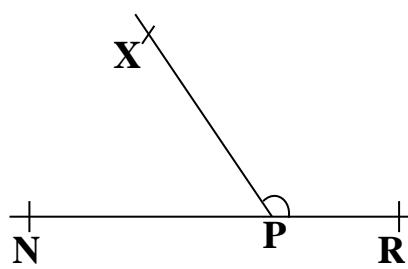
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2. Measure the angles drawn below.



3. Study the figure below and use it to answer the questions that follow.



- Which type of angle is XPR marked on the figure.
- Using a protractor, measure
 - acute angle NPX.
 - obtuse angle RPX.
 - reflex angle XPN.
 - reflex angle RPX.

Drawing angles

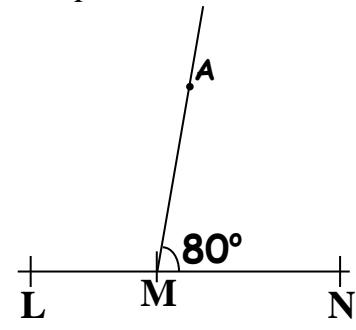
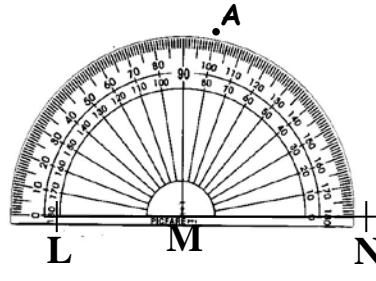
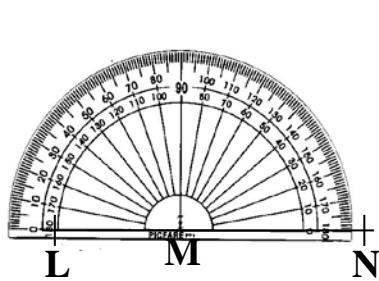
Example

Using a ruler, a pencil and a protractor only, draw an angle of 80° at point M

Steps

- Place the central point of your protractor at P.
- Let line 0° to 180° lie on LN.
- Count 80° round the edge of the protractor from zero line and put a dot A.

Remove the protractor and join A to M.



Exercise

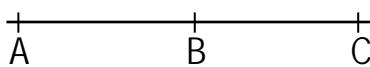
1. Use a protractor to draw an angle of;

- | | | | | |
|---------------|----------------|----------------|----------------|----------------|
| a) 30° | d) 78° | g) 105° | j) 45° | m) 110° |
| b) 54° | e) 49° | h) 120° | k) 88° | n) 135° |
| c) 60° | f) 100° | i) 170° | l) 150° | o) 30° |

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2. With the help of a protractor, draw the following angles
 - a) 190°
 - b) 200°
 - c) 260°
 - d) 330°
 - e) 300°
 - f) 270°
 - h) 210°
 - i) 181°
 - j) 355°
3. Using a protractor, draw the following angles.
 - a) $\text{ABC} = 45^\circ$
 - b) $\text{MTR} = 60^\circ$
 - c) $\text{WPS} = 82^\circ$
 - d) $\text{CAR} = 100^\circ$
4. Study the figure below and use it to answer questions that follow.

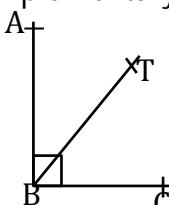


- a) Draw angle $\text{ABD} = 35^\circ$
- b) Draw angle $\text{CBX} = 52^\circ$
- c) Measure angles;
 - i) DBX
 - ii) XBA

Complementary angles

* When the sum of two angles is 90° , the angles are known as complementary angles.

* If two angles add up to form a right angle, then these angles are referred to as complementary angles.



Angles ABT and TBC are complementary angles
 $\angle \text{ABT} + \angle \text{TBC} = 90^\circ$

Note: Complementary angles are two angles that add up to 90° .

Example 1

Find the complement of 48°

Approach 1

Let the complement be y

$$\begin{array}{l} \text{y} \\ \diagdown \\ \text{48}^\circ \end{array} \quad \begin{array}{l} y+48^\circ = 90^\circ \\ y+48^\circ - 48^\circ = 90^\circ - 48^\circ \\ y = 42^\circ \end{array}$$

Approach 2

$$\begin{array}{l} ? \\ \diagdown \\ \text{48}^\circ \end{array} \quad 90^\circ - 48^\circ = 42^\circ$$

Example 2

Find the complement of $y+20^\circ$

$$\begin{aligned} 90^\circ - (y+20^\circ) \\ 90^\circ - y - 20^\circ \\ 90^\circ - 20^\circ - y \\ 70^\circ - y \end{aligned}$$

Example 3

Two complementary angles are in the ratio of 2:3. Find the size of the larger angle.

Approach 1

Total ratio

$$2+3 = 5$$

$$\frac{3}{5} \times 90^\circ = 54^\circ$$

Approach 2

$$\begin{array}{l} 2y \\ \diagdown \\ \text{3y} \end{array} \quad \begin{array}{l} 2y+3y = 90^\circ \\ 5y = 90^\circ \\ 5 \quad 5 \\ y = 18^\circ \end{array}$$

Larger angle

$$3 \times 18^\circ = 54^\circ$$

TOPIC 7: > GEOMETRIC CONSTRUCTION



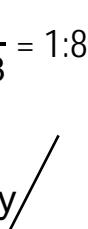
Example 4

The complement of $2y + 10^\circ$ is 70° . Find the value of y .

Approach 1	Approach 2
$\begin{aligned}2y + 10^\circ + 70^\circ &= 90^\circ \\2y + 80^\circ &= 90^\circ \\2y + 80^\circ - 80^\circ &= 90^\circ - 80^\circ \\2y &= 10^\circ \\2y &= \frac{10^\circ}{2} \\y &= 5^\circ\end{aligned}$	$\begin{aligned}90^\circ - (2y + 10^\circ) &= 70^\circ \\90^\circ - 2y - 10^\circ &= 70^\circ \\90^\circ - 10^\circ - 2y &= 70^\circ \\80^\circ - 2y &= 70^\circ \\80^\circ - 2y + 2y &= 70^\circ + 2y \\80^\circ &= 70^\circ + 2y \\80^\circ - 70^\circ &= 70^\circ - 70^\circ + 2y \\10^\circ &= 2y \\5^\circ &= y \\y &= 5^\circ\end{aligned}$

Example 5

Find the angle which is $\frac{1}{8}$ of its complement.

<i>Approach 1</i>	<i>Approach 2</i>	<i>Approach 2</i>
$\frac{1}{8} = 1:8$ Total ratio $1+8 = 9$ $\frac{1}{9} \times 90^\circ = 10^\circ$	$\frac{1}{8} = 1:8$  $y + 8y = 90^\circ$ $\frac{9y}{9} = \frac{90^\circ}{9}$ $y = 10^\circ$	<p>Let the larger angle be k</p>  $k + \frac{1}{8}k = 90^\circ$ $(kx8) + (8x\frac{1}{8}k) = (90^\circ \times 8)$ $8k + k = 720^\circ$ $\frac{9k}{9} = \frac{720^\circ}{9}$ $k = 80^\circ$ $\frac{1}{8} \times 80^\circ = 10^\circ$

Exercise

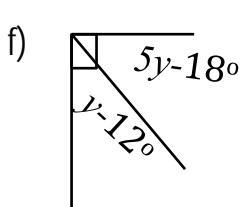
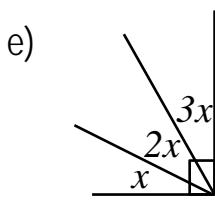
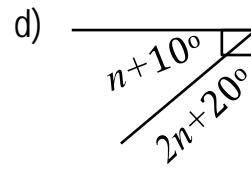
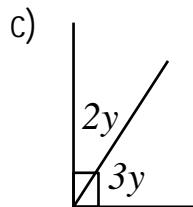
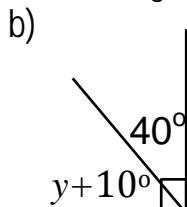
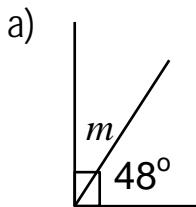
- Find the complement of each of the following angles
i) 15° iii) 30° v) 75° vii) m° ix) $(2x+15)^\circ$
ii) 65° iv) 88° vi) 45° viii) $(y-16)^\circ$ x) $3y-29^\circ$
 - What must be added to the given angles to make 90° ?
i) 40° iii) 62° v) 81° vii) $(20 - 4n)^\circ$
ii) 65° iv) 89° vi) 30° viii) $(3y- 14)^\circ$

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3. Two angles $2x$ and x are complementary angles. Find the value of x .

4. Find the value of the unknown angles.



5. Two complementary angles are in the ratio of 1:5. Find the size of each angle.

6. Two complementary angles are in the ratio of 1:3 respectively. Find the size of the larger angle.

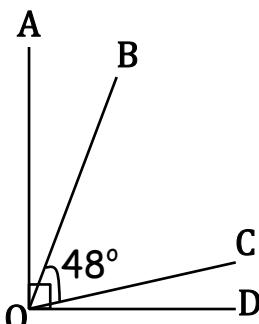
7. One of the two complementary angles is 47° . Find the other angle.

8. If $2y + 40^\circ$ and $4y+2^\circ$ are complementary angles

a) Find the value of y

b) Find the size of the larger angle.

9. In the figure below, angle AOB is twice angle COD.



a) Find the size of angle

i) COD

ii) AOB

b) Calculate the complement of angle COD.

10. What angle is $\frac{1}{2}$ of its complement?

11. Find the angle which is $\frac{7}{8}$ of its complement.

12. $\angle ABC$ and $\angle CBD$ are complementary angles. If CBD is 4 times ABC , find the size of angle CBD .

13. Find the angle which is 8 times of its complement.

14. The complement of p is 30° . Find the value of p .

15. The complement of $3y+10^\circ$ is $5y-16^\circ$.

a) Find the value of y .

b) Find the actual size of each angle.

16. Two complementary angles are $12n$ and $6n$. Find the value of n .

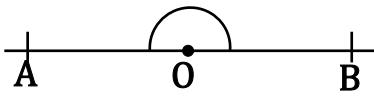
17. Add half of the complement of 48° to thrice the complement of 72°

TOPIC 7: GEOMETRIC CONSTRUCTION



Supplementary angles.

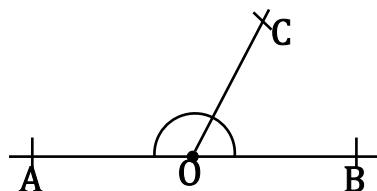
Study the figure below.



It was noted out that for a straight line AOB , angle AOB is a straight angle (180°)

*All angles on a straight line add up to 180° .

* Supplementary are two angles that add up to 180° as shown below.



$$\angle AOC + \angle COB = 180^\circ$$

Example 1

Find the size of n

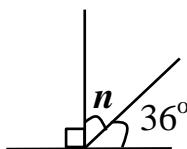


$$n + 150^\circ = 180^\circ$$

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

$$n = 30^\circ$$

ii)



$$n + 36^\circ + 90^\circ = 180^\circ$$

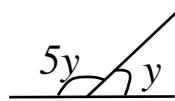
$$n + 126^\circ - 126^\circ = 180^\circ - 126^\circ$$

$$n = 54^\circ$$

Example 2

Find the angle which is 5 times of its supplement.

Let the smaller angle be y



$$5y + y = 180^\circ$$

$$6y = 180^\circ$$

$$\underline{6} \quad \underline{6}$$

$$y = 30^\circ$$

$$5y = 5 \times y$$

$$= 5 \times 30^\circ$$

$$= 150^\circ$$

The angle is 150°

Example 3

Find the supplement of $(34-2y)^\circ$



$$180^\circ - (34-2y)^\circ$$

$$180^\circ - 34^\circ + 2y$$

$$146^\circ + 2y$$

$$(146 + 2y)^\circ$$

Exercise

1. Find the supplement of each of the following

- a) 46°
- b) 30°
- c) 91°
- d) 84°
- e) 16°
- f) 122°

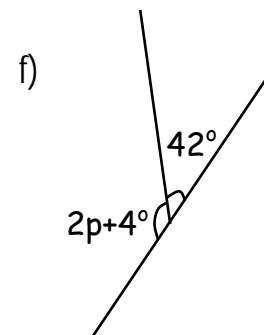
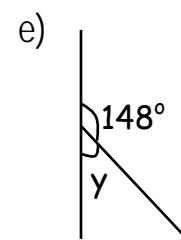
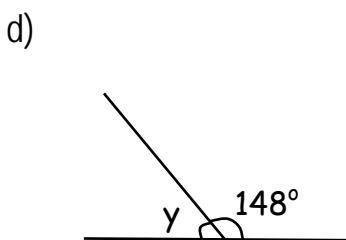
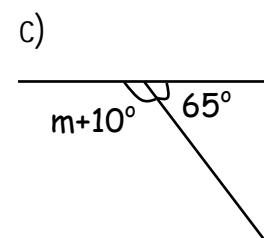
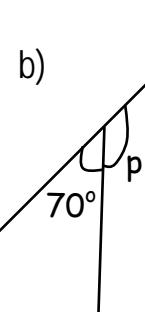
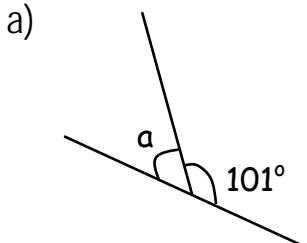
- g) 130°
- h) 135°
- i) 102°
- j) 80°
- k) 179°
- l) 105°

- m) k°
- n) $y+70^\circ$
- o) $2x - 6^\circ$
- p) $(3y + 12)^\circ$
- q) $(12 - p)^\circ$
- r) $(38 + 7m)^\circ$

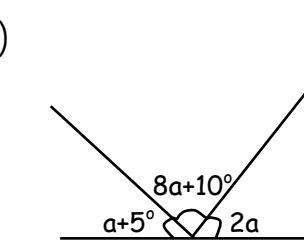
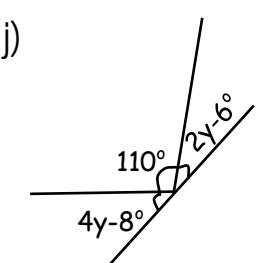
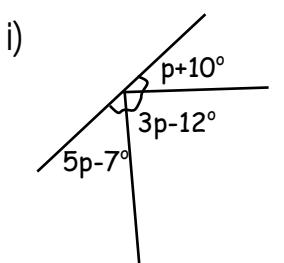
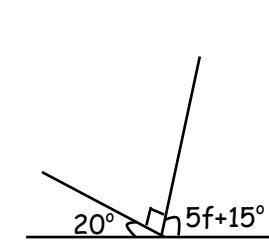
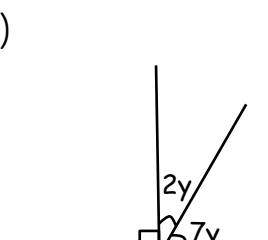
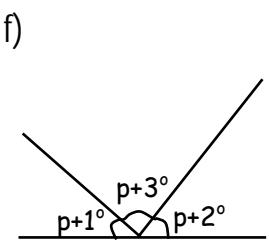
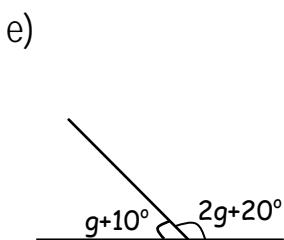
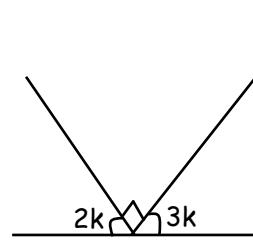
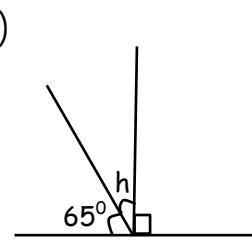
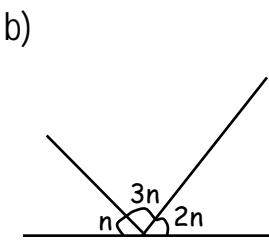
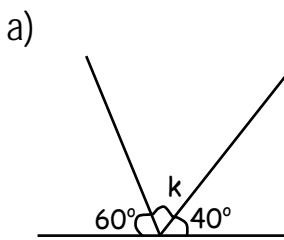
TOPIC 7: GEOMETRIC CONSTRUCTION



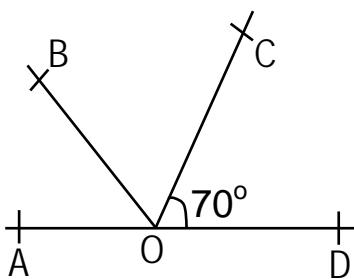
2. Calculate the size of the unknown angles.



3. Find the size of the unknown angles.



4. In the figure below, AOD is a straight line. Angle BOC is 4 times of angle AOB.

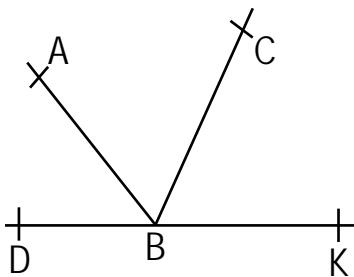


Find the size of angle BOC in degrees.

TOPIC 7: GEOMETRIC CONSTRUCTION



5. Given that $3m$, $2m - 12^\circ$ and $2m + 80^\circ$ are angles on the straight line. Find the value of m .
6. On a straight line, one angle is three times the other. Find the size of the angles.
7. What is the supplement of 90° ?
8. The supplement of $4m + 10^\circ$ is 70° . Find the value of m .
9. What angle is;
 - a) twice its supplement?
 - b) 8 times of its supplement?
 - c) a half of its supplement?
 - d) a third of its supplement?
 - e) $\frac{2}{7}$ of its supplement?
 - f) $\frac{7}{8}$ of its supplement?
 - g) $\frac{4}{5}$ of its supplement?
10. Two supplementary angles are in the ratio of 5:7 respectively. Find the size of each angle.
11. The difference between two supplementary angles is 108° . Find the size of the smaller angle.
12. One of the two supplementary angles is 90° more than the other. Find the size of each of the angles.
13. In the figure below, DBK is a straight line, AB is perpendicular to CB and angle ABD is 18° less than angle CBK.



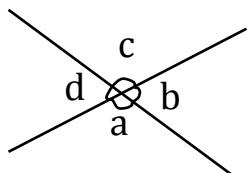
Find the size of angle
 i) CBK
 ii) ABD

14. Subtract the supplement of 172° from the three quarters of the supplement of 20° .
15. Find the angle which is 4 times larger than its supplement.

Vertically opposite angles

When two straight lines intersect, they form four angles having a common vertex. The two angles which are on opposite sides of the vertex are called vertically opposite angles.

Note: Vertically opposite angles are equal.



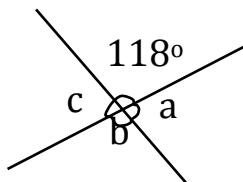
$$\begin{aligned} \angle a &= \angle c \\ \angle b &= \angle d \end{aligned}$$

TOPIC 7: GEOMETRIC CONSTRUCTION



Example 1

Find the value of the unknown angles in the figure below.



Value of a

$$\begin{aligned} a + 118^\circ &= 180^\circ \text{ (angles on a straight line)} \\ a + 118^\circ - 118^\circ &= 180^\circ - 118^\circ \\ a &= 62^\circ \end{aligned}$$

Value of b

$b = 118^\circ$ (Vertically opposite angles)

Value of c

$c = a$ (Vertically opposite angles)
 $c = 62^\circ$

Example 2

Study the figure below and use it to answer questions that follow.

$$\begin{aligned} 2y+24^\circ &= y+49^\circ \text{ (Vert. Opp. } \angle s) \\ 2y-y+24^\circ &= y-y+49^\circ \\ y+24^\circ &= 49^\circ \\ y+24^\circ-24^\circ &= 49^\circ-24^\circ \\ y &= 25^\circ \end{aligned}$$

- a) Find the value of y

$$\begin{aligned} \text{Angle BOD} &= y + 49^\circ \\ &= 25^\circ + 49^\circ \\ &= 74^\circ \end{aligned}$$

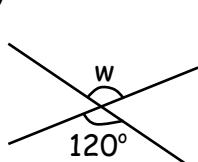
$\angle AOD + \angle BOD = 180^\circ$ (angles on a straight line)

$$\begin{aligned} \angle AOD + 74^\circ &= 180^\circ \\ \angle AOD + 74^\circ - 74^\circ &= 180^\circ - 74^\circ \\ \angle AOD &= 106^\circ \end{aligned}$$

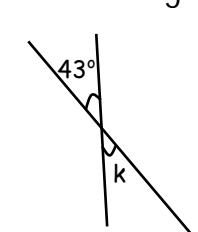
Exercise

1. Find the size of the unknown angles in degrees.

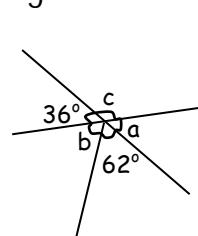
a)



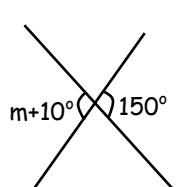
b)



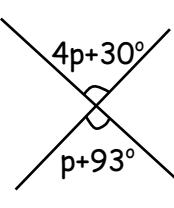
c)



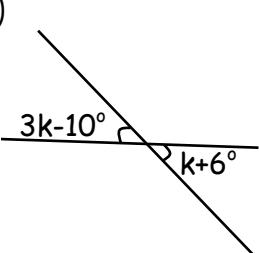
d)



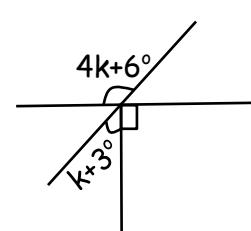
e)



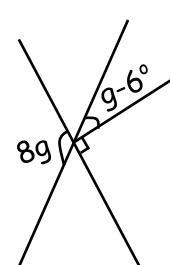
f)



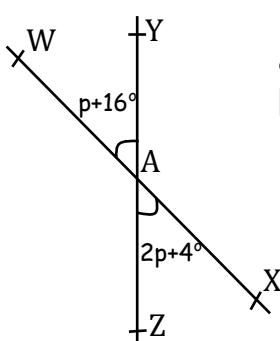
g)



h)



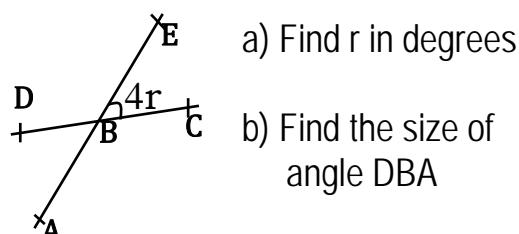
2. Study the figure below.



- a) Solve for p .

- b) Find the size of angle:
i) $\angle ZAX$
ii) $\angle YAX$

3. In the figure below, angle DBE is twice angle EBC.



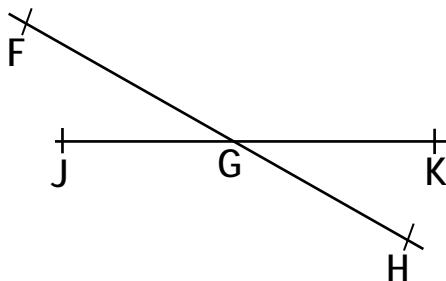
- a) Find r in degrees

- b) Find the size of angle DBA

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4. In the figure below, angle FGK is 108° more than angle HGK and angle JGH = $3n$.

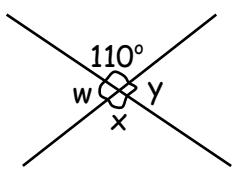


a) Find the value of n .

b) Calculate the size of angle JGF.

Angles at a point

Study the figure below.



Value of y

$$y + 110^\circ = 180^\circ$$

$$y + 110^\circ - 110^\circ = 180^\circ - 110^\circ$$

$$y = 70^\circ$$

Value of w

$$w = y$$

$$w = 70^\circ$$

Value of x

$$x = 110^\circ$$

Sum

$$110^\circ$$

$$110^\circ$$

$$70^\circ$$

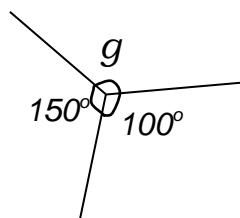
$$+ 70^\circ$$

$$360^\circ$$

So, angles at a point add up to 360°

Example

Find the value of g



$$g + 100^\circ + 150^\circ = 360^\circ \text{ (Angles at a point)}$$

$$g + 250^\circ = 360^\circ$$

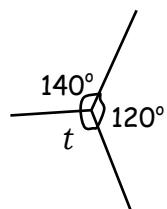
$$g + 250^\circ - 250^\circ = 360^\circ - 250^\circ$$

$$g = 110^\circ$$

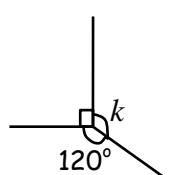
Exercise

1. Find the size of the unknown angles.

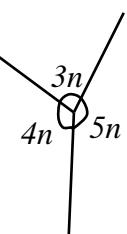
a)



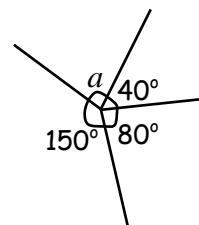
b)



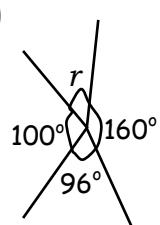
c)



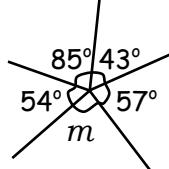
d)



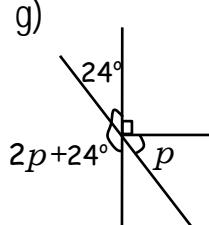
e)



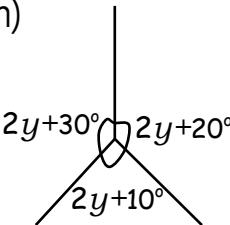
f)



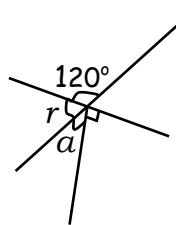
g)



h)



i)



TOPIC 7: GEOMETRIC CONSTRUCTION

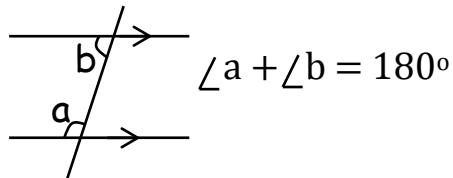


Angles formed on parallel lines

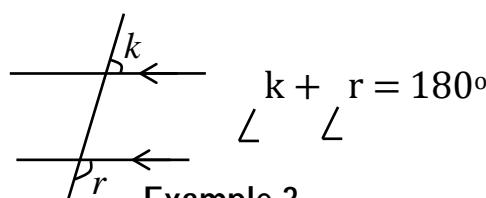
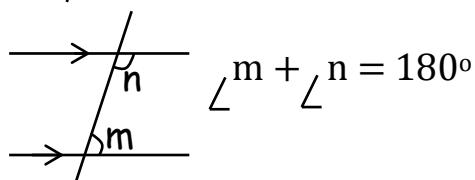
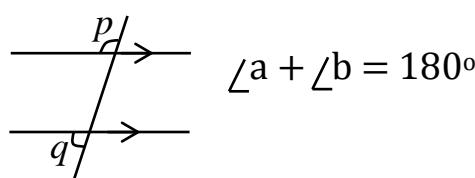
A line which cuts a pair of parallel lines is called a transversal

Co-interior and co-exterior angles

i) Co-interior angles

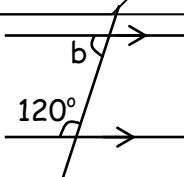


ii) Co-exterior angles



Example 1

Find the value of m .



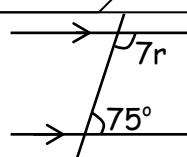
$$b + 120^\circ = 180^\circ \text{ (Co-int. } \angle \text{s)}$$

$$b + 120^\circ - 120^\circ = 180^\circ - 120^\circ$$

$$b = 60^\circ$$

Example 2

Find the value of r



$$7r + 75^\circ = 180^\circ \text{ (Co-int. } \angle \text{s)}$$

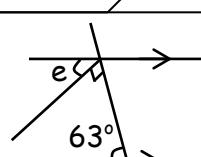
$$7r + 75^\circ - 75^\circ = 180^\circ - 75^\circ$$

$$\frac{7r}{7} = \frac{105^\circ}{7}$$

$$r = 15^\circ$$

Example 3

Find the value of e



$$(e+90^\circ) + 63^\circ = 180^\circ \text{ (Co-int. } \angle \text{s)}$$

$$e+90^\circ + 63^\circ = 180^\circ$$

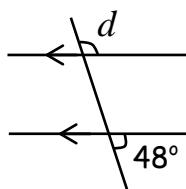
$$e+153^\circ = 180^\circ$$

$$e+153^\circ - 153^\circ = 180^\circ - 153^\circ$$

$$e = 27^\circ$$

Example 4

Find the value of d .



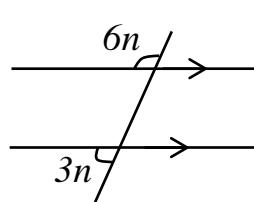
$$d + 48^\circ = 180^\circ \text{ (Co-ext. } \angle \text{s)}$$

$$d + 48^\circ - 48^\circ = 180^\circ - 48^\circ$$

$$d = 132^\circ$$

Example 5

Find the value of n



$$6n + 3n = 180^\circ \text{ (Co-ext. } \angle \text{s)}$$

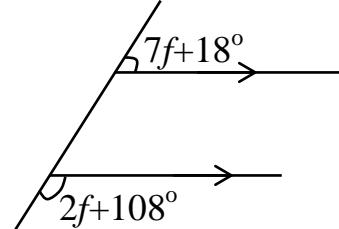
$$9n = 180^\circ$$

$$\frac{9n}{9} = \frac{180^\circ}{9}$$

$$n = 20^\circ$$

Example 6

Find the value of f in degrees



$$7f + 18^\circ + 2f + 108^\circ = 180^\circ \text{ (Co-ext. } \angle \text{s)}$$

$$7f + 2f + 18^\circ + 108^\circ = 180^\circ$$

$$9f + 126^\circ = 180^\circ$$

$$9f + 126^\circ - 126^\circ = 180^\circ - 126^\circ$$

$$9f = 54^\circ$$

$$\frac{9f}{9} = \frac{54^\circ}{9}$$

$$f = 6^\circ$$

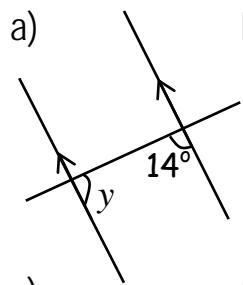
TOPIC 7: GEOMETRIC CONSTRUCTION



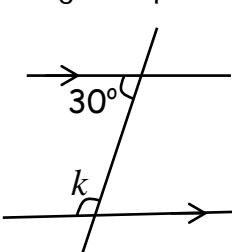
Exercise

1. Find the value of the angles represented by letters in the diagrams.

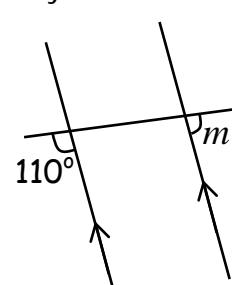
a)



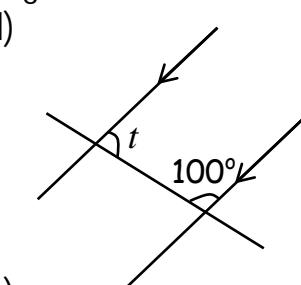
b)



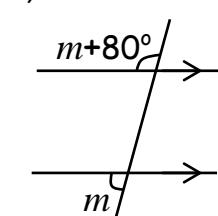
c)



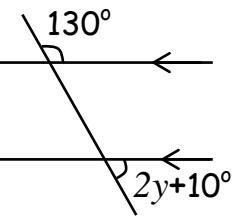
d)



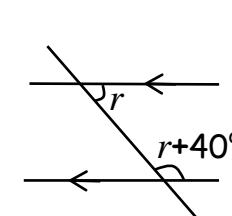
e)



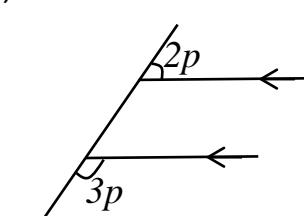
f)



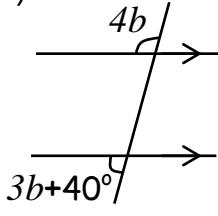
g)



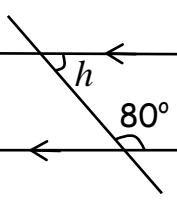
h)



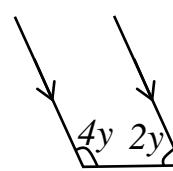
i)



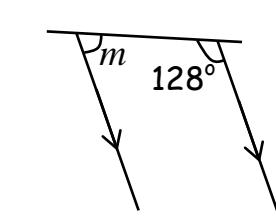
j)



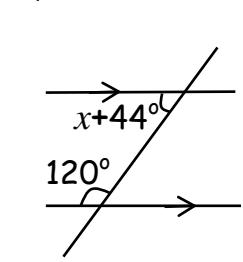
k)



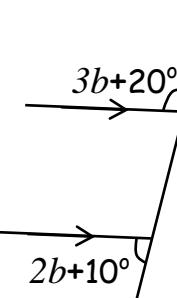
l)



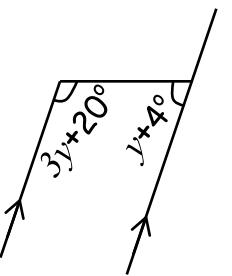
m)



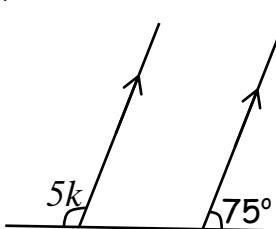
n)



o)

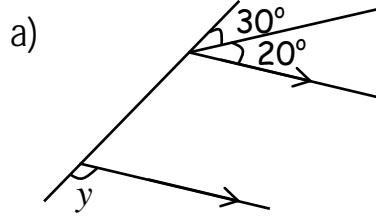


p)

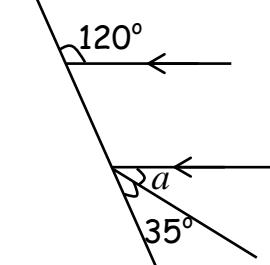


2. Find the size of the unknown angles in the diagrams below.

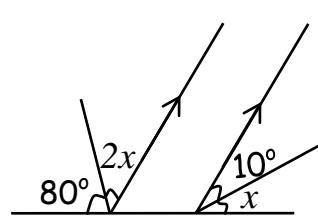
a)



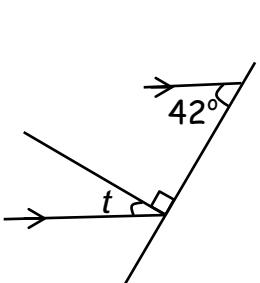
b)



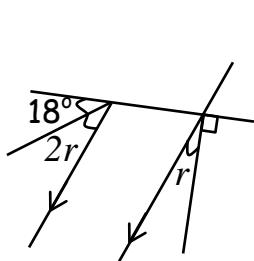
c)



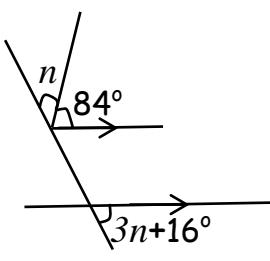
d)



e)



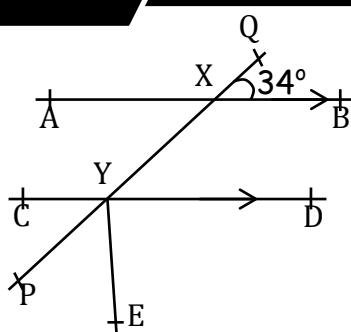
f)



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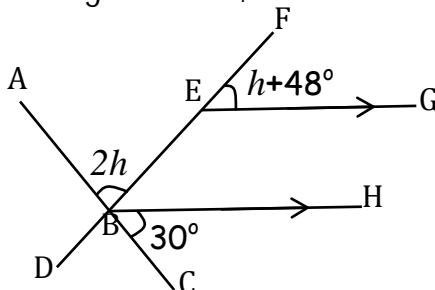


3.



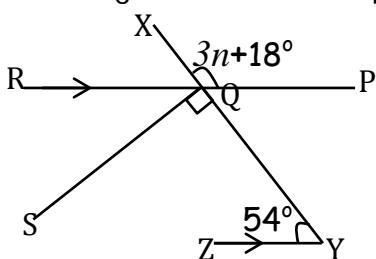
In the figure, AB is parallel to CD. Line PQ cuts AB and CD at X and Y respectively. If PE is perpendicular to CD, find the size of angle PYD.

4. In the figure below, ABC is a straight line, EG is parallel to BH and angle CBH = 30° .



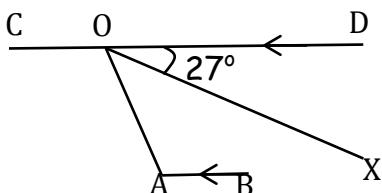
- a) Find the value of h in degrees.
- b) Find the size of angle FBH.

5. In the figure below, PR is parallel to YZ, $\angle XYZ = 54^\circ$ and QS is perpendicular to XY.



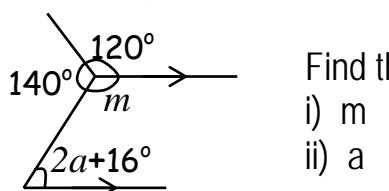
- a) Find the size of $\angle SQR$ in degrees.
- b) Find the value of n .

6. In the figure below, CD is parallel to AB. $\angle DOX = 27^\circ$ and $\angle BAO$ is twice $\angle AOX$.



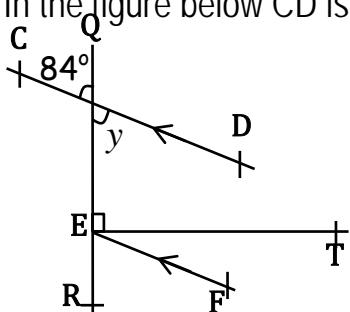
- Find the size of angle
- i) $\angle AOX$
 - ii) $\angle BAO$

7. Study the figure below and use it to answer the question that follows.



- Find the value of
- i) m
 - ii) a

8. In the figure below CD is parallel to EF and ET is perpendicular to QR.

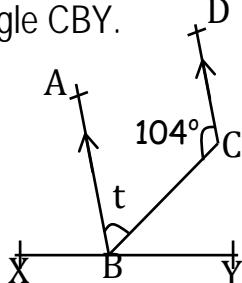


- a) Find the size of angle marked y .
- b) Find the size of $\angle TEF$.

TOPIC 7: GEOMETRIC CONSTRUCTION



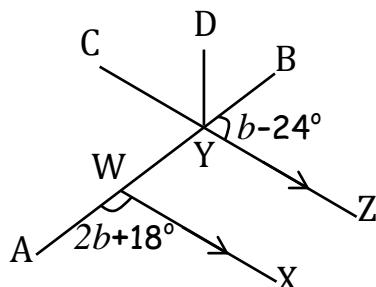
9. In the figure below, AB is parallel to CD, $\angle BCD = 104^\circ$ and $\angle ABX$ is a quarter of angle CBY.



a) Find the value of t in degrees.

b) Find the size of angle ABY.

10. In the figure below $WX // CZ$, $\angle CYD$ is 26° less than $\angle DYZ$. Study the figure carefully and use it to answer questions that follow.

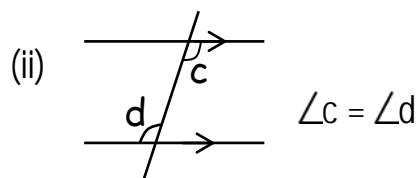
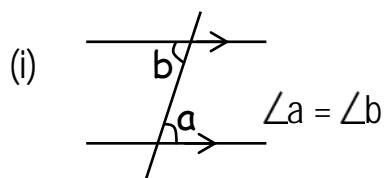


a) Find the value of b

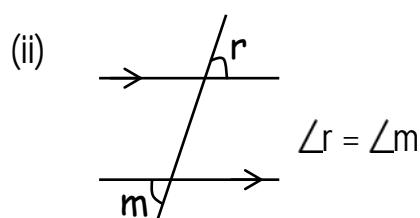
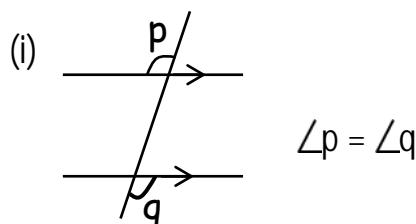
b) Find the size of angle CYD

Alternate interior and alternate exterior angles

Alternate interior angles are angles formed when a transversal line intersects two or more parallel lines. They lie on the inner side of parallel line but on opposite sides of the transversal. Alternate interior angles are equal.



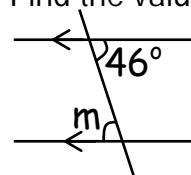
Alternate exterior angles are angles formed when a transversal line intersects two or more parallel lines. They lie on the outer side of the parallel lines but on opposite sides of the transversal. Alternate exterior angles are equal.



Alternate interior and alternate exterior angles are also called z angles.

Example 1

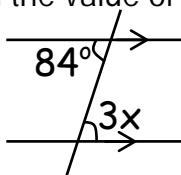
Find the value of m



$$m = 46^\circ \text{ (Alt. int. } \angle s\text{)}$$

Example 2

Find the value of x



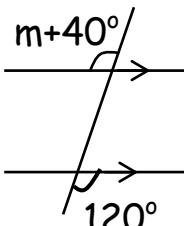
$$\begin{aligned} 3x &= 84^\circ \text{ (Alt. int. } \angle s\text{)} \\ \frac{3x}{3} &= \frac{84^\circ}{3} \\ x &= 28^\circ \end{aligned}$$

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Example 3

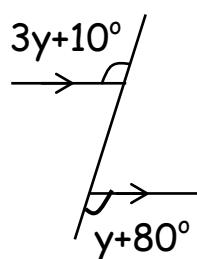
Find the size of the unknown angle in the drawing below.



$$\begin{aligned}m+40^\circ &= 120^\circ \text{ (Alt. ext. } \angle\text{s)} \\m+40^\circ - 40^\circ &= 120^\circ - 40^\circ \\m &= 80^\circ\end{aligned}$$

Example 4

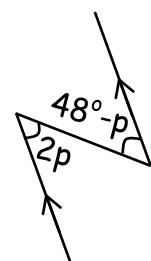
Find the value of y



$$\begin{aligned}3y+10^\circ &= y+80^\circ \text{ (Alt. ext. } \angle\text{s)} \\3y-y+10^\circ &= y-y+80^\circ \\2y+10^\circ &= 80^\circ \\2y+10^\circ - 10^\circ &= 80^\circ - 10^\circ \\2y &= 70^\circ \\2y &= \frac{70^\circ}{2} \\y &= 35^\circ\end{aligned}$$

Example 5

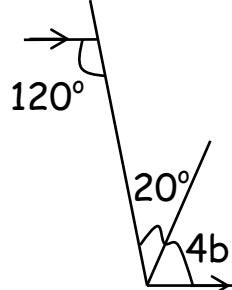
Find the value of p



$$\begin{aligned}2p &= 48^\circ - p \text{ (Alt. ext. } \angle\text{s)} \\2p+p &= 48^\circ - p + p \\3p &= 48^\circ \\3p &= \frac{48^\circ}{3} \\p &= 16^\circ\end{aligned}$$

Example 6

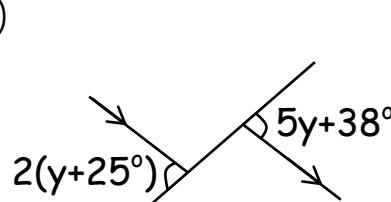
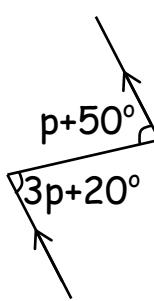
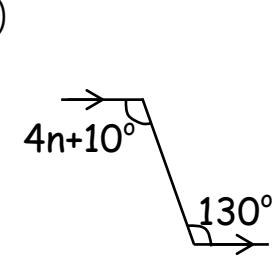
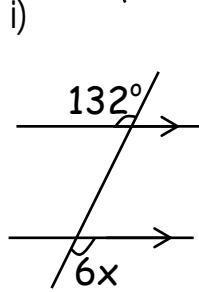
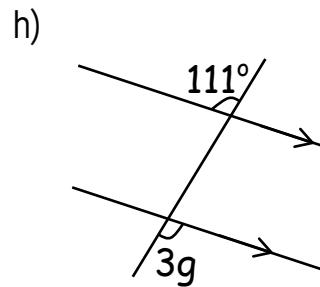
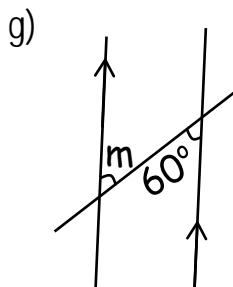
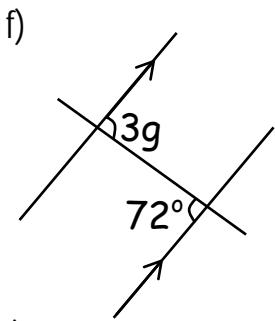
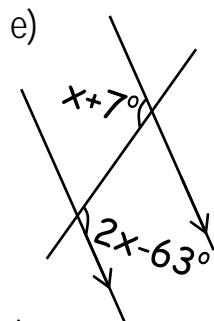
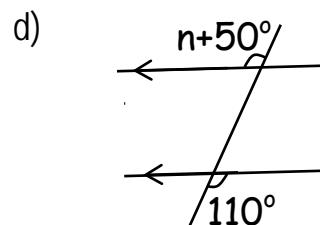
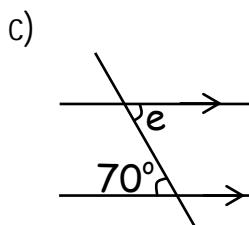
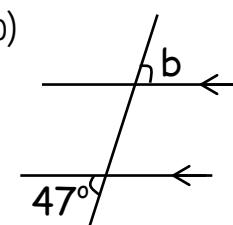
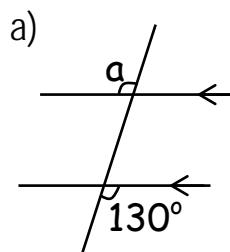
Find the value of b



$$\begin{aligned}4b+20^\circ &= 120^\circ \text{ (Alt. int. } \angle\text{s)} \\4b+20^\circ - 20^\circ &= 120^\circ - 20^\circ \\4b &= 100^\circ \\4b &= \frac{100^\circ}{4} \\b &= 25^\circ\end{aligned}$$

Exercise

1. Find the value of the unknown angles.

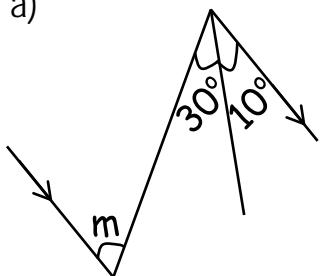


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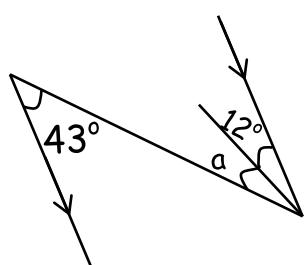


2. Find the size of the unknown angle in the drawings below.

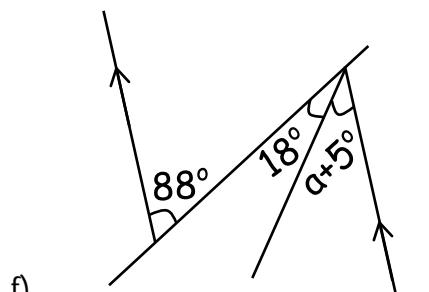
a)



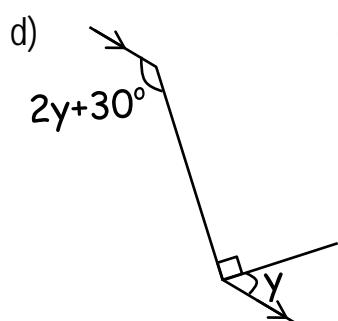
b)



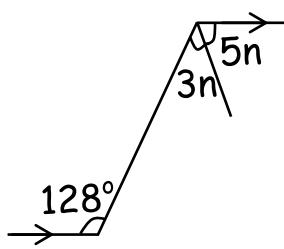
c)



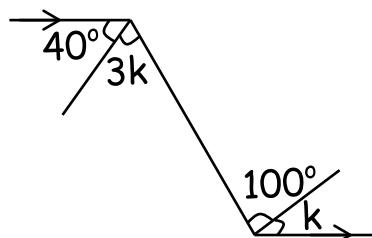
d)



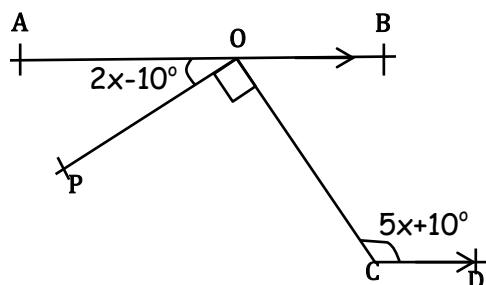
e)



f)



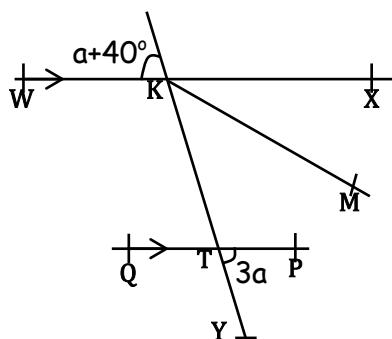
3. Study the diagram below and use it to answer questions that follow.



a) Find the value of x

b) Find the size of angle AOC

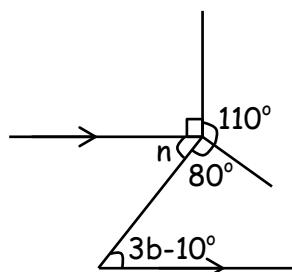
4. Study the figure below.



a) Find the value of a

b) If $\angle TKM$ is 4 times $\angle MKX$, find the size of $\angle WKM$

5. Study the drawing below carefully, use it to answer questions that follow.



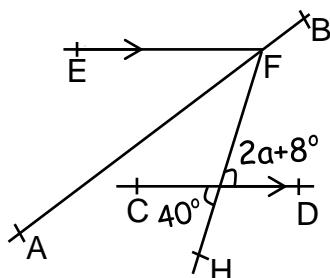
Find the value of;

- i) n
- ii) b

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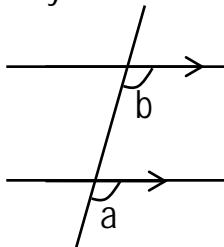
6. In the diagram below, $\angle AFE$ is 6° more than $\angle AFH$. Use the diagram to answer the questions that follow.



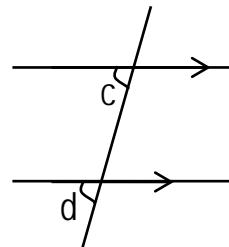
- a) Find the value of a .
b) Find the size of obtuse angle EFB.

Corresponding angles

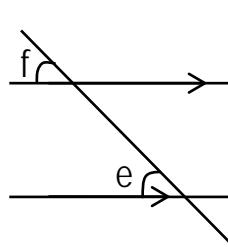
Corresponding angles are angles which occur on the same side of the transversal line. They are either both acute or both obtuse.



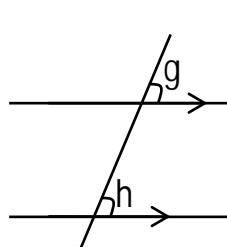
$$\angle a = \angle b$$



$$\angle c = \angle d$$



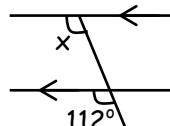
$$\angle f = \angle e$$



$$\angle h = \angle g$$

Example 1

Find the value of x



$$x = 112^\circ \text{ (Corr. } \angle s\text{)}$$

Example 2

Find the value of m

$$2m - 10^\circ = m + 60^\circ \text{ (Corr. } \angle s\text{)}$$

$$2m - m - 10^\circ = m - m + 60^\circ$$

$$m - 10^\circ = 60^\circ$$

$$m - 10^\circ + 10^\circ = 60^\circ + 10^\circ$$

$$m = 70^\circ$$

Example 3

Find the value of p

$$3p + 36^\circ = 87^\circ \text{ (Corr. } \angle s\text{)}$$

$$3p + 36^\circ = 87^\circ$$

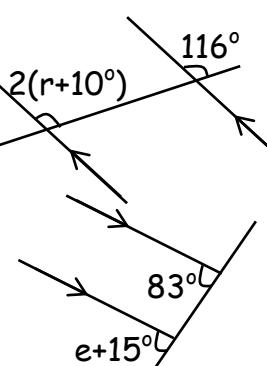
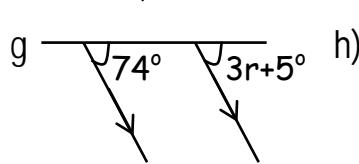
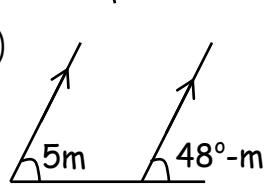
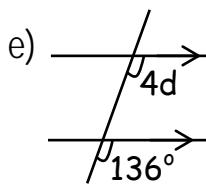
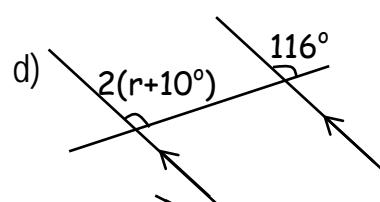
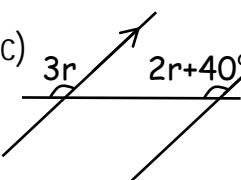
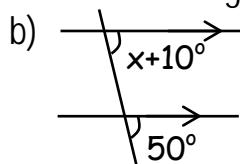
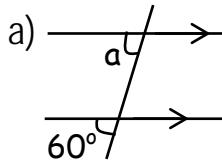
$$3p + 36^\circ - 36^\circ = 87^\circ - 36^\circ$$

$$\frac{3p}{3} = \frac{51^\circ}{3}$$

$$p = 17^\circ$$

Exercise

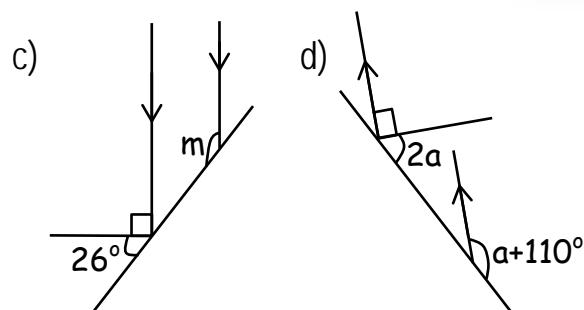
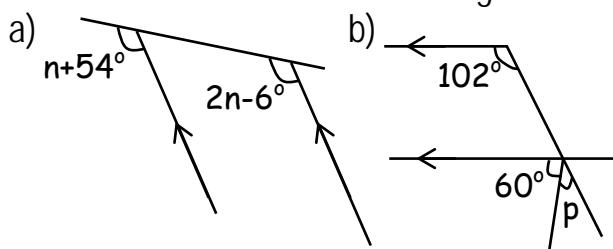
1. Find the value of the unknown angles.



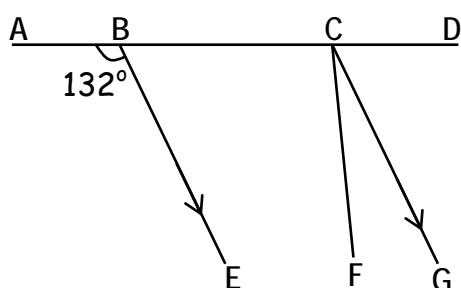
TOPIC 7: GEOMETRIC CONSTRUCTION



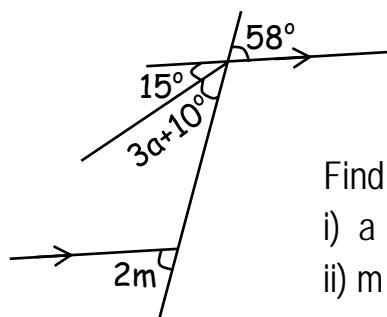
2. Find the value of the unknown angles.



3. In the figure below, $BE \parallel CG$, $\angle BCF$ is 3 times $\angle FCG$ and $\angle ABE = 132^\circ$.



4. Study the drawing below and use it to answer question that follows.



Find the value of
i) a
ii) m

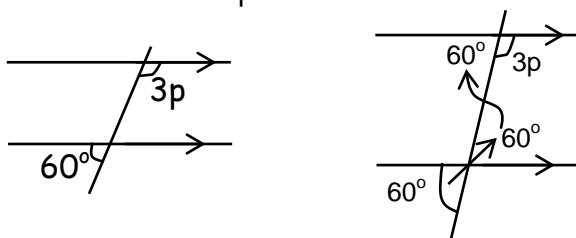
Find in degrees, the size of angle;

- i) $\angle FCG$ ii) $\angle BCF$ iii) $\angle FCD$

Solving problem involving transfer of angles on parallel lines

Example

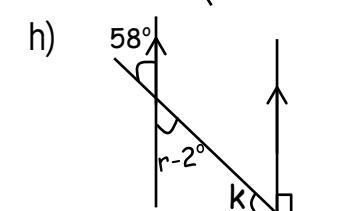
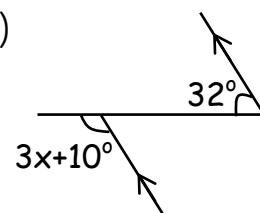
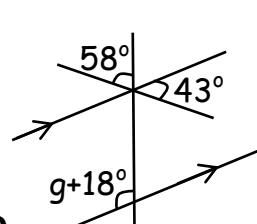
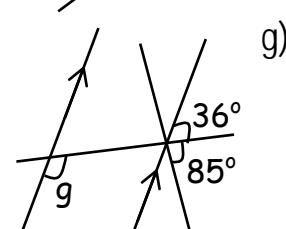
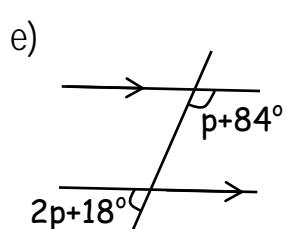
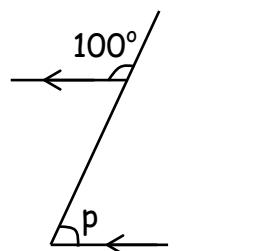
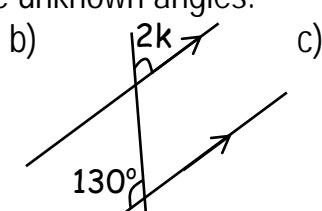
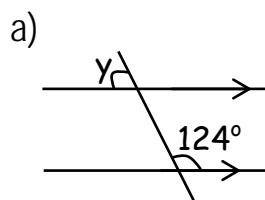
Find the value of p.



$$\begin{aligned} 3p + 60^\circ &= 180^\circ \text{ (Co. interior } \angle\text{s)} \\ 3p + 60^\circ - 60^\circ &= 180^\circ - 60^\circ \\ \frac{3p}{3} &= \frac{120^\circ}{3} \\ p &= 40^\circ \end{aligned}$$

Exercise

Find the value of the unknown angles.



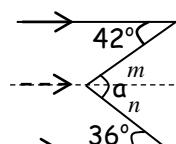
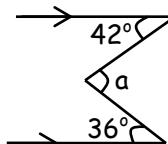
TOPIC 7: GEOMETRIC CONSTRUCTION



More problems involving angles on parallel lines.

Example 1

Find the value of a



$$m = 42^\circ \text{ (Alt. int. } \angle\text{s)}$$

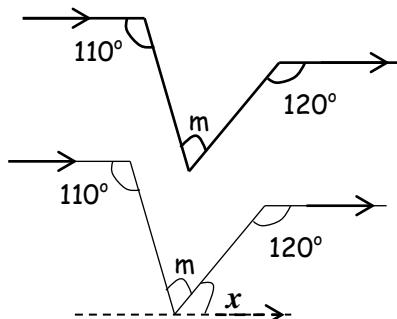
$$n = 36^\circ \text{ (Alt. int. } \angle\text{s)}$$

$$a = 42^\circ + 36^\circ$$

$$a = 78^\circ$$

Example 2

Find the value of m



$$x + 120^\circ = 180^\circ \text{ (Co-int. } \angle\text{s)}$$

$$x + 120^\circ - 120^\circ = 180^\circ - 120^\circ$$

$$x = 60^\circ$$

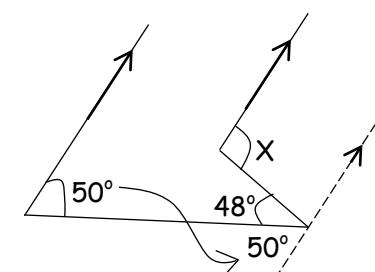
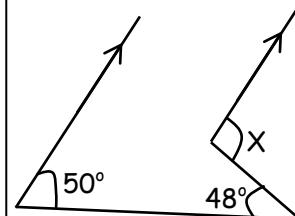
$$m + 60^\circ = 110^\circ$$

$$m + 60^\circ - 60^\circ = 110^\circ - 60^\circ$$

$$m = 50^\circ$$

Example 3

Find the value of x

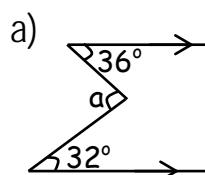


$$x = 50^\circ + 48^\circ \text{ (Alternating } \angle\text{s)}$$

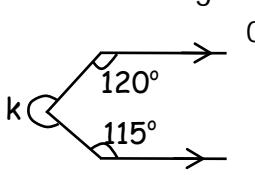
$$x = 98^\circ$$

Exercise

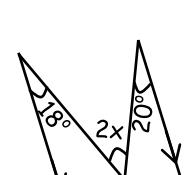
1. Find the value of the unknown angles.



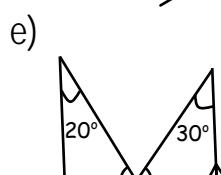
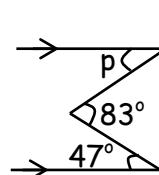
a)



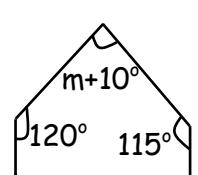
b)



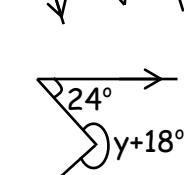
c)



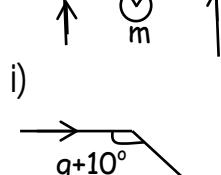
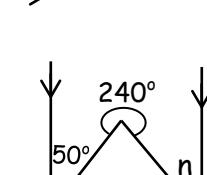
e)



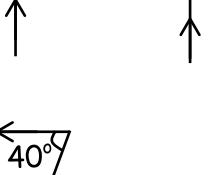
f)



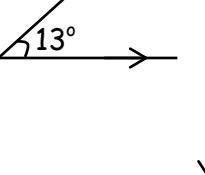
g)



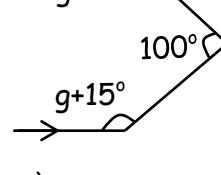
i)



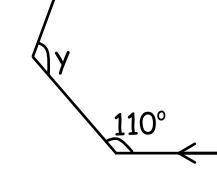
j)



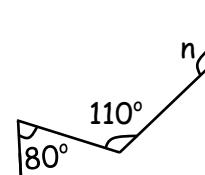
k)



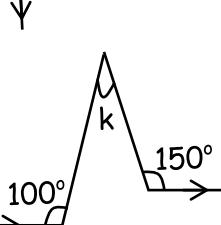
l)



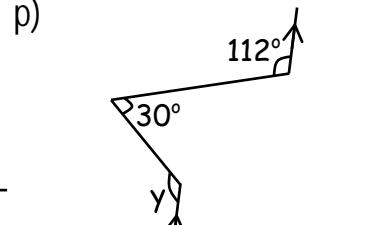
m)



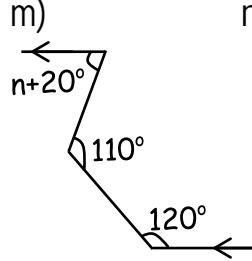
n)



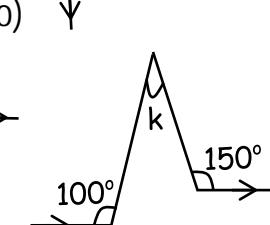
o)



p)



q)



r)

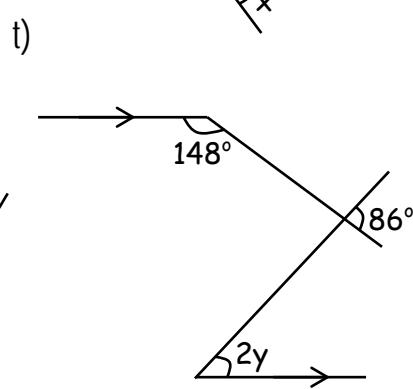
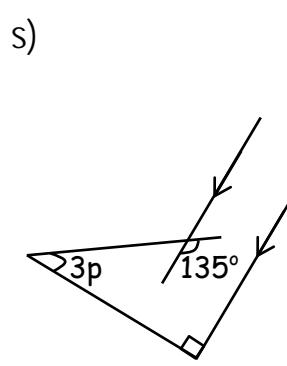
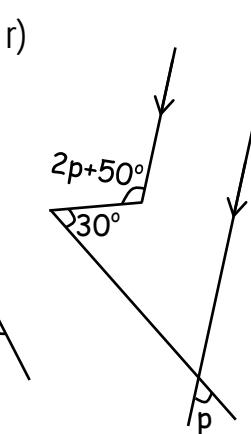
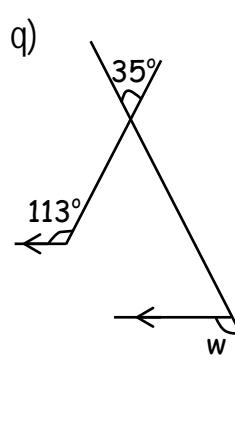
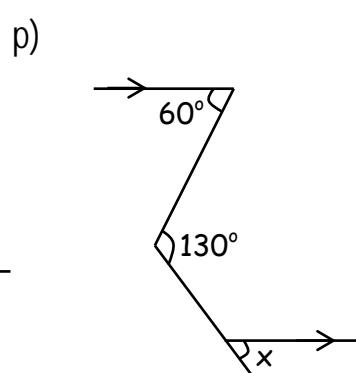
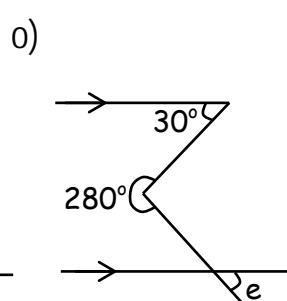
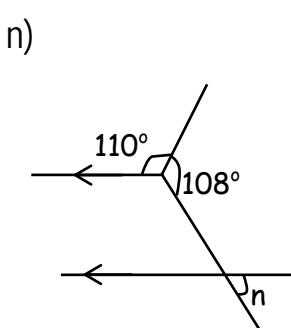
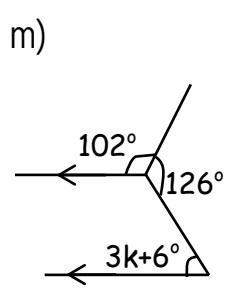
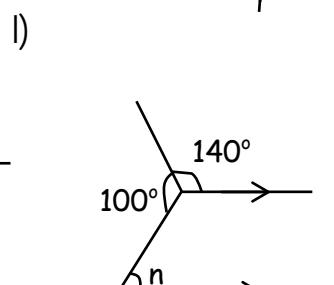
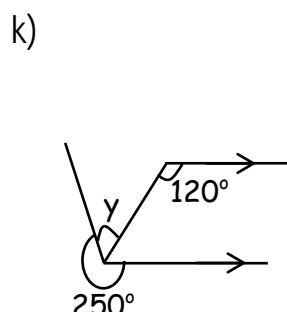
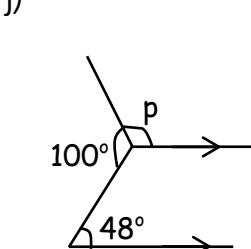
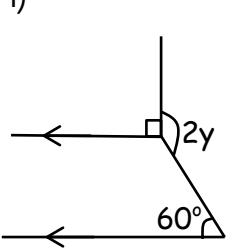
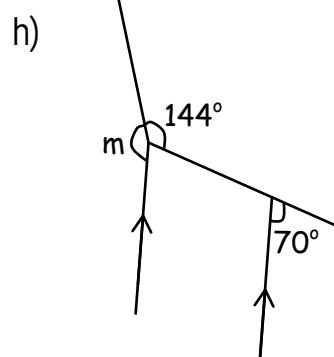
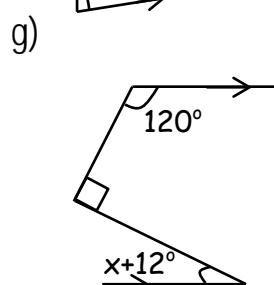
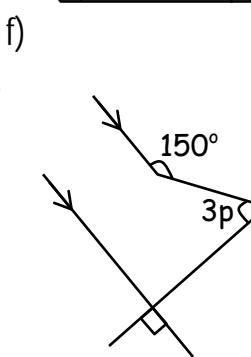
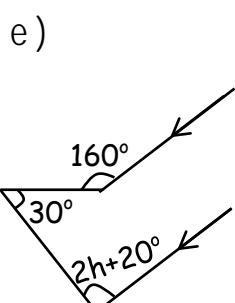
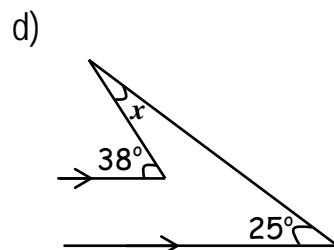
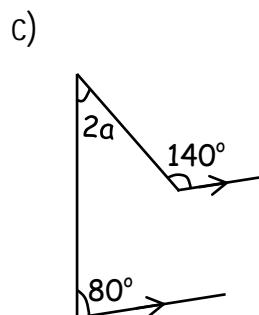
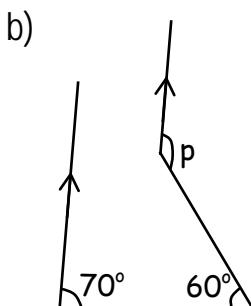
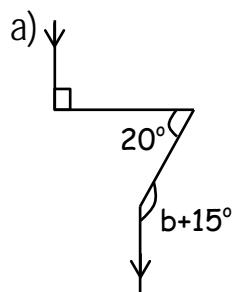
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By Sseggyai Benjamin Kasuka

TOPIC 7: GEOMETRIC CONSTRUCTION



2. Find the size of the angles represented by the letters.



TOPIC 7: GEOMETRIC CONSTRUCTION



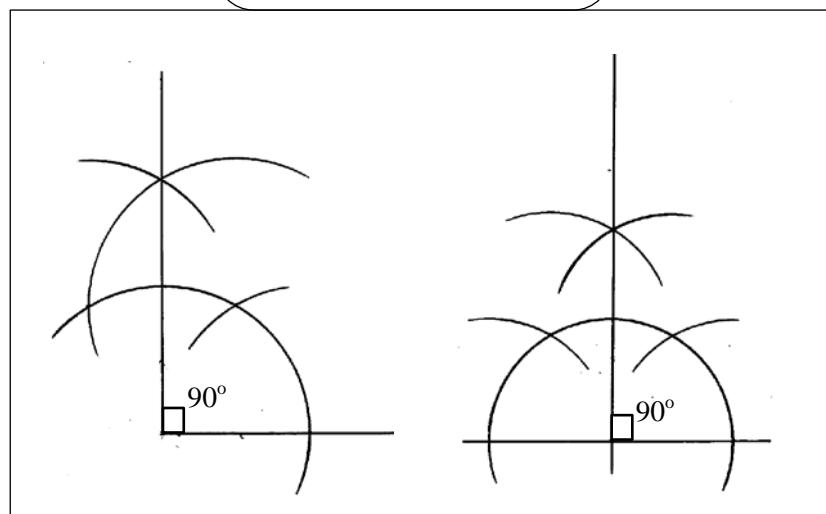
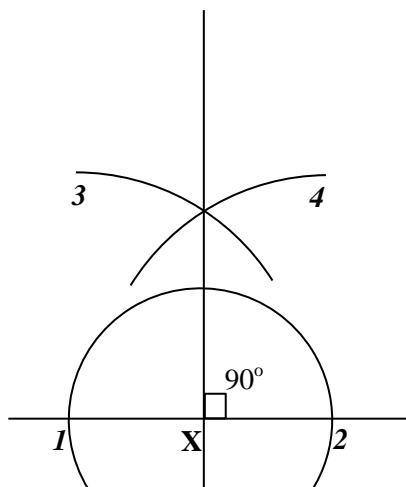
GEOMETRIC CONSTRUCTION

Constructing an angle of 90°

Steps .

- * Draw a straight line and mark point X.
- * From X, draw an arc to bisect the line at 1 and 2 .
- * Place the compass at point 1 and draw arc 3 and later at 2 draw arc 4.
- * Draw a straight line to join the point of intersections of the above arcs and point X.

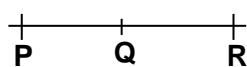
Other approaches



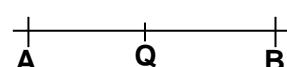
Exercise

1. Using a ruler, a pencil and a pair of compasses only, construct an angle of 90°
2. With the help of a ruler, a pencil and a pair of compasses only, construct an angle of 90° at point Q.

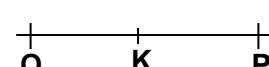
a)



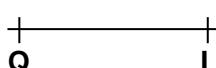
b)



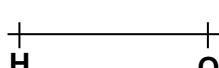
c)



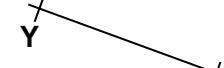
d)



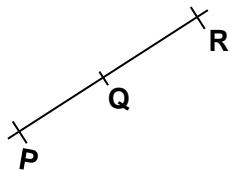
e)



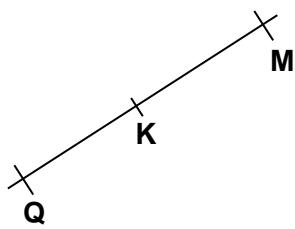
f)



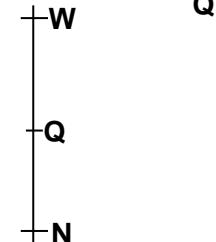
g)



h)



i)



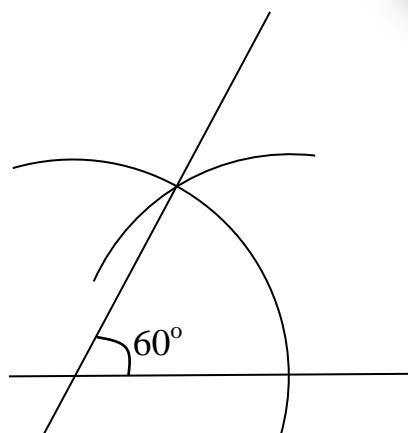
TOPIC 7: GEOMETRIC CONSTRUCTION



Constructing angle of 60°

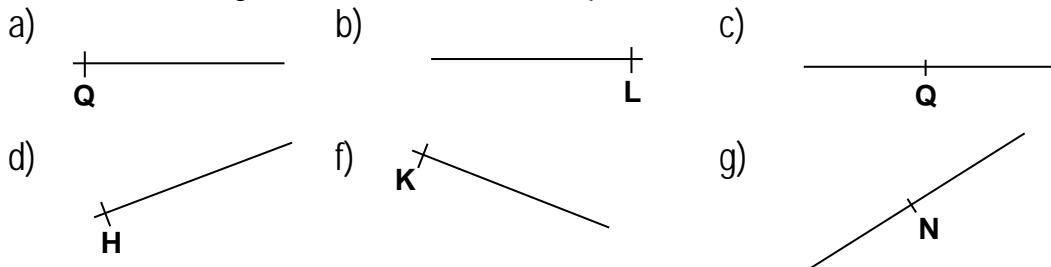
Steps

- * Draw a straight line, mark point P.
- * Taking P as the centre and any convenient radius, draw arc 1 intersecting the line at Q.
- * With Q as the centre and the radius, draw an arc intersecting the previous arc at T.



Exercise

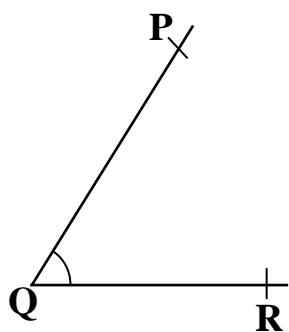
1. Using a ruler, a pencil and a pair of compasses only, construct an angle of 60° .
2. Draw a line segment PQ = 4.5cm. Construct an angle of 60° at point P.
3. Draw a line segment AB = 3.8 cm. Construct an angle of 60° at point B.
4. Construct an angle of 60° at the marked points..



Copying angles

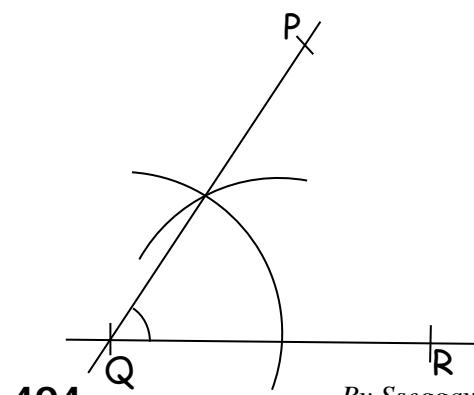
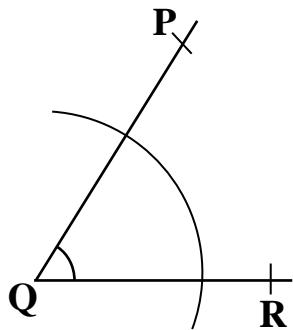
Example

Using a ruler, a pencil and a pair of compasses only, copy angle PQR.



Steps

- * Draw line QR.
- * From point Q of the given angles, draw an arc touching angles PQR.
- * Mark the same arc from point Q as shown below .
- * Adjust the compasses to fit arc that makes angle PQR.
- * Transfer the exact radius and mark the same size of angle.

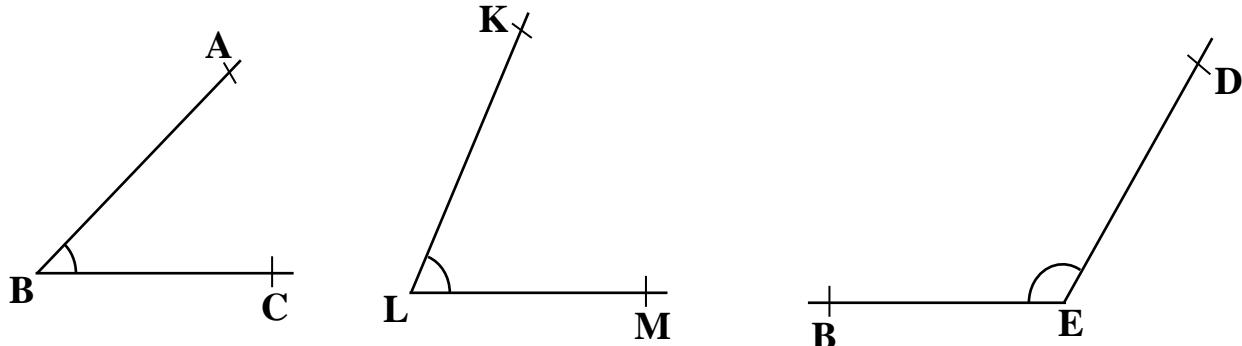


TOPIC 7: GEOMETRIC CONSTRUCTION



Exercise

Copy the given angles



Bisecting angles

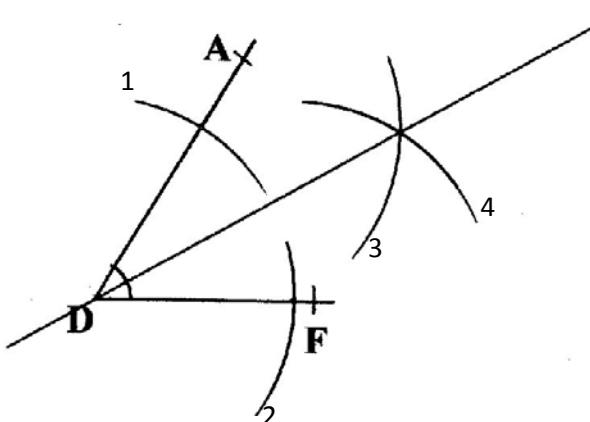
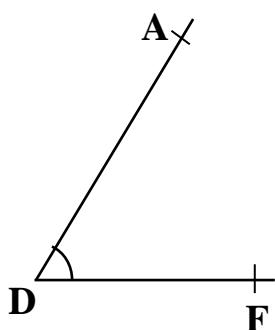
Angle bisector in geometry refers to a line that splits an angle into two equal parts.

Example

Using a pair of compasses and a sharp pencil, bisect angle ADF.

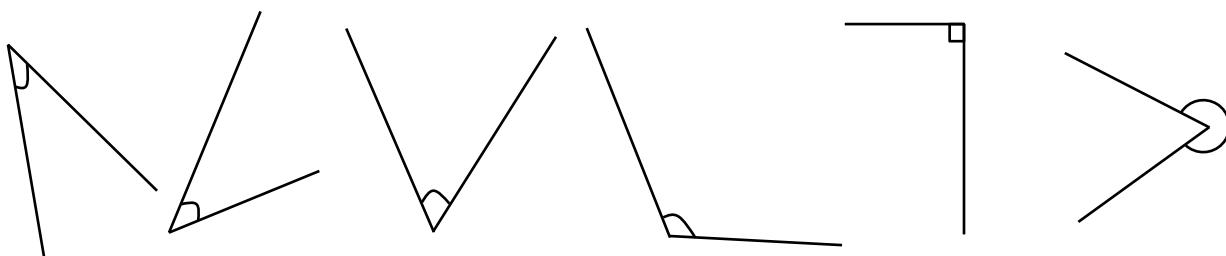
Steps

- * Place the compasses at D and adjust it to mark arcs 1 and 2
- * Place the compass at point 1 and mark arc 3, transfer the compasses to arc 2 and mark arc 4.
- * Draw a line joining point B to the point of intersection of the two arcs 3 and 4.
- * Draw a line joining point B to the point of intersection of the two arcs 3 and 4.



Exercise

Bisect the marked angles.

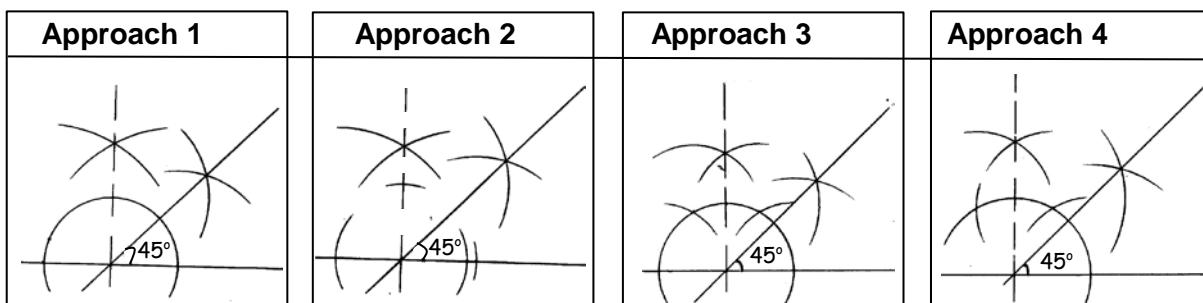


TOPIC 7: GEOMETRIC CONSTRUCTION



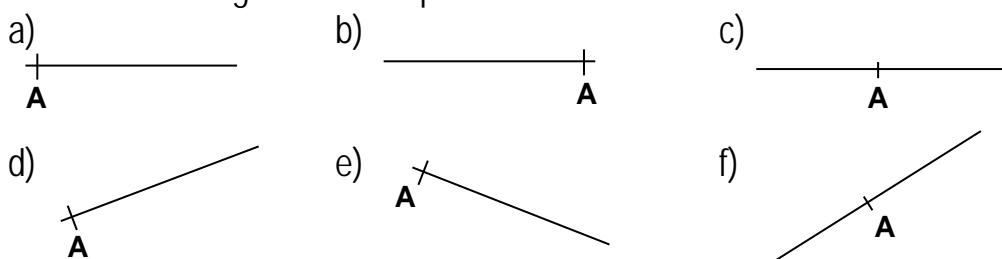
Constructing an angle of 45° .

To construct an angle of 45° , you first construct an angle of 90° then bisect it as shown below.



Exercise

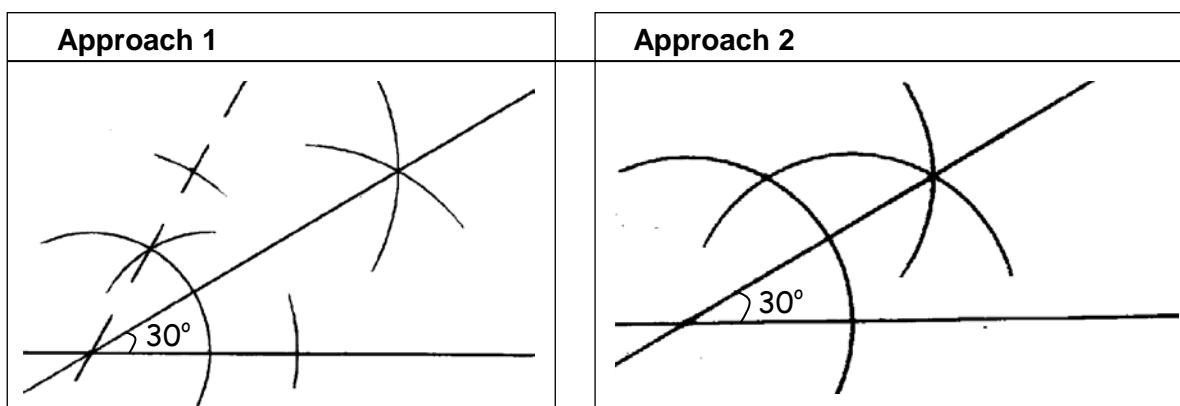
1. Construct an angle of 45° at point A.



2. Using a pair of compasses, a ruler and sharp pencil only, construct an angle of angle of 45° .
3. Draw a line segment XY = 4cm and construct angle of 45° at point Y.

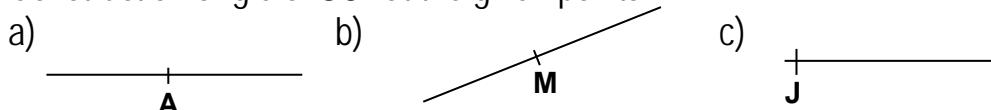
Constructing an angle of 30°

To construct an angle of 30° , construct an angle of 60° and bisect it.



Exercise

1. Using a ruler, pencil and a pair compasses only, construct an angle of 30° .
2. Construct an angle of 30° at the given points.



3. Draw a line segment MN = 5.2cm and construct an angle of 30° at point N.

TOPIC 7: GEOMETRIC CONSTRUCTION



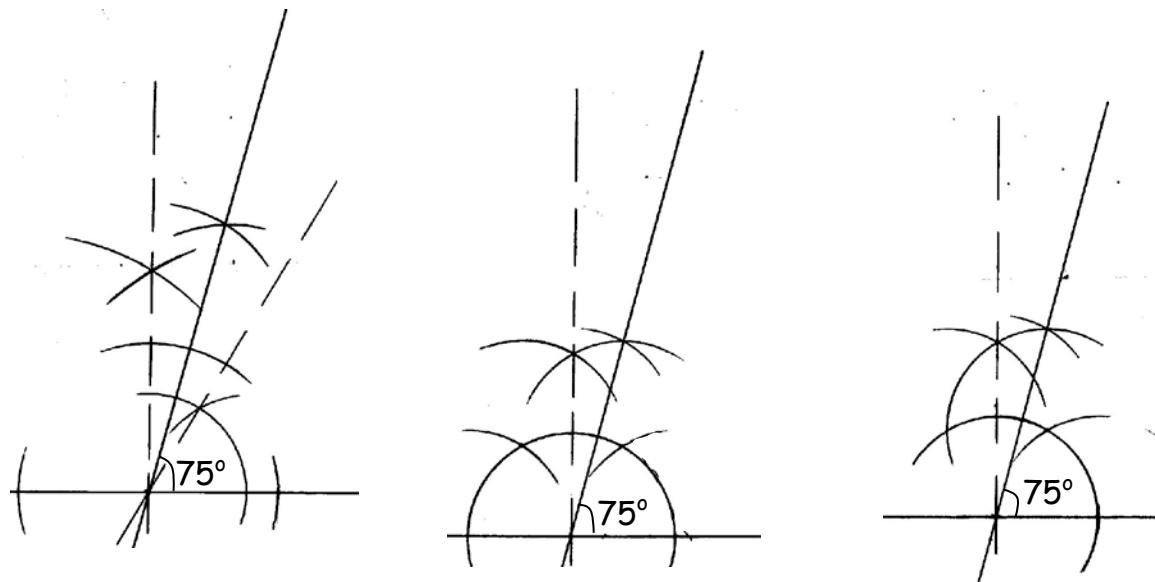
Constructing an angle of 75°

Approach 1

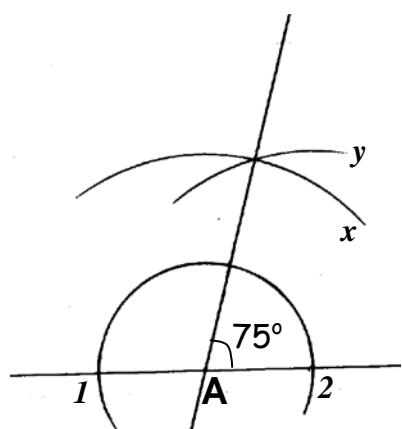
To construct an angle of 75°

* Construct angles; 90° and 60° at the same point

* Bisect the acute angle formed between 60° and 90° as shown in the drawings below.



Approach 2

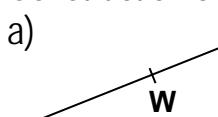


Steps

- * Draw a line and mark point A. At A, draw a semi-circular arc to intersect the line at 1 and 2.
- * Place the compasses at 1 and adjust it to point 2.
- * Draw arc x from point A
- * Using the same radius draw an arc y from point 2 .
- * Join the points as shown.

Exercise

1. Using a sharp pencil, a pair of compasses and a ruler only, construct an angle of 75° .
2. Construct an angle of 75° at the marked points.



3. Draw a line segment XY = 4.7cm and construct angle of 75° at point X.

Group activity

Using a ruler, a pencil and a pair of compasses only, construct an angle of

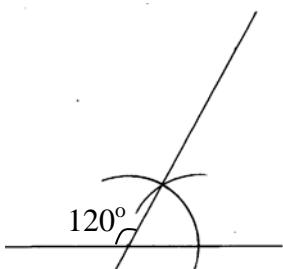
- a) 15°
- b) $22\frac{1}{2}^\circ$
- c) $67\frac{1}{2}^\circ$

TOPIC 7: GEOMETRIC CONSTRUCTION

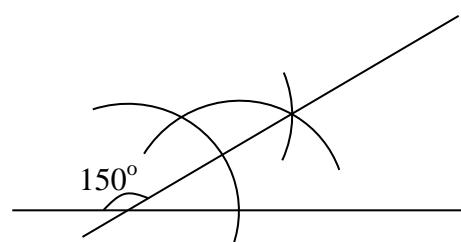


Constructing obtuse angles

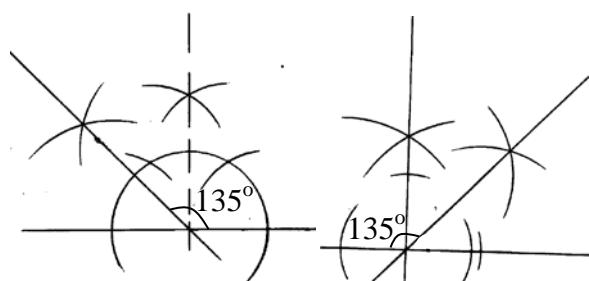
An angle of 120°



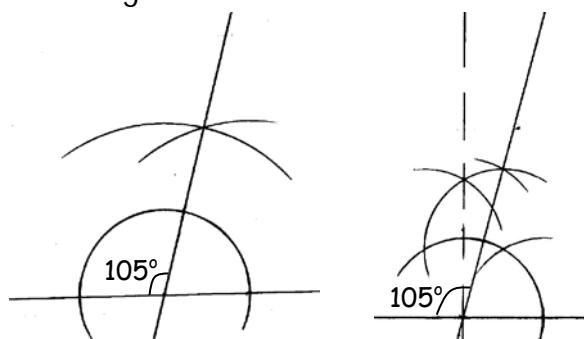
An angle of 150°



An angle of 135°

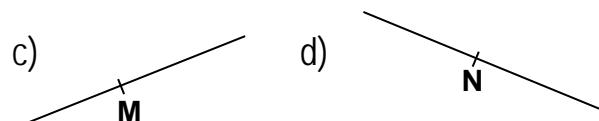
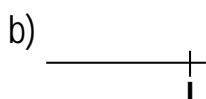
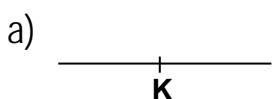


An angle of 105°



Exercise

1. Using a ruler, a pair of compasses and a pencil only, construct an angle of;
 - a) 120°
 - b) 150°
 - c) 135°
 - d) 105°
2. Copy the lines below and construct each of the following angles: 135° , 150° , 105° and 120°

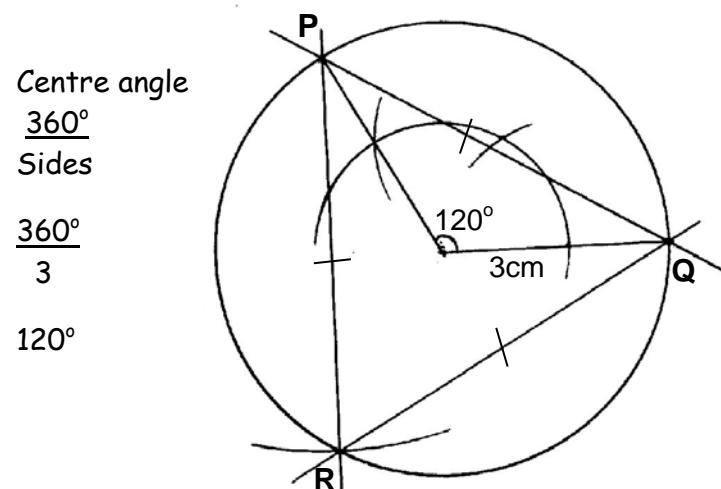


CONSTRUCTING POLYGONS

Constructing an equilateral triangle in a circle

Example

- a) Construct an equilateral triangle ABC in a circle of radius 3cm.



- b) Measure length PQ in centimeters

$$PQ = 5.2\text{cm}$$

- c) Measure angle RPQ

$$\text{Angle RPQ} = 60^\circ$$

TOPIC 7: GEOMETRIC CONSTRUCTION



Exercise

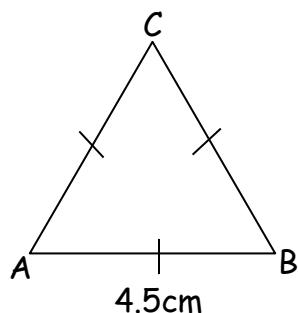
1. Using a ruler, a pencil and a pair of compasses only, construct a triangle
 - a) AXY in a circle of radius 3.5cm.
 - b) PLE in a circle of radius 4.5cm.
 - c) STV in a circle of radius 4cm.
 - d) WXY in a circle of radius 5cm.
2. a) Construct a triangle NUP in a circle of radius 4.8cm.
b) Measure;
 - i) length NP
 - ii) angle PNU

Constructing a triangle when all sides are given (SSS)

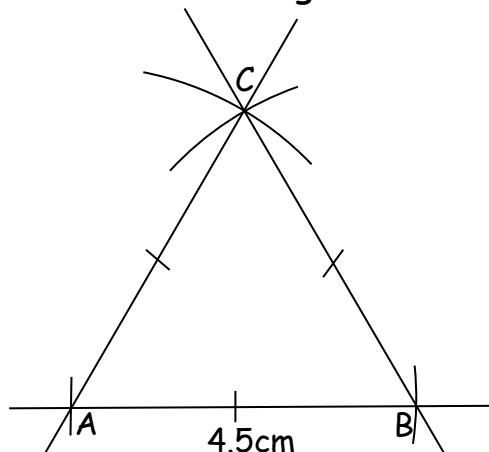
Example 1

Using a ruler, a pencil and a pair of compasses only, construct a triangle ABC such that $AB = BC = CA = 4.5\text{cm}$.

Sketch



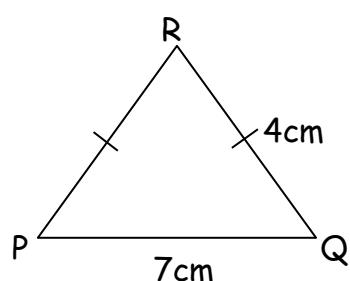
Accurate diagram



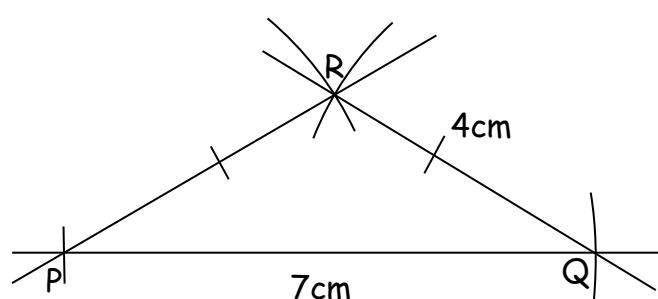
Example 2

Using a ruler, a pencil and pair of compasses only, construct a triangle PQR such that $PQ = 7\text{cm}$, $QR = PR = 4\text{cm}$.

Sketch



Accurate diagram



Measure

- i) angle QRP = 118°
- ii) angle PQR = 31°

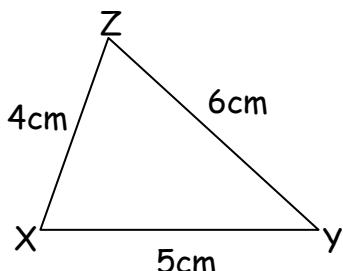
TOPIC 7: GEOMETRIC CONSTRUCTION



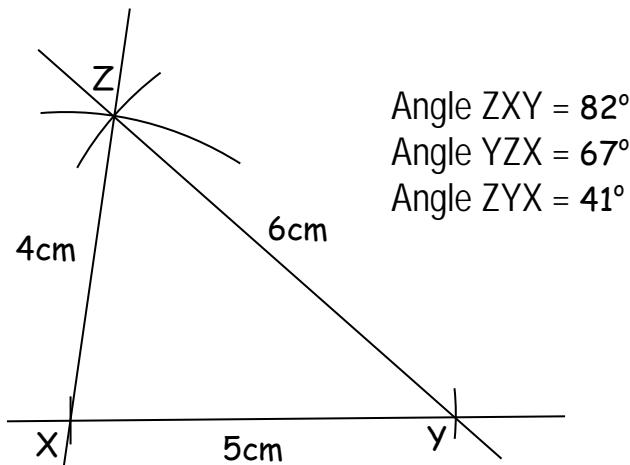
Example 3

Construct a triangle XYZ in which $XZ = 4\text{cm}$, $XY = 5\text{cm}$ and $YZ = 6\text{cm}$.

Sketch



Accurate diagram



Exercise

1. Using a ruler, a pair of compasses and pencil only, construct a triangle;
 - i) ABC where $AB = AC = BC = 4\text{cm}$
 - ii) DEF in which $DE = EF = 4.5\text{cm}$ and $DF = 3.5\text{cm}$
 - iii) HIG where $IG = 6\text{cm}$ and $IH = HG = 4.5\text{cm}$
 - iv) JKL in which $JK = 5.4\text{ cm}$ and $JL = LK = 4\text{cm}$.
 - v) MON where $OM = 4.5\text{cm}$, $ON = 7\text{cm}$ and $MN = 6\text{cm}$
 - vi) DRQ where $DQ = 5\text{cm}$, $RQ = 6.5\text{cm}$ and $RD = 3.5\text{cm}$
 - Vii) STU where $UT = 3.5\text{ cm}$, $TS = 5\text{cm}$ and $US = 7.6\text{cm}$
 - Viii) XWV where $XW = WV = 4.5\text{cm}$ and $XV = 8.5\text{cm}$
 - ix) MTN such that $MN = 8\text{cm}$, $MT = 6\text{cm}$ and $NT = 10\text{cm}$.
2. a) Using a ruler, a pencil and a pair compasses only, construct a triangle WPS such that $PS = 8\text{cm}$, $WS = 7\text{cm}$ $WP = 4.5\text{cm}$.
 b) Measure angle
 - i) WPS
 - ii) PWS
 - iii) PSW
3. a) Construct a triangle APK such that $AP = 6.5\text{cm}$ and point K lies on a perpendicular bisector of AP. Point K is 5.5cm above line AP.
 b) What special names is given to triangle APK ?
 c) Measure
 - i) line PK
 - ii) angle AKP.
4. a) Construct an equilateral triangle PQR of sides 5.5cm.
 b) Construct a perpendicular line from point R to meet line PQ at K
 c) Measure
 - i) angle PRO
 - ii) line RK

TOPIC 7: GEOMETRIC CONSTRUCTION

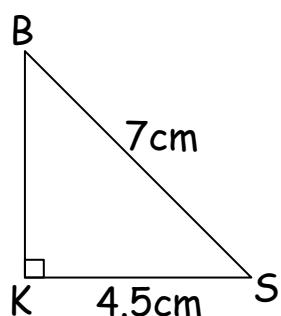


Constructing a triangle when one angle and two sides (ASS) are given

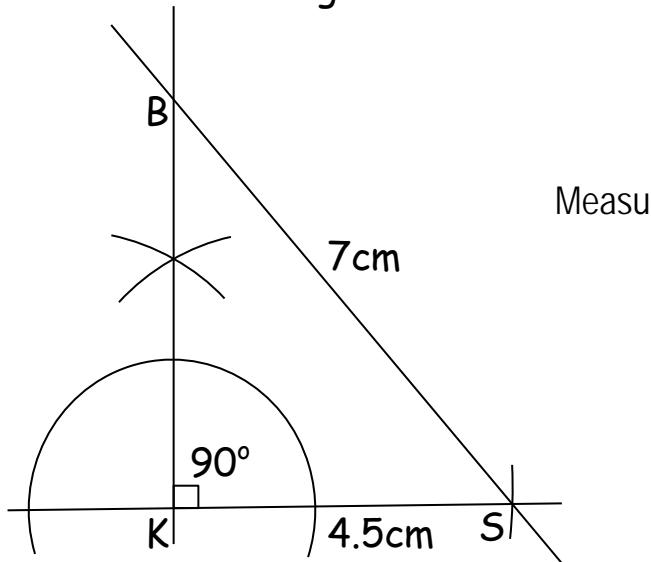
Example 1

Using a ruler, a pair of compasses and a pencil only, construct triangle KBS such that $BS = 7\text{cm}$, $KS = 4.5\text{ cm}$ and $\angle SKB = 90^\circ$.

Sketch



Accurate diagram



Measure i) line BK

5.5cm

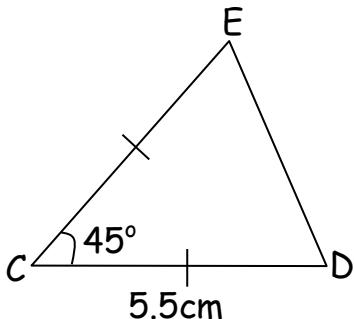
ii) angle SBK

41°

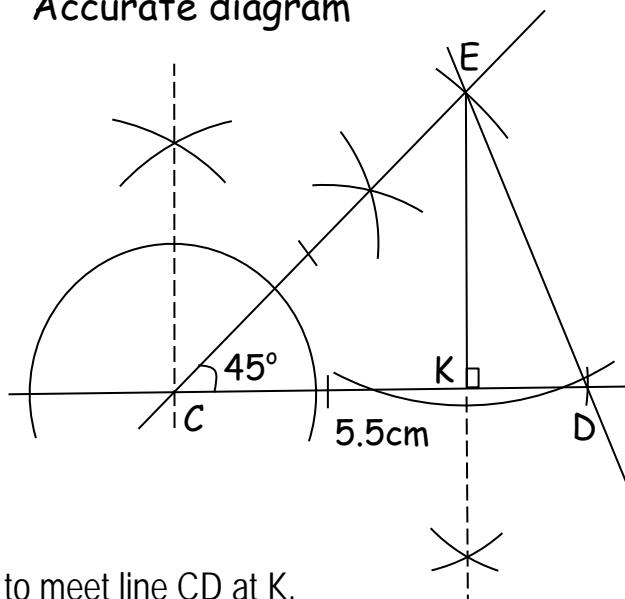
Example 2

a) Construct a triangle CDE where $CD = CE = 5.5\text{cm}$ and angle $\angle ECD = 45^\circ$

Sketch



Accurate diagram



b) Drop a perpendicular from E to meet line CD at K.

c) Measure:

i) line $EK = 4\text{cm}$

ii) line $ED = 4.3\text{cm}$

iii) angle $\angle CDE = 67^\circ$

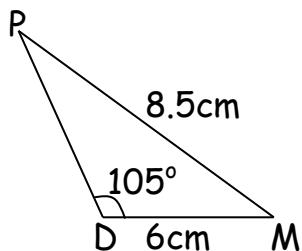
TOPIC 7: GEOMETRIC CONSTRUCTION



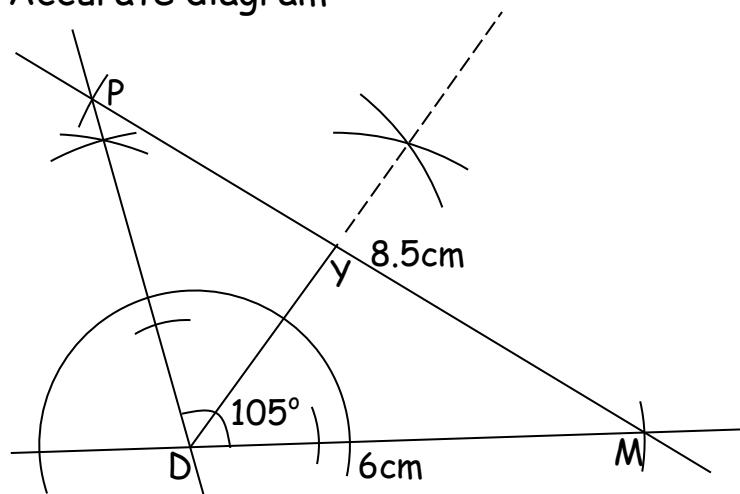
Example 3

- a) Construct a triangle PDM such that $DM = 6\text{cm}$, $PM = 8.5\text{cm}$ and angle $PDM = 105^\circ$.

Sketch



Accurate diagram



- b) Bisect angle PDM such that the bisector meets line PM at Y.
 c) Measure:
 i) line DY = 3.2cm
 ii) angle DMY = 33°

Exercise

1. Construct a triangle;
 - i) MTN such that $MT = 4.5\text{cm}$, $\angle NTM = 60^\circ$ and $TN = 6\text{cm}$.
 - ii) TVS where $TV = VS = 4.5\text{cm}$ and $\angle STV = 60^\circ$.
 - iii) PQR in which $RQ = QP = 5\text{cm}$ and $\angle PRQ = 45^\circ$.
 - iv) WRP such that $RP = 5\text{cm}$, $PW = 5\text{cm}$ and $\angle WRP = 90^\circ$.
 - v) LKM where angle $MLK = 90^\circ$ and $ML = LK = 4.8\text{cm}$.
 - vi) EFD where angle $D = 90^\circ$, $FD = 5\text{cm}$ and $DE = 4.8\text{cm}$.
 - vii) WYX where angle $Y = 45^\circ$, $WX = 5\text{cm}$ and $YX = 4.5\text{cm}$.
 - viii) FED where $\angle EFD = 30^\circ$, $FD = 5\text{cm}$ and $FE = 9\text{cm}$.
 - ix) ABC in which $\angle BCA = 75^\circ$, $CA = 6\text{cm}$ and $AB = 7\text{cm}$.
 - x) MNL where $ML = NL = 4.5\text{cm}$ and $\angle NLM = 120^\circ$.
2. a) Construct a triangle EFG where $EF = 7\text{cm}$, angle $FEG = 60^\circ$ and $EG = 5\text{cm}$.
 b) What is the size of angle GFE?
3. a) Construct a triangle XYZ, such that $YZ = 5\text{cm}$, $\angle XYZ = 120^\circ$, $XY = 4\text{cm}$.
 b) Measure
 - i) angle ZXY
 - ii) line XZ
4. a) Construct an isosceles triangle XYZ such that line $XY = XZ = 6\text{cm}$ and $\angle YXZ = 90^\circ$.
 b) Measure angle XYZ .

TOPIC 7: GEOMETRIC CONSTRUCTION



5. a) Construct a triangle ABC such that $AB = 6\text{cm}$, $\angle BAC = 75^\circ$ and $BC = 8\text{cm}$.
b) Measure line AC.
c) Measure angle ABC.
6. a) Construct a triangle PQR such that $PQ = 5.8\text{cm}$, $QP = 7\text{cm}$ and angle $PQR = 60^\circ$.
b) Drop a perpendicular from point R to meet line PQ at N.
c) Measure line RN.
7. a) Construct a triangle ABC where $AB = 4\text{cm}$, $\angle ABC = 135^\circ$ and $BC = 6.5\text{cm}$.
b) Measure
i) angle ACB
ii) line AC
8. a) Construct a triangle DAP where $DA = 9\text{cm}$, $PA = 4.5\text{cm}$ and angle $PDA = 30^\circ$.
b) Drop a perpendicular line from P to meet line DA at T.
c) Measure line PT, $\angle DPT$, $\angle DAP$
9. a) Construct a triangle CBS in which $CS = 9\text{cm}$, $\angle SBC = 120^\circ$ and line $BC = 4.5\text{cm}$.
Drop a perpendicular line from C to meet line BS at Y.
b) Measure line CY.
c) Measure angle BCS.
- 10.a) Construct a triangle CAT such that $TA = 6.5\text{cm}$, $\angle TCA = 60^\circ$ and $CA = 8\text{cm}$. Drop a perpendicular line from T to meet CA at X.
b) Measure angle CAT.
c) Using TX as the height, find the area of triangle CAT.
- 11a) Construct a triangle CTV where $TV = 6\text{cm}$, $CV = 9.7\text{cm}$ and angle $CTV = 105^\circ$.
Draw a perpendicular line from C to meet TV at P.
b) Measure line CP.
c) Calculate the area of triangle CTV in square centimeters.
- 12a) Follow the instructions below to construct triangle MTN .
i) Draw line segment $TN = 6\text{cm}$.
ii) Construct an angle of 105° at point N.
iii) Locate point M such that M and N are 4.2cm apart.
iv) Join T to M to make a triangle.
b) Measure
i) $\angle MTN$
ii) line MT
- 13a) Construct a triangle EHN where $HN = 6.9\text{cm}$, $\angle NHE = 45^\circ$, point K is half-way between H and N such that EK is perpendicular to HN.
b) Measure line EN.
c) Measure angle HEN.

TOPIC 7: GEOMETRIC CONSTRUCTION



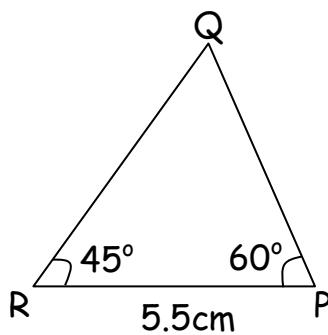
Constructing a triangle when one side and two angles (ASS) are given

Note: To construct such triangles, you should always start with the base line.

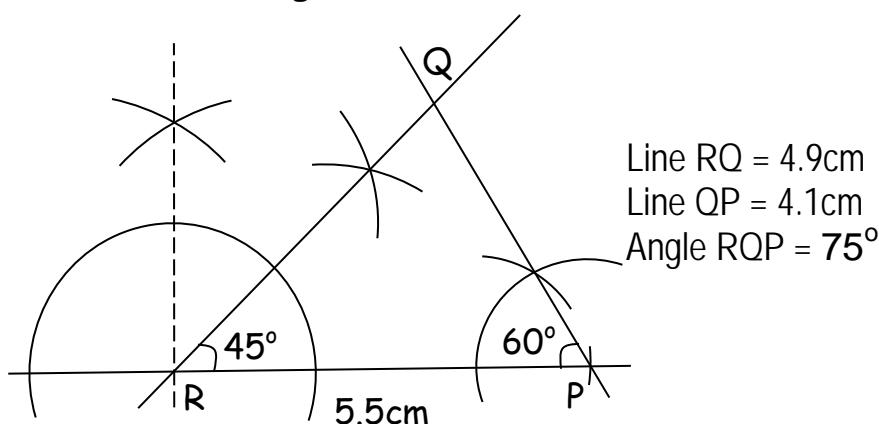
Example 1

Using a ruler, a pencil and a pair of compasses only, construct a triangle PQR where line RP = 5.5cm, $\angle QRP = 45^\circ$ and $\angle RPQ = 60^\circ$.

Sketch



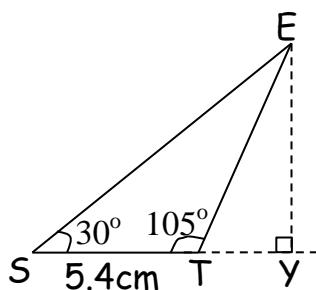
Accurate diagram



Example 3

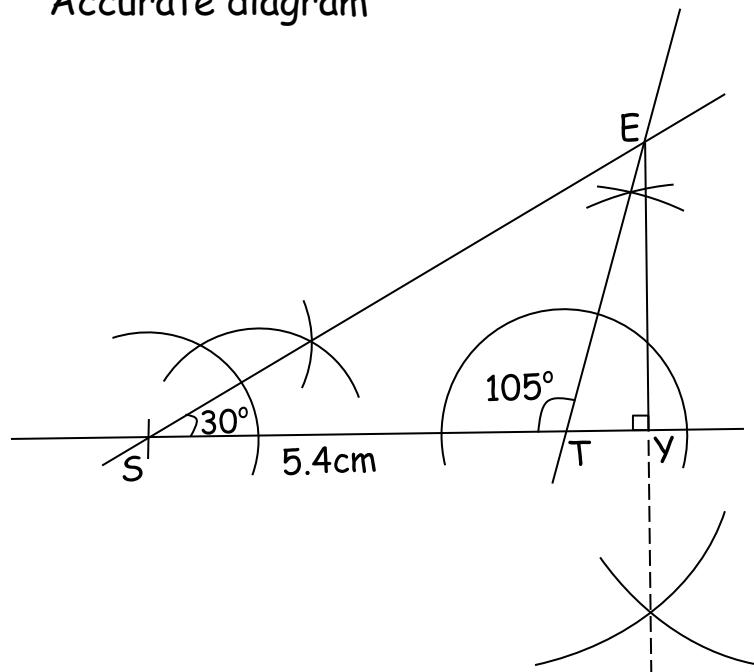
Construct a triangle ETS where $\angle T = 105^\circ$, TS = 5.4cm and $\angle S = 30^\circ$. Drop a perpendicular from E to meet TS at Y.

Sketch



Accurate diagram

$$\begin{aligned} EY &= 3.8\text{cm} \\ SE &= 7.6\text{cm} \\ TE &= 4\text{cm} \\ \angle SET &= 45^\circ \\ \angle TEY &= 16^\circ \\ \angle SEY &= 60^\circ \end{aligned}$$



TOPIC 7: GEOMETRIC CONSTRUCTION



Exercise

1. Using a ruler a pencil and a pair of compasses only, construct a triangle.
 - a) ABC where $CB = 4.5\text{ cm}$, $\angle ACB = 90^\circ$ and $\angle ABC = 45^\circ$.
 - b) FDC in which $\angle DFC = 30^\circ$, $FC = 6.5\text{cm}$ and $\angle FCD = 90^\circ$.
 - c) GHI where $\angle GIH = 45^\circ$, $\angle IHG = 60^\circ$, and $IH = 5.5\text{cm}$.
 - d) JKL in which $\angle K = 45^\circ$, $\angle L = 30^\circ$ and $LK = 6.5\text{cm}$.
 - e) KML such that $\angle L = 45^\circ$, $\angle M = 105^\circ$ and line $ML = 4\text{cm}$.
 - f) NTV in which $\angle NVT = \angle NTV = 30^\circ$ and $VT = 8.3\text{cm}$.
 - g) LNM where $NML = 90^\circ$, $LNM = 75^\circ$ and $NM = 2.8\text{cm}$.
 - h) PQR in which $\angle QRP = 30^\circ$, $\angle RQP = 120^\circ$ and $RQ = 45\text{cm}$.
 - i) STU where $UT = 5\text{cm}$, $\angle T = 150^\circ$ and $\angle U = 15^\circ$
 - j) TVS where $\angle V = 105^\circ$, $\angle T = 30^\circ$ and line $TV = 6.2\text{cm}$
2. a) Construct a triangle PQR where $\angle R = 60^\circ$, $\angle Q = 30^\circ$ and $RQ = 7.1\text{cm}$
b) Draw a perpendicular line from P to meet RQ at Y
c) Measure line PY.
3. a) Construct a triangle ABC in which $AB = 6\text{cm}$, angle $CAB = 45^\circ$, $CBA = 60^\circ$.
Drop perpendicular line from C to meet line AB at X.
b) Measure XC.
c) Find the area of the triangle ABC.
4. a) Construct a triangle ABC where angle $A = 60^\circ$, $AB = 7\text{cm}$ and angle $B = 45^\circ$.
Drop perpendicular from C to meet AB at P.
b) Measure CP.
5. a) Construct a triangle RST where $RT = 7\text{cm}$, angle $SRT = 45^\circ$ and angle $RTS = 60^\circ$.
b) Measure length RS.
6. a) Construct a triangle ABC where $AB = 7\text{cm}$, $\angle BAC = 120^\circ$ and $\angle CBA = 30^\circ$.
b) Measure length CB.
7. a) Construct a triangle UBC where $BC = 7.5\text{cm}$, $UBC = 45^\circ$ and $\angle UCB = 30^\circ$.
Drop a perpendicular line from point M to meet BC at Y.
b) Measure UY in centimeters.
8. a) Construct a triangle ATM such that $TM = 5.4\text{ cm}$, $\angle ATM = 45^\circ$ and $\angle TMA = 60^\circ$.
b) Measure:
 - i) TA
 - ii) MA
9. Construct a triangle;
 - a) PQR where $PQ = 5\text{cm}$, $\angle RQP = 45^\circ$ and $\angle QPR = 30^\circ$.
 - b) SBN where $BS = 6.5\text{cm}$, $\angle NBS = 45^\circ$, $\angle BSN = 75^\circ$.

TOPIC 7: GEOMETRIC CONSTRUCTION



10. Construct a triangle;
 - a) ARC where $AR = 6.8\text{cm}$, $\angle RAC = 60^\circ$ and $CRA = 45^\circ$
 - i) Measure line CA.
 - ii) Measure CAR
 - b) BOX where $XO = 5.5\text{cm}$, $\angle XOB = 120^\circ$, $BXO = 30^\circ$.
11. a) Using a protractor, a pencil and a ruler only, draw a triangle MFK where $FM = 6\text{cm}$, $\angle KFM = 50^\circ$ and $\angle M = 65^\circ$.
b) Draw a perpendicular line from K to meet line FM at Y.
12. a) Construct a triangle MKL in which $\angle LMK = 30^\circ$, $\angle K = 105^\circ$ and $MK = 6\text{cm}$.
Drop a perpendicular from L to meet MK at X.
b) Measure;
 - i) line LX in centimetres.
 - ii) angle KLX in degrees .
13. a) Construct a triangle ABC such that $\angle CBA = 135^\circ$, $\angle CAB = 30^\circ$ and line $AB = 4.5\text{cm}$
Drop a perpendicular from C to meet AB at M.
b) Measure
 - i) line AC
 - ii) line CM
 - iii) Angle ACM

Group activity

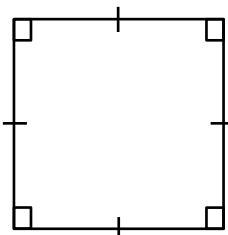
1. Construct a triangle SVT such that $\angle SVT = 105^\circ$, line $SV = 4.2\text{cm}$ and $\angle VTS = 30^\circ$
2. a) Construct a triangle WPS in which $WP = 6\text{cm}$, $\angle SPW = 30^\circ$ and $\angle WSP = 45^\circ$
b) Measure line WS.
3. a) Construct a triangle SNQ where $SQ = 7\text{cm}$, $\angle SNQ = 90^\circ$ and $\angle S = 60^\circ$.
b) Drop a perpendicular from N to meet SQ at Y. Measure NY.
4. a) Construct a triangle WMX such that $MX = 4.5\text{cm}$, $\angle WMX = 120^\circ$ and $\angle XWM = 30^\circ$.
Drop a perpendicular from W to meet MX at C.
b) Measure
 - i) WC
 - ii) WX
 - iii) $\angle XWC$
5. a) Construct a triangle KTR in which $\angle RTK = 90^\circ$, $\angle TKR = 60^\circ$ and line $RT = 6\text{cm}$.
Bisect angle TRK and let the bisector meet line TK at X.
b) Measure
 - i) Angle RXK
 - ii) Line RX
 - iii) Line XK.

TOPIC 7: GEOMETRIC CONSTRUCTION



CONSTRUCTING QUADRILATERALS

SQUARE

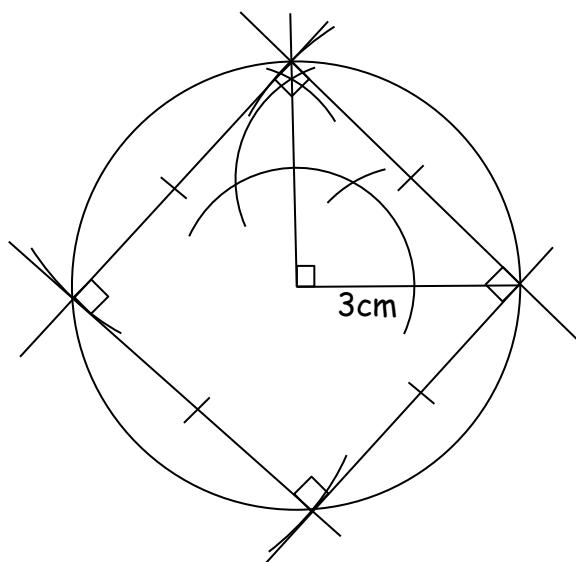


Properties of a square

- All sides are equal.
- Opposite sides are parallel.
- Has an angle of 90° at each vertex.
- Diagonals are equal.
- Diagonals bisect each other at right angles.
- Has four lines of folding symmetry.

Example 1

Construct a square in a circle of radius 3cm.

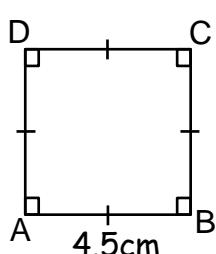


Length of each side = 4.2cm

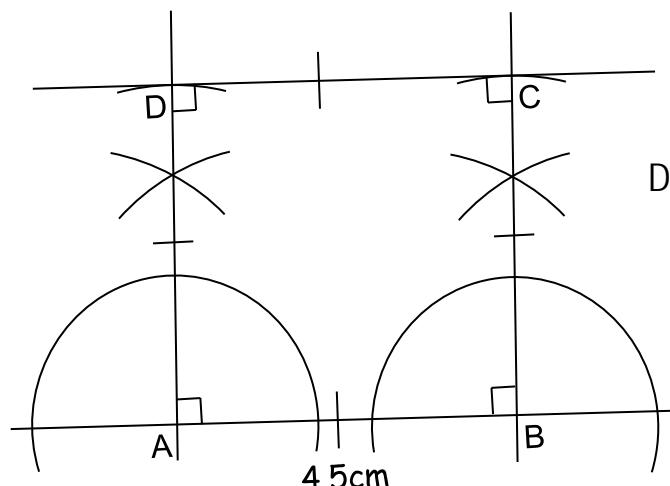
Example 2

Construct a square ABCD in which AB = BC = CD = DA = 4.5cm.

Sketch



Accurate diagram



Diagonal AC = 6.4cm

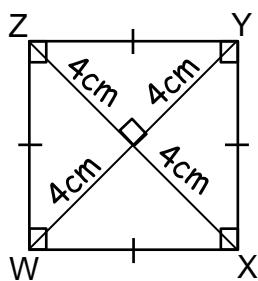
TOPIC 7: GEOMETRIC CONSTRUCTION



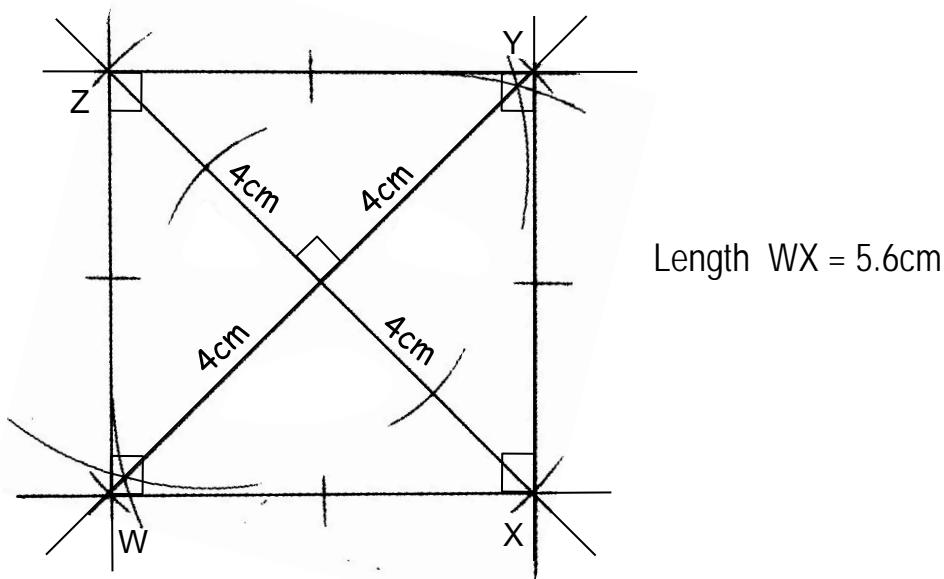
Example 3

Construct a square WXYZ such that diagonal $WY = 8\text{cm}$.

Sketch



Accurate diagram

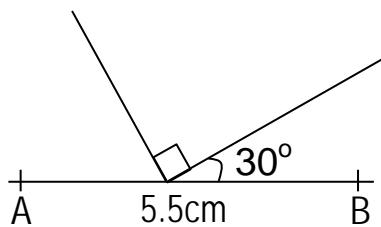


Exercise

- Using a pair of compasses a pencil and a ruler only, construct a square of the sides given below.

a) 3.5cm	c) 3cm	e) 6cm	g) 4.3 cm	i) 8cm
b) 4cm	d) 5cm	f) 5.5 cm	h) 5.2cm	j) 9cm
- a) Construct a square UVWX such that $UV = VW = 4.5\text{cm}$.
b) Measure the length of diagonal UW.
- Use a ruler, a protractor and a pencil only to draw a square EFGH of sides 4cm.

a) 6cm	c) 9cm	e) 10cm	g) 6.4 cm
b) 12cm	d) 8cm	f) 8.5cm	h) 11.6cm
- Construct a square ABCD such that diagonal AC = 10.5cm .
- Construct a quadrilateral PQRS such that $PQ = QR = RS = SP = 6.2\text{cm}$.
- The drawing below shows part of a sketch diagram of the square KLMN of side 4cm, angle LKB = 30° , K bisects line AB and line AB = 5.5cm.



- a) Copy and complete the sketch diagram.
b) Use a pair of compasses, a ruler and a pencil to construct an accurate diagram.
c) Drop a perpendicular from N to meet line AB at Y.
d) Measure line NY.
- Construct a square in a circle whose radius is:

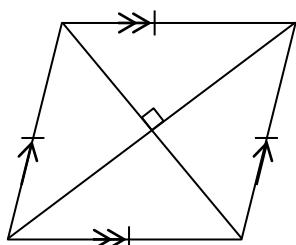
a) 3.5cm	b) 4cm	c) 3cm	d) 4.5 cm	e) 4.8cm	f) 3.7cm
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- a) Construct a square PQRS in a circle of radius 4.2cm.
b) Measure line PQ in cm.

TOPIC 7: GEOMETRIC CONSTRUCTION



10. a) Construct a square DEFG in a circle whose diameter is 6.6cm.
 b) Measure length FG in centimetres.

RHOMBUS



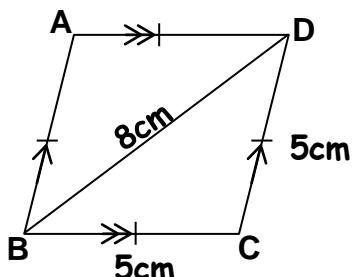
Properties of a rhombus.

- All sides are equal .
- Opposite sides are parallel .
- Opposite angles are equal.
- Diagonals bisect each other at right angles.
- Has two lines of folding symmetry.

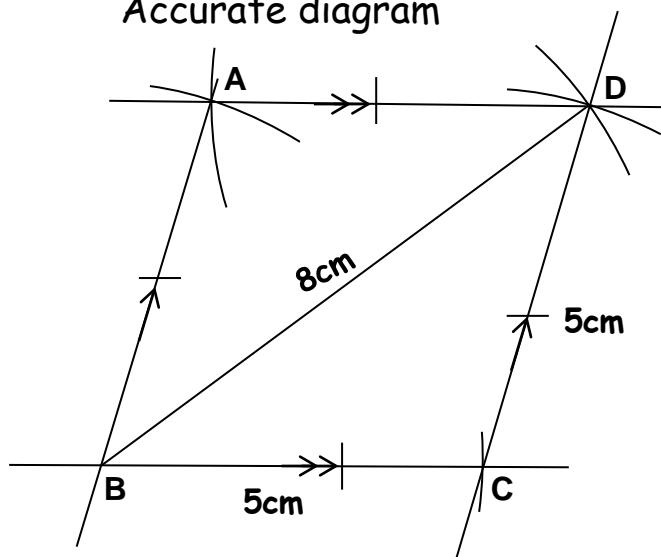
Example 1

Construct a rhombus ABCD in which DC = 5cm and diagonal DB = 8cm.

Sketch



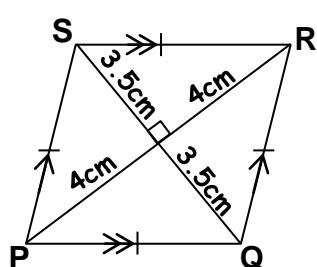
Accurate diagram



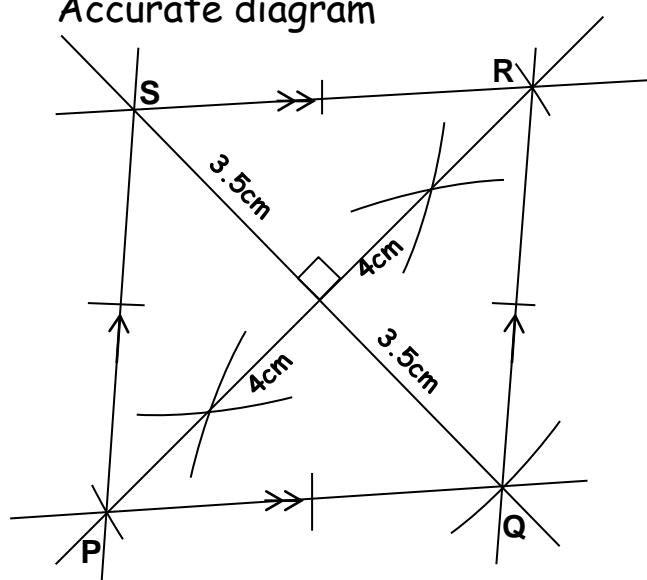
Example 2

Construct a rhombus PQRS where diagonal SQ = 7cm and diagonal PR = 8cm.

Sketch



Accurate diagram



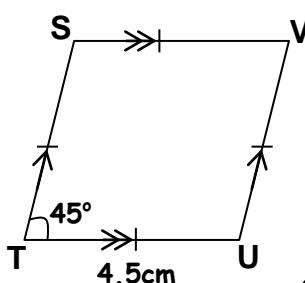
TOPIC 7: GEOMETRIC CONSTRUCTION



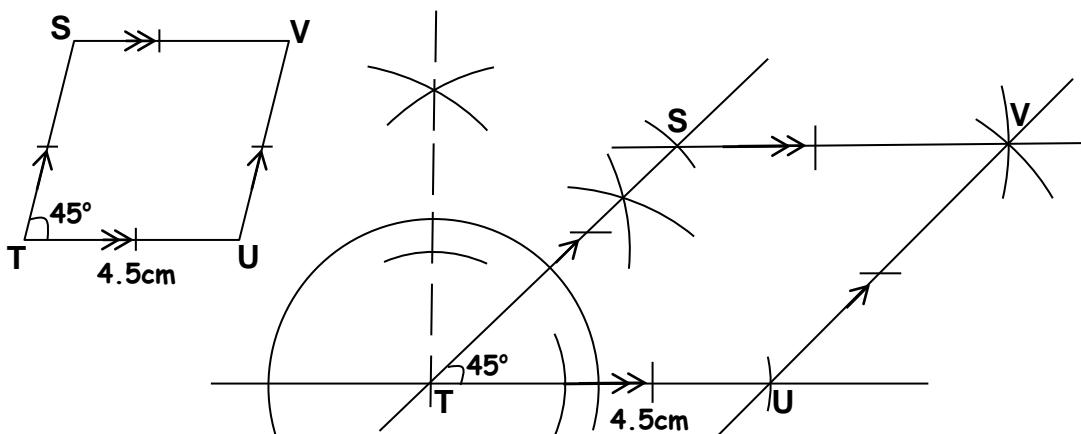
Example 3

Construct a rhombus STUV where angle STU = 45° and line TU = 4.5cm.

Sketch



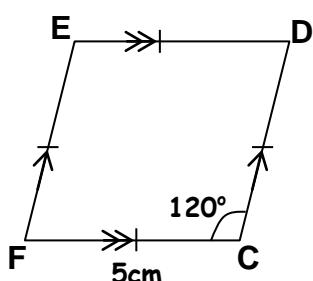
Accurate diagram



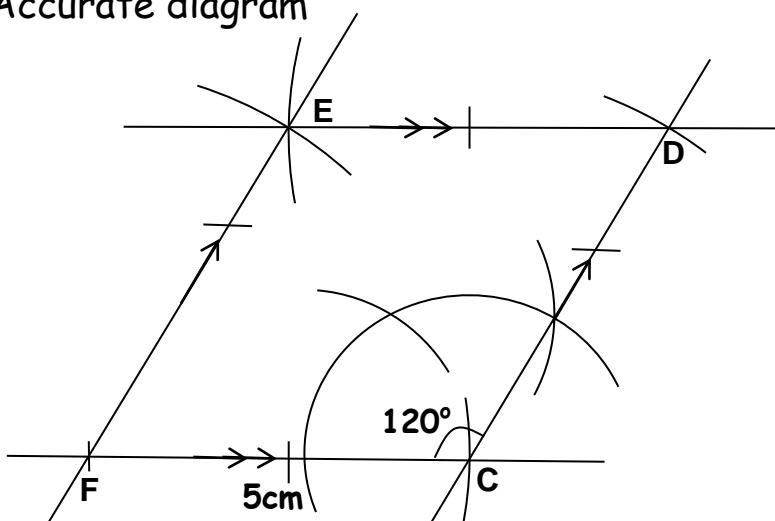
Example 4

Construct a rhombus CDEF such that FC = 5cm and angle FCD = 120° and $\overline{FC} = 5\text{cm}$.

Sketch



Accurate diagram



Exercise

1. Construct a rhombus;
 - a) ABCD in which diagonal AD = 4cm and diagonal AC = 7cm.
 - b) JKLM where diagonal MK = 6.5cm and line ML = 4.5cm.
 - c) EFGH such that HG = 5cm and EG = 6cm.
 - d) PQRS where diagonal PR = 7cm and SQ = 8cm.
 - e) TUVW such that VT = 10cm and UW = 6cm.
 - f) WXYZ where XZ = 8cm and YW = 6cm.
 - g) DMTQ where DT = 12cm and MQ = 7cm.

TOPIC 7: GEOMETRIC CONSTRUCTION



2. Using a ruler a pencil and a pair of compasses only, construct a rhombus;
 - a) PQRS where $RQ = 5\text{cm}$ and angle $SRQ = 30^\circ$.
 - b) WYSK such that $\angle Y=60^\circ$ and line $SY=4.5\text{cm}$.
 - c) MNTV where $MN = 4.5\text{cm}$ and $\angle V = 75^\circ$.
 - d) WTSB where $\angle S= 105^\circ$ and line $TS= 4\text{cm}$.

3. a) Construct a rhombus $CBXV$ in which $\angle CBX = 135^\circ$ and line $CB = 5.5\text{cm}$.
 - b) Measure;
 - i) angle BXV .
 - ii) diagonal BV .

4. a) Construct rhombus YMCA such that $AC = 4.8\text{cm}$ and $\angle ACM = 150^\circ$.
 - b) Drop a perpendicular from Y to meet AC at K.
 - c) Measure;
 - i) line YK .
 - ii) angle AYK .
 - iii) diagonal AM .

5. a) Construct a rhombus $CSVM$ such that $MV = 4\text{cm}$, $\angle CSV = 120^\circ$. Drop perpendicular from point V to meet line CS at P.
 - b) Measure;
 - i) line VP .
 - ii) diagonal MS .
 - iii) diagonal CV .
 - iv) angle SVP .

6. a) Construct a rhombus $ABCD$ where ABD is an equilateral triangle of side 6cm .
 - b) Drop a perpendicular from D to meet AB at M.
 - c) Measure;
 - i) line MD .
 - ii) diagonal AC .
 - iii) angle MDC .

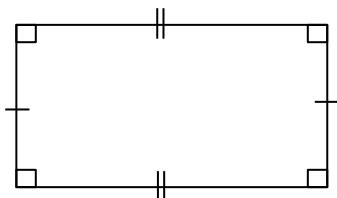
7. a) Construct a rhombus $ABCD$ such that $\angle DAB = 120^\circ$ and diagonal $AC = 6\text{cm}$. Diagonal AC bisects angle BAD .
 - b) Drop a perpendicular from C to meet line AB at N.
 - c) Measure
 - i) Length AB .
 - ii) diagonal BD .
 - iii) angle ADC .

8. The diagonals of a rhombus $KPLE$ intersect at point Y such that line $LY = 7\text{cm}$ and diagonal $EP = 9\text{cm}$. With the help of a ruler, a pencil and a pair of compasses only, construct rhombus $KPLE$ then measure line KP and angle LEK .

TOPIC 7: GEOMETRIC CONSTRUCTION



RECTANGLES



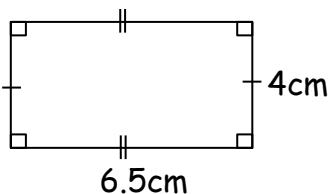
Properties of a rectangle

- Opposite sides are equal and parallel.
- Diagonals are equal.
- Has 4 right angles.
- Has 2 lines of folding symmetry.

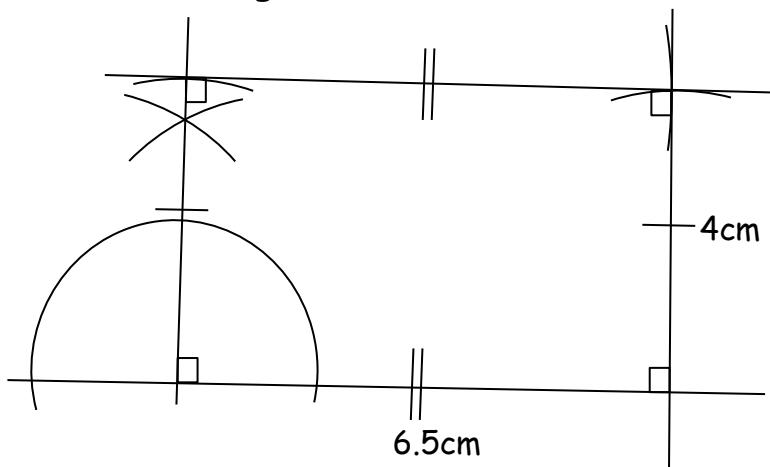
Example 1

Construct rectangle of length 6.5cm and width 4cm.

Sketch



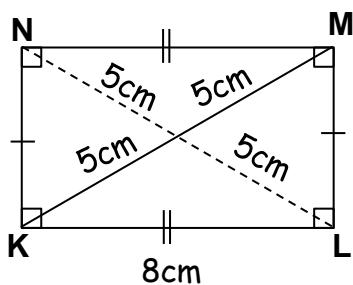
Accurate diagram



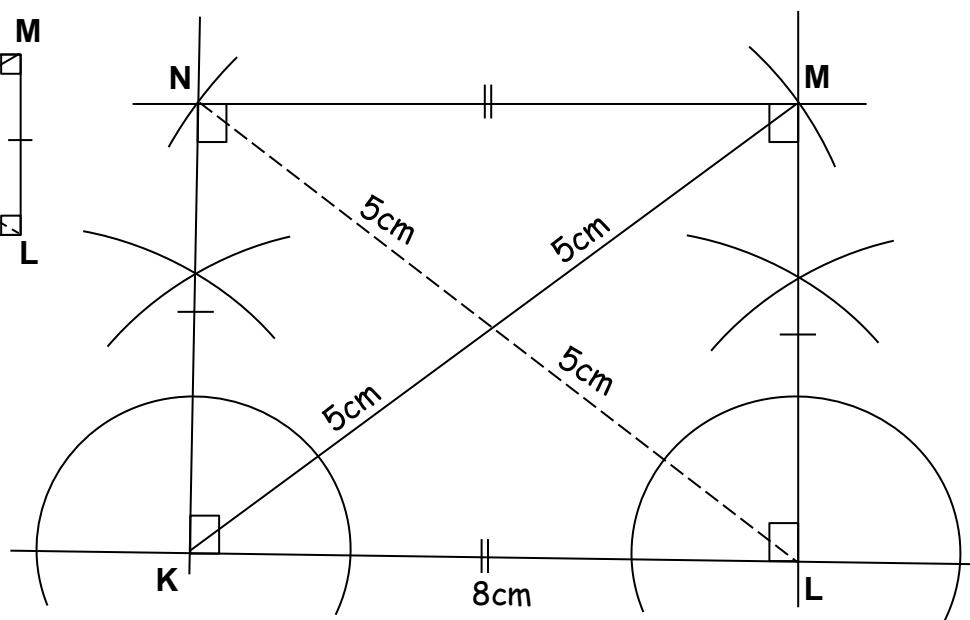
Example 2

Construct a rectangle KLMN where $KL = 8\text{cm}$ and diagonal $KM = 10\text{cm}$.

Sketch



Accurate diagram



TOPIC 7: GEOMETRIC CONSTRUCTION



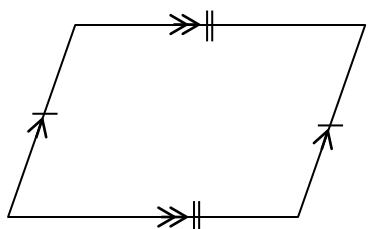
Exercise

1. Construct a rectangle of
 - a) length 4cm and width 3cm.
 - b) length 7cm and width 4.5cm.
 - c) length 8cm and width 6cm.
 - d) length 6.2cm and width 3.5cm.
2. Construct a rectangle
 - a) ABCD in which $AB = 5\text{cm}$ and $BC = 4\text{cm}$
 - b) PQRS where $QR = 7\text{cm}$ and $PQ = 5.5\text{cm}$
 - c) MNPT such that $MT = 4.5\text{cm}$ and $MN = 6\text{cm}$
 - d) EFGH in which $EF = 10\text{cm}$ and $FG = 6.4\text{cm}$
3. a) Construct a rectangle DSTV in which length $DS = 7.4\text{cm}$ and width $ST = 5\text{cm}$.
b) Measure
 - i) diagonal DT
 - ii) angle VDT
4. a) Construct a rectangle MSBK such that $MS = 4\text{cm}$ and diagonal $MB = 5\text{cm}$.
b) Measure i) line SB
ii) angle KBM
c) Find the area of the rectangle.
5. a) Construct a rectangle whose length is 6.5cm and diagonal 8cm .
b) Measure its width.
6. a) Construct a rectangle in which width $KL = 3.5\text{cm}$ and diagonal $MK = 7\text{cm}$.
b) Measure length ML.
7. a) Construct a rectangle ADKQ such that diagonal $AK = 8.2\text{cm}$ and angle $KAD = 30^\circ$
b) Measure:
 - i) AD
 - ii) DK
8. a) With the help of a protractor, a ruler and sharp pencil only, draw a rectangle PRST such that $PT = 7\text{cm}$ and angle $TPS = 40^\circ$.
b) Measure
 - i) diagonal PS.
 - ii) line ST.
9. a) Using a ruler, a pencil and a pair of compasses only, construct a quadrilateral WPQR whose diagonal intersect at O such that diagonal such that angle $WOP = 120^\circ$ and diagonal $WQ = RP = 8\text{cm}$.
b) Measure (i) line RQ
(ii) line PQ

TOPIC 7: GEOMETRIC CONSTRUCTION



PARALLELOGRAMS



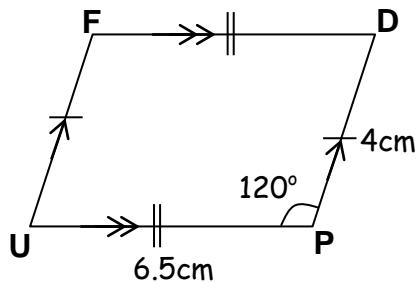
Properties of a parallelogram

- Opposite sides are equal and parallel.
- Opposite angles are equal.
- Diagonals are not equal.
- Has no line of folding symmetry.

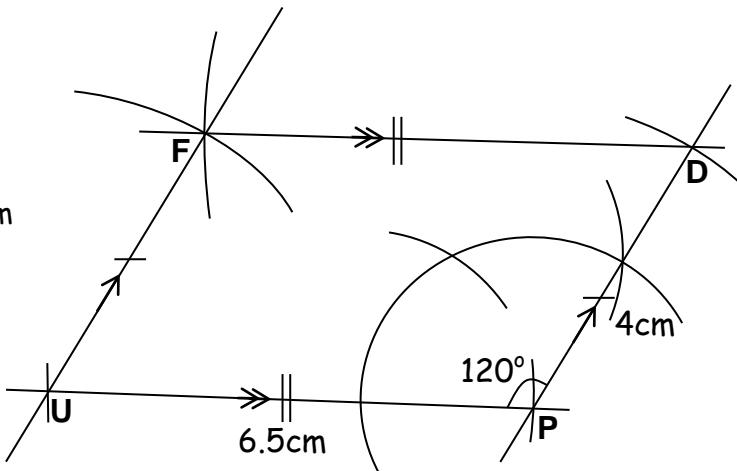
Example 1

Construct a parallelogram FUPD where angle UPD = 120° . UP = 6.5cm and PD = 4cm.

Sketch



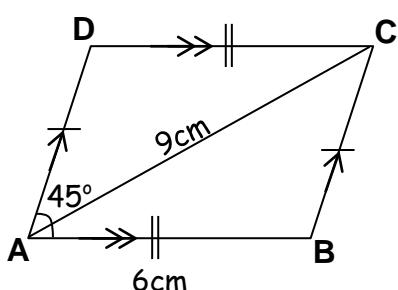
Accurate diagram



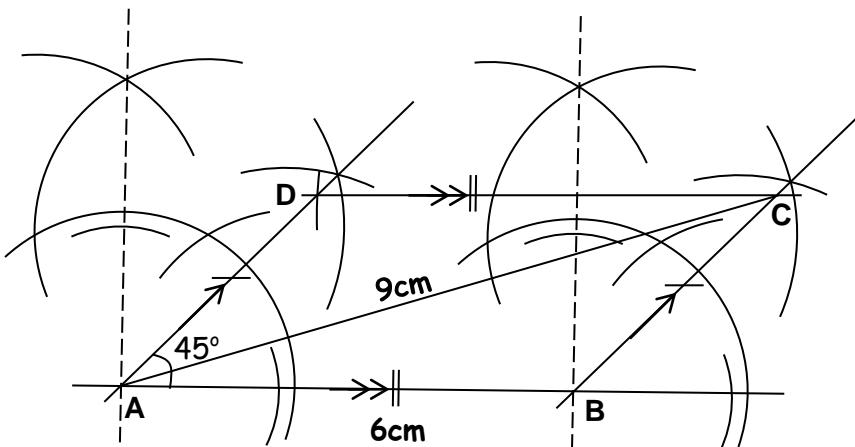
Example 2

Construct a parallelogram ABCD in which AB = 6cm, angle DAB = 45° and diagonal AC = 9cm.

Sketch



Accurate diagram



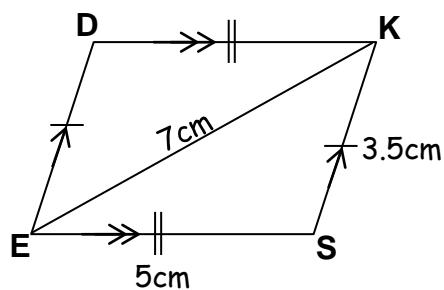
TOPIC 7: GEOMETRIC CONSTRUCTION



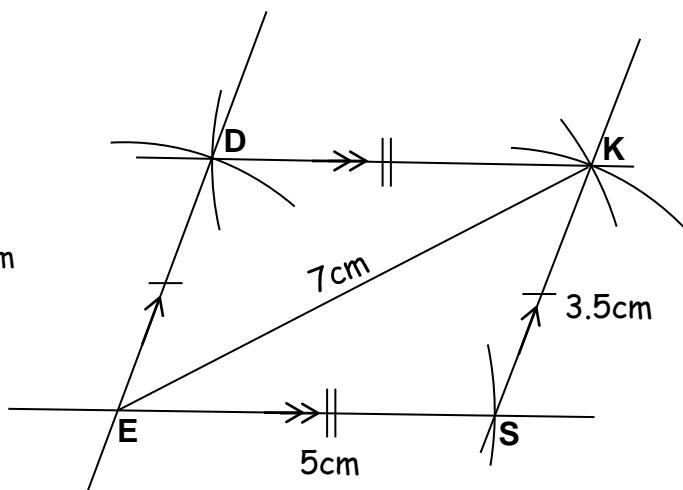
Example 3

Construct a parallelogram DESK where $ES = 5\text{cm}$, $SK = 3.5\text{cm}$ and $EK = 7\text{cm}$.

Sketch



Accurate diagram



Exercise

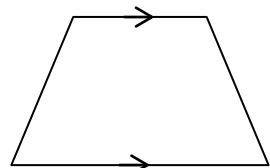
1. Construct a parallelogram ABCD where $AB = 8\text{cm}$, angle A = 60° and line AD = 4.5cm .
2. Construct a parallelogram
 - a) WPSM such that WP = 7cm , PS = 5.5cm and MWP = 30° .
 - b) IJKL where angle L = 45° , LK = 6.5cm and KJ = 4.2cm
 - c) LMNP such that ML = 5cm , PNM = 75° and NM = 7.5cm
 - d) PQRS where SR = 6cm , RQ = 4cm and SRQ = 120° .
 - e) SQRT where TR = 5.4cm , RQ = 4.5cm and TRQ = 105° .
 - f) EFGH in which GF = 5cm , HG = 6.5cm and HGF = 135° .
 - g) ABCD where AB = 6.8cm , BC = 5cm and ABC = 150° .
3. Construct a parallelogram
 - a) ABCD where AB = 7.5cm , CB = 4.5cm and diagonal AC = 6cm .
 - b) GOAT where OG = 5cm , OA = 7.5cm and GA = 7.5cm .
 - c) RUDE such that RU = 5.6cm , UE = 4cm and UD = 5.5cm .
 - d) GHJK where KG = 7.5cm , GH = 4.5cm and KH = 5cm .
4. a) Construct a parallelogram KLMN where KN = 7cm , KL = 5cm and NL = 10cm .
 - b) Measure
 - i) angle MNK
 - ii) angle NKL
 - iii) diagonal KM.
5. a) Construct parallelogram RSTU where UR = 5.5cm , RS = 4cm and diagonal US = 8cm . Drop a perpendicular from point T to meet line UR at Y.
 - b) Measure
 - i) angle URS
 - ii) angle TUS
 - iii) line TY

TOPIC 7: GEOMETRIC CONSTRUCTION



6. Construct a parallelogram
 - a) STUV in which $ST = 4\text{cm}$, $SU = 6\text{cm}$ and angle $T = 120^\circ$.
 - b) VWXY where $VW = 6\text{cm}$, $WY = 8.5\text{cm}$ and $VWX = 75^\circ$.
7. a) Construct a parallelogram BEST where $ES = 7.5\text{cm}$, $BES = 45^\circ$ and diagonal $BS = 4.5\text{cm}$. Drop a perpendicular from B to meet ES at K.
b) Measure
 - i) line BK
 - ii) line ST
8. a) Construct a parallelogram BCDE in which $BC = 7\text{cm}$, diagonal $BD = 10\text{cm}$ and diagonal $CE = 6\text{cm}$.
b) Measure
 - i) line CD
 - ii) angle EDC
9. a) Construct a parallelogram KLMN where $NK = 5.5\text{ cm}$, $KM = 5\text{cm}$ and $NL = 9\text{cm}$. Drop a perpendicular from M to meet line NK at P.
b) Measure
 - i) line MP
 - ii) angle NML
10. a) Construct a parallelogram ABCD such that $AD = BC = 9\text{cm}$. Bisect line AD and let the bisector meet line AD at point M. Mark point B on the bisector such that line $MB = 4\text{cm}$. Join point A to B and complete the construction of the parallelogram.
b) Measure
 - i) line AB
 - ii) angle ABC

TRAPEZIUM



Properties

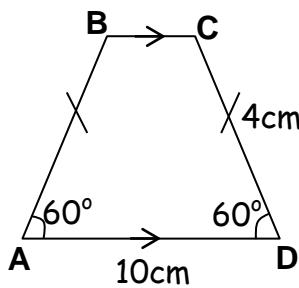
Has two sides parallel but not equal.

Base angles of an isosceles trapezium are equal

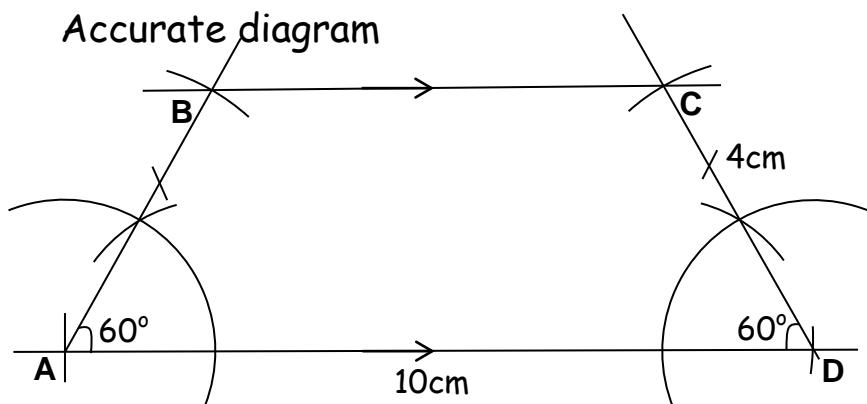
Example 1

Construct a trapezium ABCD such that angle $BAD = ADC = 60^\circ$, $AB = CD = 4\text{cm}$ and line $AD = 10\text{cm}$.

Sketch



Accurate diagram



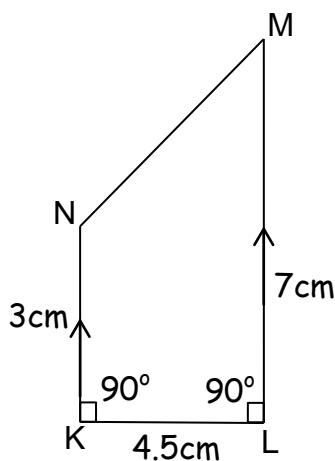
TOPIC 7: GEOMETRIC CONSTRUCTION



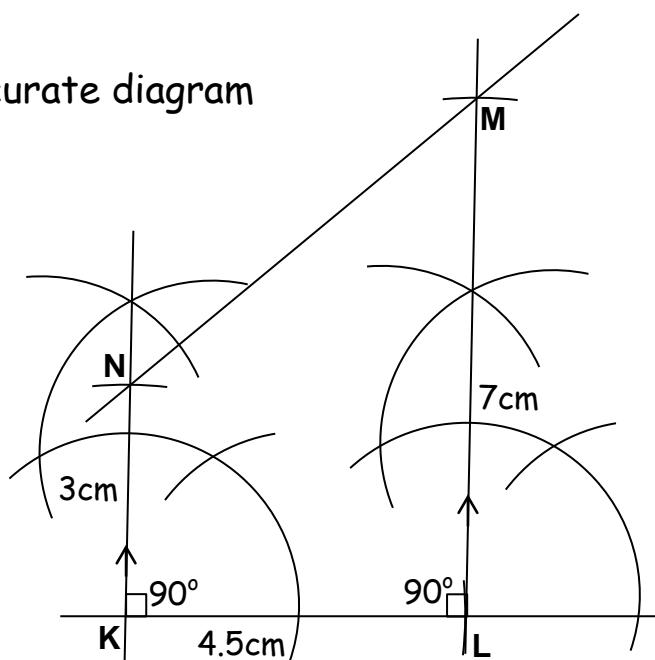
Example 2

Construct a trapezium KLMN such that $LM = 7\text{cm}$, $\angle KLM = \angle NKL = 90^\circ$, $KL = 4.5\text{cm}$ and $KN = 3\text{cm}$.

Sketch



Accurate diagram



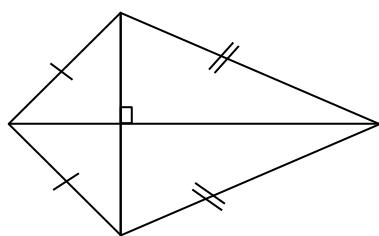
Exercise

1. a) Construct a trapezium ABCD in which $AB = 6\text{cm}$, angle $ABC = BAD = 60^\circ$ and line $AD = BC = 35\text{cm}$.
b) Measure line CD.
2. Construct a trapezium
 - a) ADEF such that $FE = 8\text{cm}$, $DE = AF = 3\text{cm}$ and $AFE = FED = 30^\circ$
 - b) CDEF where $DEF = CFE = 45^\circ$, $FE = 8.5\text{cm}$ and $CF = DE = 4\text{cm}$.
 - c) BCDA in which $AD = 6\text{cm}$, $AB = CD = 45\text{cm}$ and $\angle A = \angle D = 75^\circ$.
 - d) PMNX such that $\angle PNX = \angle XNM = 105^\circ$, $PX = NM = 4\text{cm}$ and $XN = 2.5\text{cm}$
 - e) KEVO where $KE = EV = OV = 4.5\text{cm}$ and $\angle V = \angle E = 120^\circ$.
 - f) PQRS such that $SR = 3\text{cm}$, $PS = QR = 5.5\text{cm}$ and angle $PSR = SRQ = 150^\circ$.
 - g) WXYZ where line WZ is parallel to line XY, $WXY = 90^\circ$, line $WX = 4\text{cm}$, $XY = 6.5\text{cm}$ and $WZ = 3.5\text{cm}$.
3. a) Construct a quadrilateral ABCD such that BA is parallel to CD, angle $BCD = 60^\circ$, line $CD = 4\text{cm}$ and $CB = 4.5\text{cm}$.
b) Name the Quadrilateral
c) Measure i) line BA ii) angle BAD.
4. a) Construct a trapezium JKLM in which line $JM = 3.5\text{cm}$, $JK = 6.5\text{cm}$ and $ML = 5\text{cm}$.
KJ is perpendicular to JM and JK parallel to ML.
b) Bisect angle KLM and let the bisector meet line KJ at X.
c) Measure: i) angle KLX ii) line KL iii) line LX .

TOPIC 7: GEOMETRIC CONSTRUCTION



KITES



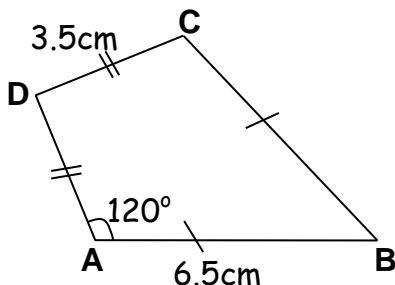
Properties

- Two of the opposite angles are equal
- Adjacent sides are equal
- Diagonals are not equal
- Diagonals intersect at right angles
- Has one line of folding symmetry

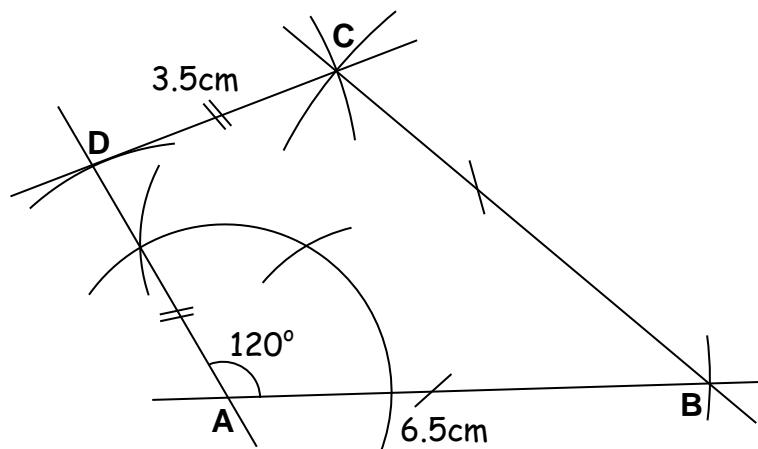
Example 1

Construct a kite ABCD where line AB = BC = 6.5cm, CD = DA = 3.5cm and angle BAD = 120°.

Sketch



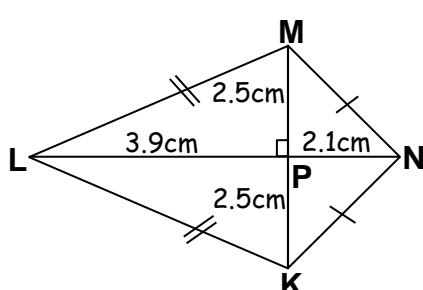
Accurate diagram



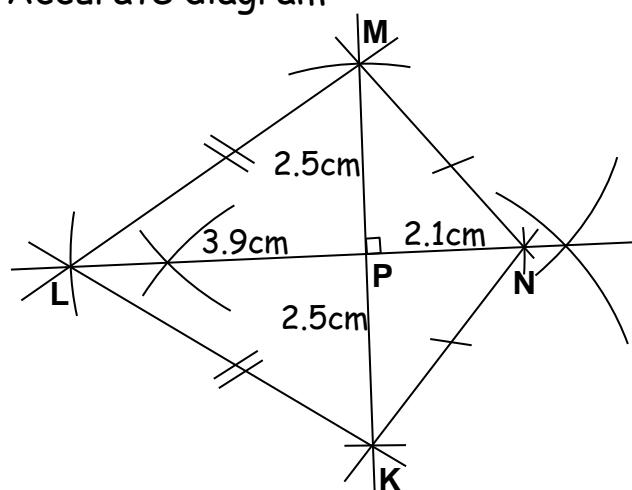
Example 2

Construct a kite KLMN where diagonal KM = 5cm. Diagonal LN bisects KM at point P such that NP = 2.1cm and LP = 3.9cm.

Sketch



Accurate diagram



TOPIC 7: GEOMETRIC CONSTRUCTION



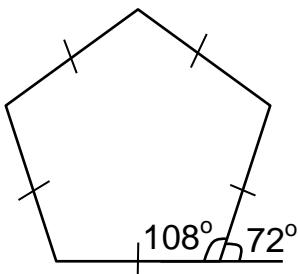
Exercise

1. a) Construct a kite PQRS where $PQ = QR = 7\text{cm}$, $RS = SR = 4\text{cm}$ and angle $\text{SRQ} = 105^\circ$.
b) Measure
 - i) angle RQP
 - ii) diagonal SQ
2. a) Construct a kite TDPQ where line $TD = TQ = 3.5\text{cm}$, angle $\text{QPD} = 45^\circ$ and $QP = PD = 8\text{cm}$.
b) Bisect angle TDP and let the bisector meet line QP at N.
c) Measure
 - i) line DN
 - ii) diagonal TP .
3. a) Construct a kite NWSC such that line $CS = 6.5\text{cm}$, angle $\text{CSW} = 105^\circ$ and angle $\text{SCW} = 30^\circ$.
b) Measure
 - i) line WS
 - ii) line CW
 - iii) angle CWN
4. a) Construct a kite PQRS such that shorter diagonal $PR = 6\text{cm}$ and the longer diagonal $SQ = 12\text{cm}$. Let the diagonals intersect at point O such that $OQ = OR = OP$.
b) Measure the size of angle PQR .
5. a) Construct a kite NEAT whose diagonal intersect at point R such that $RT = 3.5\text{cm}$, $TN = TA = 4\text{cm}$ and diagonal $TE = 9.4\text{cm}$
b) Measure
 - i) angle AEN .
 - ii) line NE .
6. a) Construct a kite JKLM such that line $KL = 7.5\text{cm}$, $JK = 4\text{cm}$ and angle $\text{JKL} = 135^\circ$.
b) Measure
 - i) diagonal KM
 - ii) angle MLK
 - iii) angle KJM
7. Construct a kite EFGH in which angle $\text{GFE} = 60^\circ$, line $FG = 4.5\text{cm}$ and its longer diagonal $FH = 10\text{cm}$. Measure angle EHG , line HE and diagonal GE .
8. Construct a kite TUVW where angle $\text{WTU} = 105^\circ$, diagonal $TV = 10\text{cm}$ and line $UV = 8.5\text{cm}$. Measure line UT and diagonal UW .

TOPIC 7: GEOMETRIC CONSTRUCTION



REGULAR PENTAGON

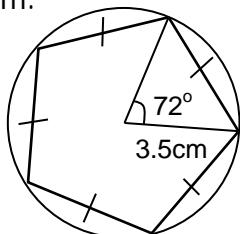


Properties of a regular pentagon

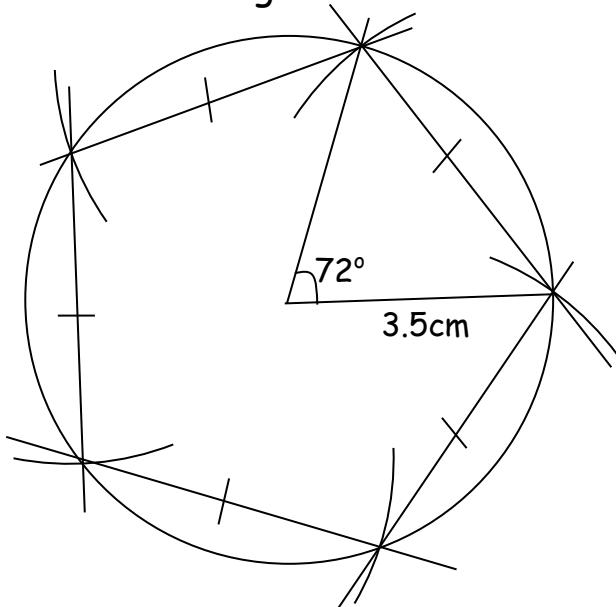
- Has 5 equal sides
- Has 5 equal angles
(Each exterior angle is 72° and each interior angle is 108°)
- Has 5 lines of folding symmetry.

Example 1

Construct a regular pentagon in a circle of radius 3.5cm.

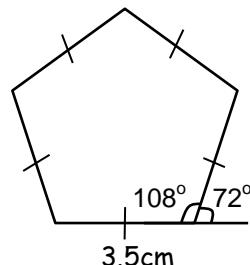


Accurate diagram

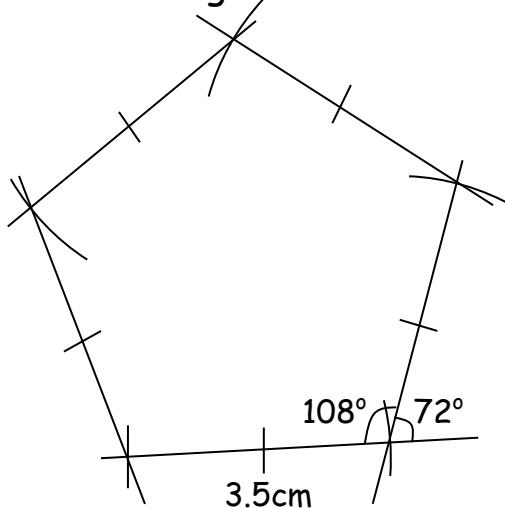


Example 2

Construct a regular pentagon of sides 3.5cm.



Accurate diagram



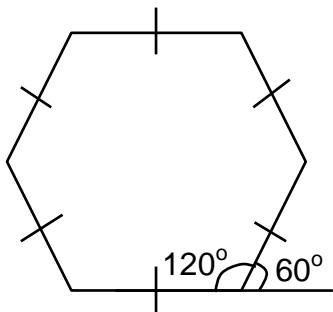
Exercise

1. Construct a regular pentagon in a circle of radius:
a) 4cm b) 3cm c) 3.5 cm d) 3.8 cm e) 2.9cm f) 4.2cm
2. a) Construct a regular pentagon in a circle of radius 2.5cm.
b) Measure its side.
c) Find its perimeter.
3. a) Construct a regular pentagon in a circle whose diameter is 6cm.
b) Find its perimeter.
4. Construct a regular pentagon of sides:
a) 3cm c) 2.8cm e) 4.0cm
b) 3.5cm d) 3.8cm f) 4.2cm

TOPIC 7: GEOMETRIC CONSTRUCTION



REGULAR HEXAGON .



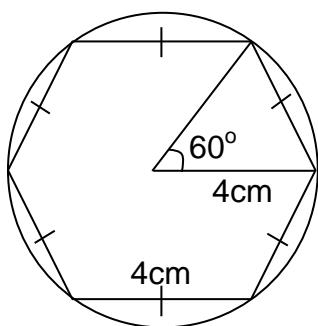
Properties of a regular hexagon

- Has six equal sides.
 - Has six line of folding symmetry.
 - Has six equal angles.
- (Each exterior angle is 60° and each interior angle is 120°)

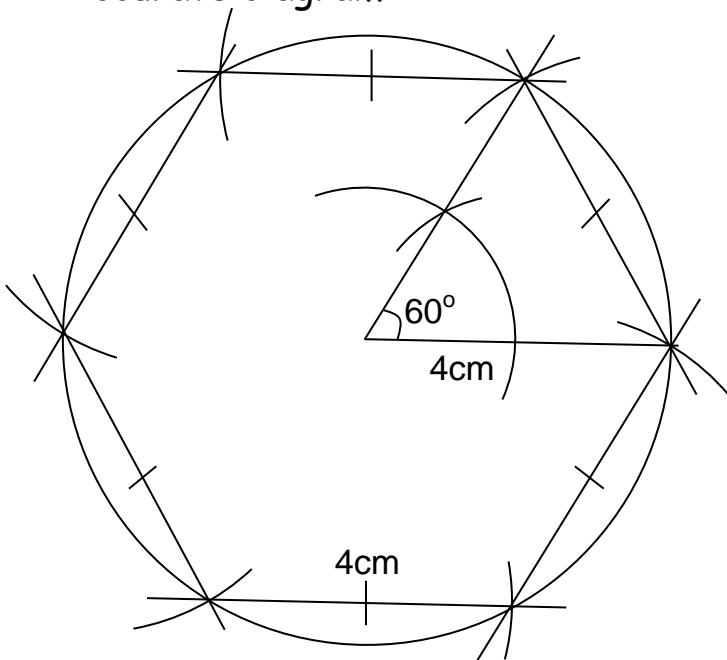
Example

Construct a regular hexagon of sides 4cm.

Sketch



Accurate diagram



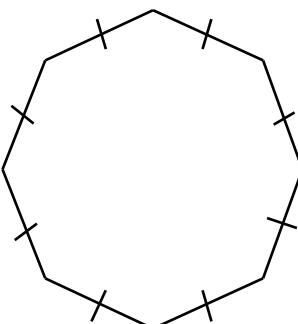
Exercise

1. Construct a regular hexagon of sides.
 - a) 3cm
 - b) 3.5cm
 - c) 2.8 cm
 - d) 3.4cm
 - e) 4cm
 - f) 4.5cm
2. Construct a regular hexagon in a circle of radius;
 - a) 3.5cm
 - b) 4cm
 - c) 4.5cm
 - d) 3.5cm
 - e) 5cm
 - f) 4.1cm
3. a) Construct a regular hexagon in a circle whose diameter is 7cm.
b) Find its perimeter.
4. Construct a regular hexagon whose perimeter is 24cm.
5. Construct a polygon whose interior angle is 120° with side 3.5cm

TOPIC 7: GEOMETRIC CONSTRUCTION



REGULAR OCTAGON



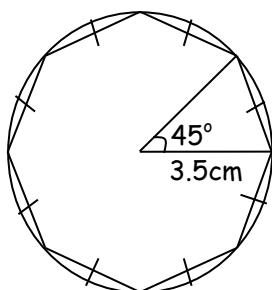
Properties of a regular octagon

- Has 8 equal sides
- Has 8 lines of folding symmetry
- Each centre angle is 45° .
- Each interior angle is 135° .

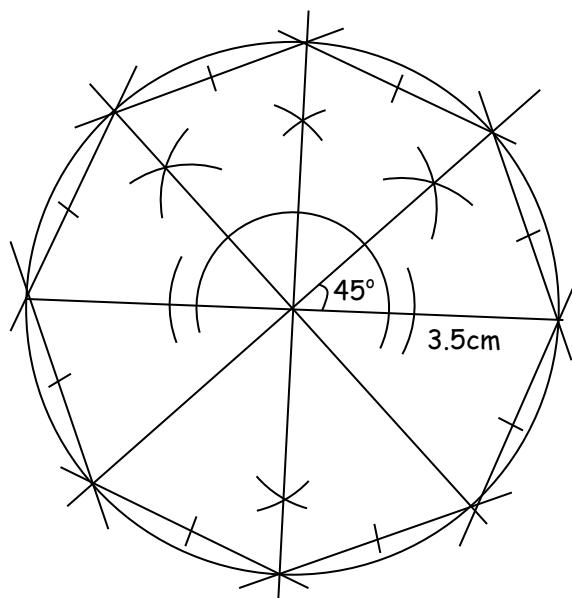
Example

Construct a regular octagon in a circle of radius 3.5cm

Sketch



Accurate diagram



Exercise

1. Construct a regular octagon in a circle of radius

a) 3cm	c) 2.5cm	e) 4cm
b) 3.5cm	d) 4.5cm	f) 5cm
2. Construct a regular octagon in a circle of diameter 6cm.
3. Construct a regular octagon in a circle of radius 3.8cm.

Group activity.

1. Construct a regular octagon of sides 3cm.
2. The exterior angle of a regular polygon is 90° less than its interior angle.
 - a) Name the polygon.
 - b) Construct the polygon if its perimeter is 28cm.
3. In a circle of radius 4cm, construct a regular polygon whose interior angle is 2 times more than the exterior angle.

TOPIC 7: GEOMETRIC CONSTRUCTION



POLYGONS

A polygon is a plane figure formed by three or more straight lines that do not cross over each other.

A polygon having all its sides equal and all its interior angles equal is called a **regular polygon**.

Note: Polygons are named according to the number of sides they have as shown in the table below.

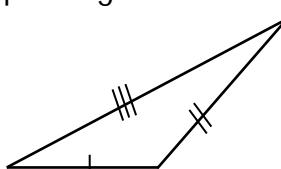
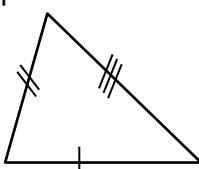
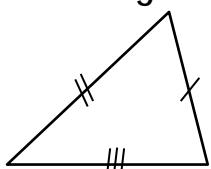
Number of sides	Name of polygon
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon
11	Hendecagon
12	Dodecagon

Types of triangles

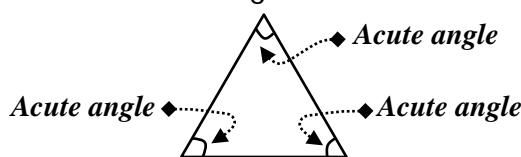
A triangle is a three sided polygon.

There are different kinds of triangle:

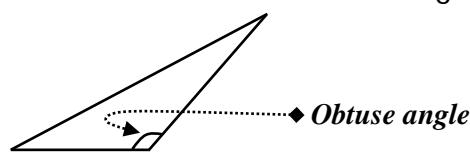
1. A scalene triangle has no equal sides and no equal angles as shown below:



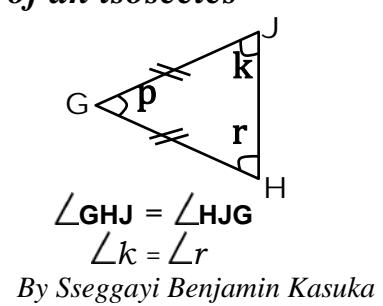
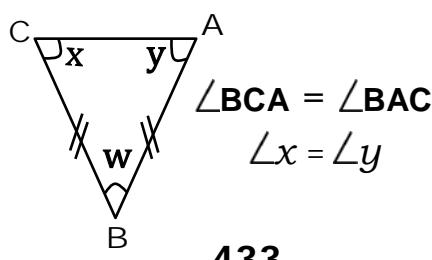
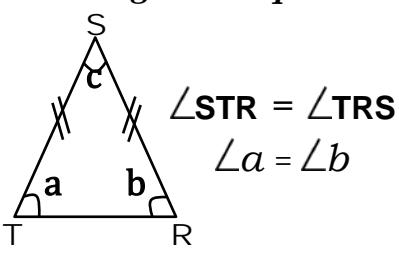
2. An acute angled triangle is a triangle whose interior angles are acute.



3. An obtuse angled triangle is a triangle that contains an obtuse interior angle.



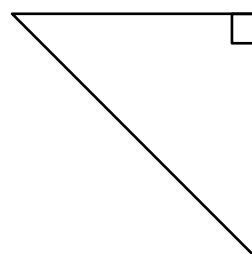
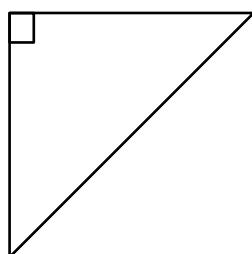
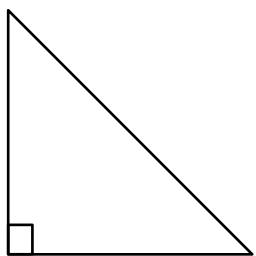
4. An isosceles triangle has two sides equal. **The base angles of an isosceles triangle are equal.**



TOPIC 7: GEOMETRIC CONSTRUCTION



5. A right angled triangle has one right angle. The side opposite to the right angle is called the ***hypotenuse***.

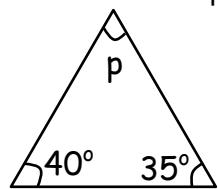


Interior angle sum of a triangle

Note: ***The interior angle sum of a triangle is 180°.***

Example 1

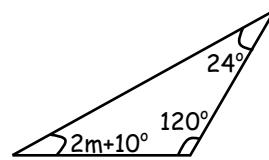
Find the value of p



$$\begin{aligned} p+40^\circ+35^\circ &= 180^\circ \\ p+75^\circ &= 180^\circ \\ p+75^\circ-75^\circ &= 180^\circ-75^\circ \\ p &= 105^\circ \end{aligned}$$

Example 2

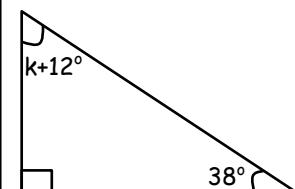
Find the value of m



$$\begin{aligned} 2m+10^\circ+120^\circ+24^\circ &= 180^\circ \\ 2m+154^\circ &= 180^\circ \\ 2m+154^\circ-154^\circ &= 180^\circ-154^\circ \\ \frac{2m}{2} &= \frac{26^\circ}{2} \\ m &= 13^\circ \end{aligned}$$

Example 3

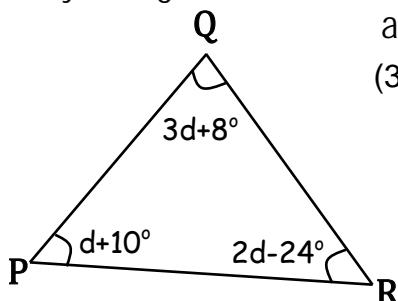
Find the value of k



$$\begin{aligned} k+12^\circ+38^\circ+90^\circ &= 180^\circ \\ k+140^\circ &= 180^\circ \\ k+140^\circ-140^\circ &= 180^\circ-140^\circ \\ k &= 40^\circ \end{aligned}$$

Example 4

Study the figure below and use it to answer questions that follow.



a) Find the value of d.

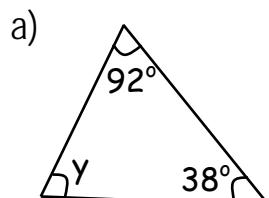
$$\begin{aligned} (3d+8^\circ)+(2d-24^\circ)+(d+10^\circ) &= 180^\circ \\ 3d+8^\circ+2d-24^\circ+d+10^\circ &= 180^\circ \\ 3d+2d+d+8^\circ+10^\circ-24^\circ &= 180^\circ \\ 6d-6^\circ &= 180^\circ \\ 6d-6^\circ+6^\circ &= 180^\circ+6^\circ \\ \frac{6d}{6} &= \frac{186^\circ}{6} \\ d &= 31^\circ \end{aligned}$$

b) Find the size of angle PRQ.

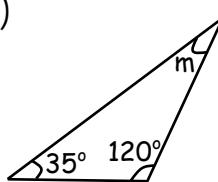
$$\begin{aligned} 2d-24^\circ & \\ 2 \times 31^\circ - 24^\circ & \\ 62^\circ - 24^\circ & \\ 38^\circ & \\ \angle PRQ &= 38^\circ \end{aligned}$$

Exercise

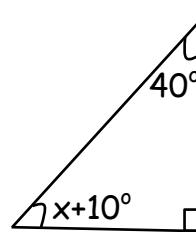
1. Find the value of the unknown angles.



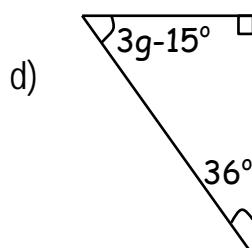
a)



b)



c)

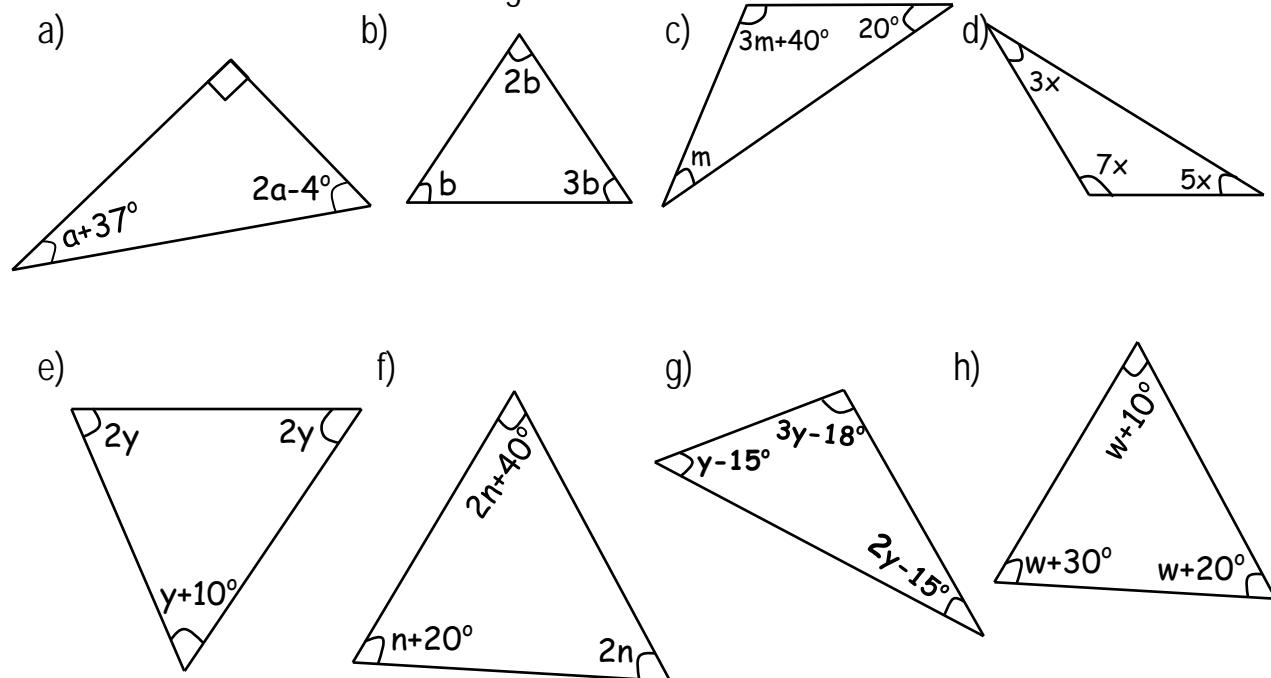


d)

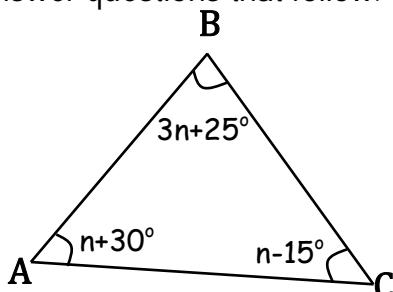
TOPIC 7: GEOMETRIC CONSTRUCTION



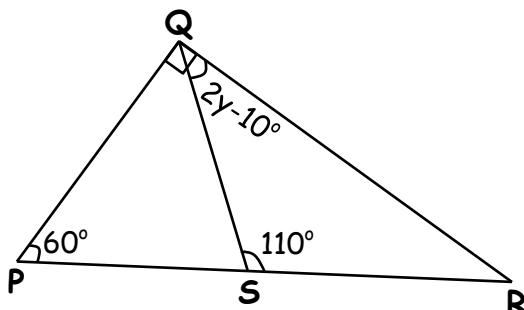
2. Find the value of the unknown angles.



3. Study the figure below and use it to answer questions that follow.

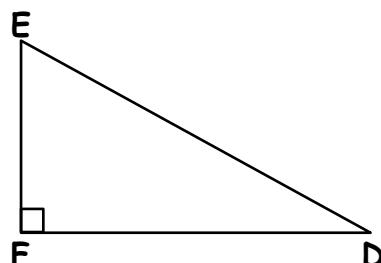


- a) Find the value of n in degrees.
 b) Find the size of angle CBA.
 4. In the figure below, PQR is a right angled triangle, $\angle SPQ = 60^\circ$, $\angle SQR = 2y-10^\circ$, $\angle PQR = 90^\circ$ and $\angle QSR = 110^\circ$



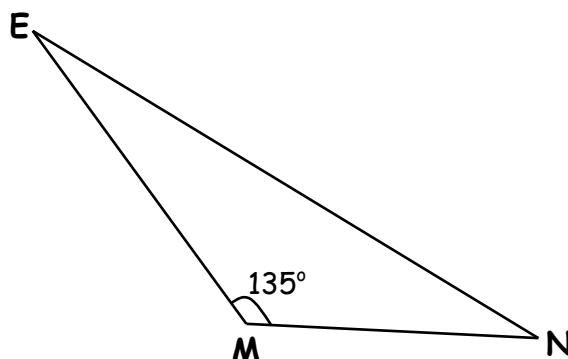
- a) Find the size of angle PRO
 b) Find the value of y in degrees.

5. In the figure below, angles FED and FDE are in the ratio of 3:2 respectively.



Find the size of angle FDE in degrees.

6. In the figure below, angle MEN is 135° less than angle MNE.

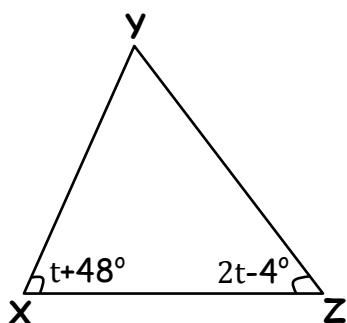


- Find the size of angle:
 i) MNE
 ii) MEN

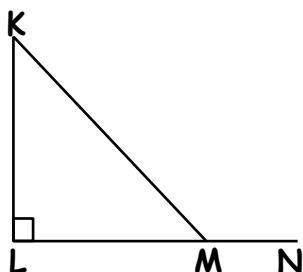
TOPIC 7: GEOMETRIC CONSTRUCTION



7. In the drawing below; $\angle YXZ$ is 3 times $\angle XZY$.



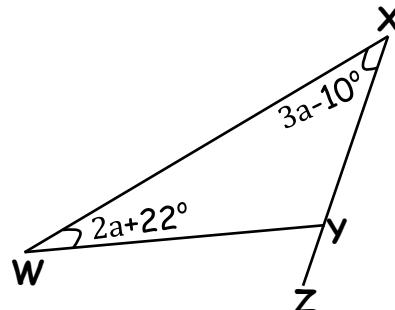
- a) Find the value of t in degrees.
 b) Find the size of angle XYZ.
8. In the figure below, KL is perpendicular to LN, KLM is a triangle and $\angle LKM$ is four fifths of $\angle LMN$.



Find the size of angle.

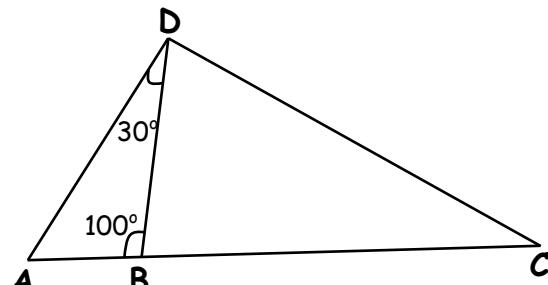
- i) $\angle LKM$
 ii) $\angle KMN$

9. Study the figure below carefully and use it to answer questions that follow.



- a) If $\angle YWX$ is 40° larger than $\angle WXY$, find the value of a in degrees.
 b) Find the size of angle.
 i) $\angle WYX$
 ii) $\angle WYZ$

10. In the figure below, line AD is perpendicular to line DC. $\angle ABD = 100^\circ$ and $\angle ADB = 30^\circ$.

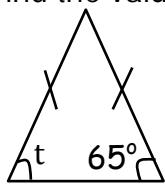


Find in degrees, the size of angle ACD

Solving problems related to base angles of an isosceles triangle.

Example 1

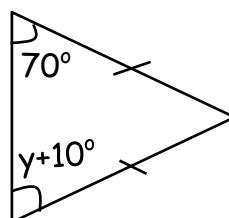
Find the value of t



$$\begin{array}{l} \text{Base angles are equal} \\ \text{Therefore } t = 65^\circ \end{array}$$

Example 2

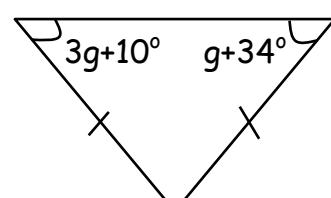
Find the value of y



$$\begin{aligned} y+10^\circ &= 70^\circ \\ y+10^\circ - 10^\circ &= 70^\circ - 10^\circ \\ y &= 60^\circ \end{aligned}$$

Example 3

Find the value of g



$$\begin{aligned} 3g+10^\circ &= g+34^\circ \\ 3g-g+10^\circ &= g-g+34^\circ \\ 2g+10^\circ &= 34^\circ \\ 2g+10^\circ - 10^\circ &= 34^\circ - 10^\circ \\ \frac{2g}{2} &= \frac{24^\circ}{2} \\ g &= 12^\circ \end{aligned}$$

Remember:

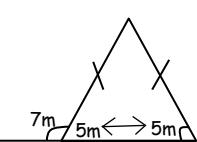
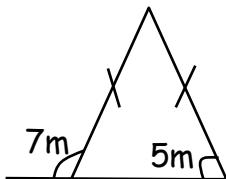
► Base angles of an isosceles triangle are equal.

TOPIC 7: GEOMETRIC CONSTRUCTION



Example 4

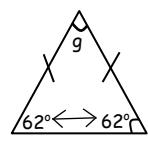
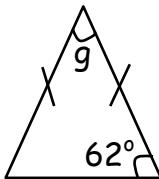
Find the value of m



$$\begin{aligned} 7m + 5m &= 180^\circ \\ 12m &= 180^\circ \\ \frac{12m}{12} &= \frac{180^\circ}{12} \\ m &= 15^\circ \end{aligned}$$

Example 5

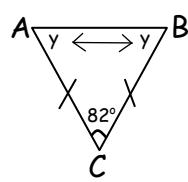
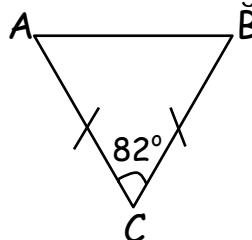
Find the value of g



$$\begin{aligned} g + 62^\circ + 62^\circ &= 180^\circ \\ g + 124^\circ &= 180^\circ \\ g + 124^\circ - 124^\circ &= 180^\circ - 124^\circ \\ g &= 56^\circ \end{aligned}$$

Example 6

Find the size of angle CAB



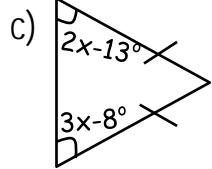
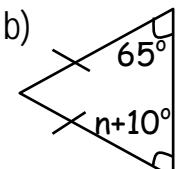
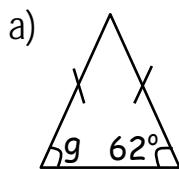
Let angle CAB be y

$$\begin{aligned} y + y + 82^\circ &= 180^\circ \\ 2y + 82^\circ &= 180^\circ \\ 2y + 82^\circ - 82^\circ &= 180^\circ - 82^\circ \\ \frac{2y}{2} &= \frac{98^\circ}{2} \\ y &= 49^\circ \end{aligned}$$

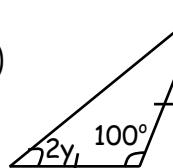
Angle CAB = 49°

Exercise

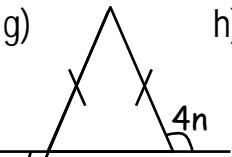
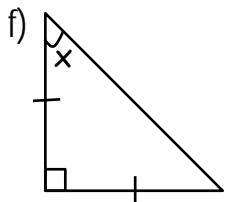
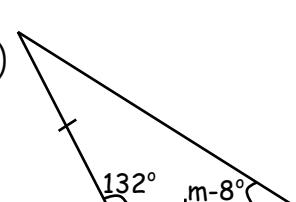
1. Find the value of the unknown.



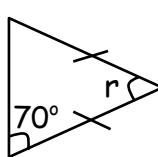
d)



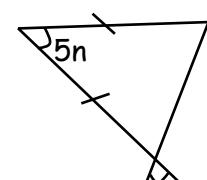
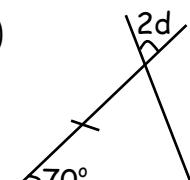
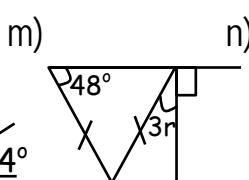
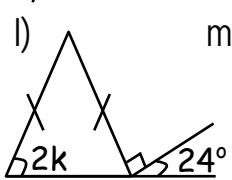
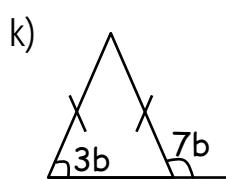
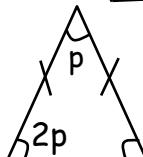
e)



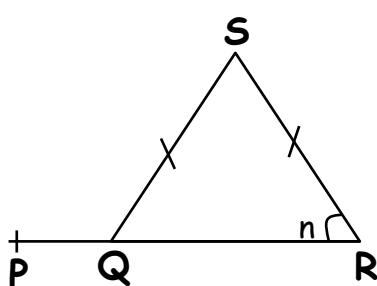
i)



j)



2. In the figure below, $QS = RS$, $\angle PQS$ is 5 times $\angle QRS$.

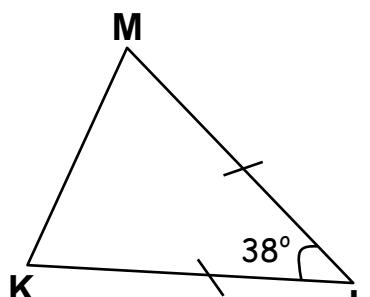


- a) Find the value of n .
- b) Find the size of angle.
 - i) $\angle PQS$
 - ii) $\angle PSR$

TOPIC 7: GEOMETRIC CONSTRUCTION

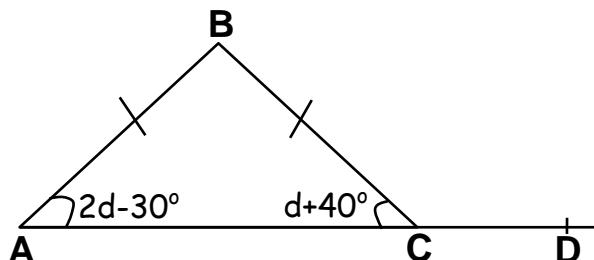


3. Study the figure below and use it to answer the question that follows.



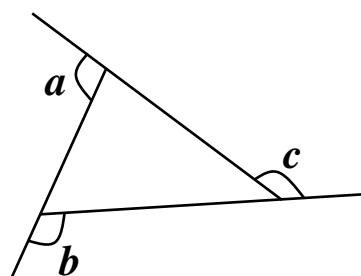
Find the size of angle KML.

4. Study the figure below and use it to answer questions that follow.



- a) Find the value of d in degrees.
b) Find the size of angle BCD.

Exterior angles of a triangle

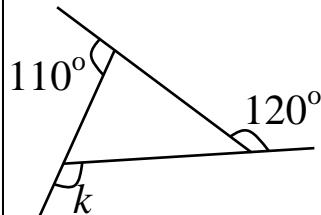


$$\angle a + \angle b + \angle c = 360^\circ$$

The interior angle sum of a triangle add up to 360°

Example 1

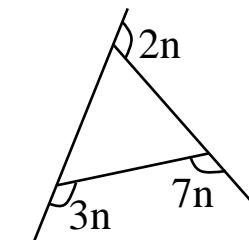
Find the value of k .



$$\begin{aligned} k + 110^\circ + 120^\circ &= 360^\circ \\ k + 230^\circ &= 360^\circ \\ k + 230^\circ - 230^\circ &= 360^\circ - 230^\circ \\ k &= 130^\circ \end{aligned}$$

Example 2

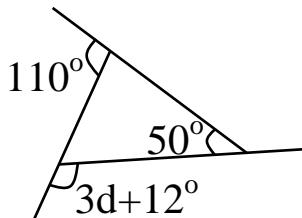
Find the value of n .



$$\begin{aligned} 7n + 3n + 2n &= 360^\circ \\ 12n &= 360^\circ \\ \frac{12n}{12} &= \frac{360^\circ}{12} \\ n &= 30^\circ \end{aligned}$$

Example 3

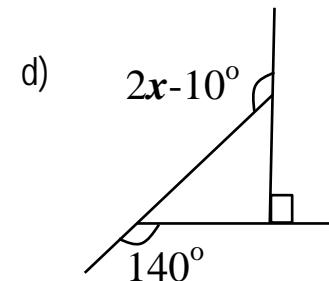
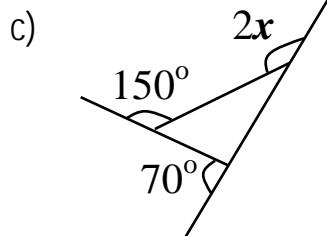
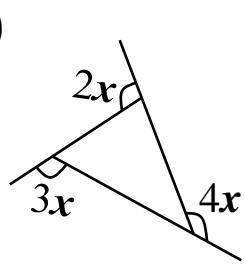
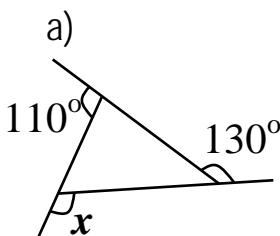
Find the value of d .



$$\begin{aligned} 180^\circ - 50^\circ &= 130^\circ \\ 3d + 12^\circ + 110^\circ + 130^\circ &= 360^\circ \\ 3d + 252^\circ &= 360^\circ \\ 3d + 252^\circ - 252^\circ &= 360^\circ - 252^\circ \\ \frac{3d}{3} &= \frac{108^\circ}{3} \\ d &= 36^\circ \end{aligned}$$

Exercise

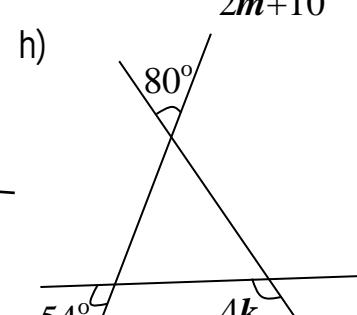
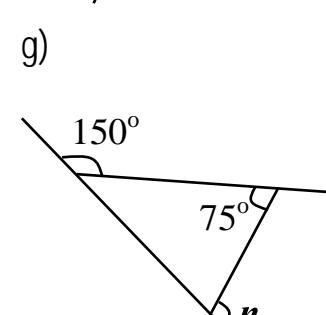
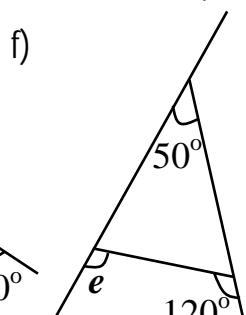
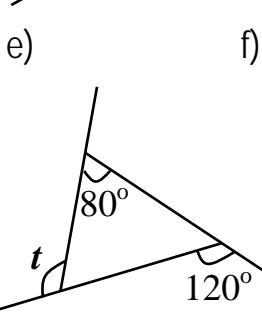
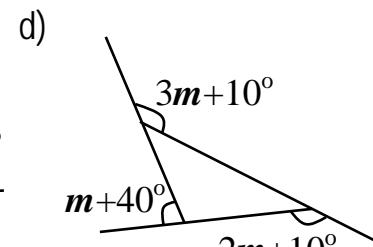
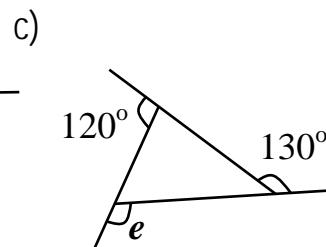
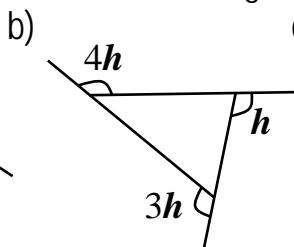
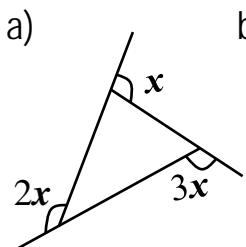
1. Find the value of x .



TOPIC 7: GEOMETRIC CONSTRUCTION

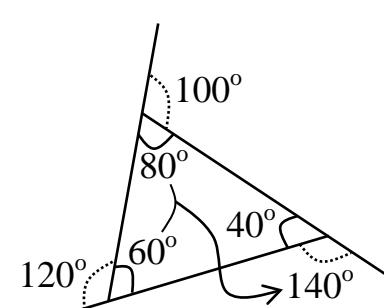
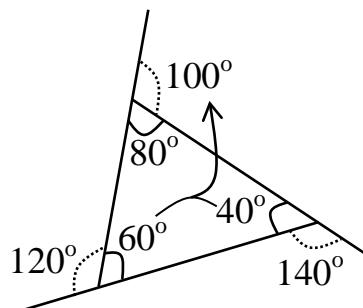
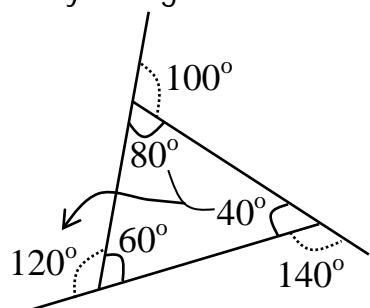


2. Find the value of the unknown angles.



Relationship between interior angles and exterior angles of a triangle

Study the figures below.

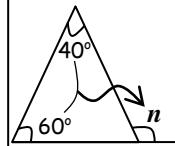
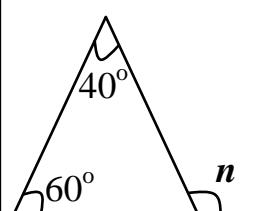


Note:

The sum of two interior angles of a triangle equals to one opposite exterior angle.

Example 1

Find the value of n

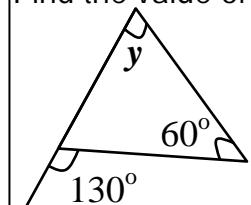


$$n = 40^\circ + 60^\circ$$

$$n = 100^\circ$$

Example 2

Find the value of y



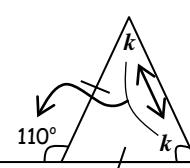
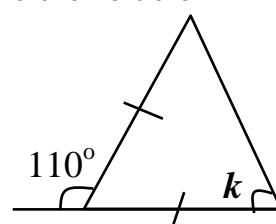
$$y + 60^\circ = 130^\circ$$

$$y + 60^\circ - 60^\circ = 130^\circ - 60^\circ$$

$$y = 70^\circ$$

Example 3

Find the value of k



$$k + k = 110^\circ$$

$$2k = 110^\circ$$

$$\frac{2k}{2} = \frac{110^\circ}{2}$$

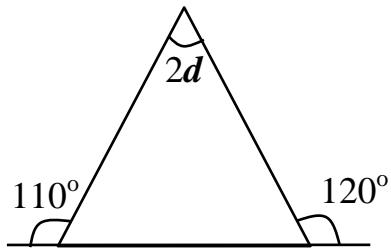
$$k = 55^\circ$$

TOPIC 7: GEOMETRIC CONSTRUCTION

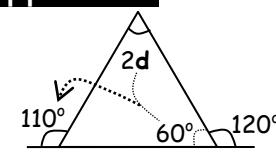


Example 4

Find the value of d

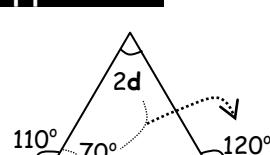


Approach 1



$$\begin{aligned}180^\circ - 120^\circ &= 60^\circ \\2d + 60^\circ &= 110^\circ \\2d + 60^\circ - 60^\circ &= 110^\circ - 60^\circ \\2d &= 50^\circ \\ \frac{2d}{2} &= \frac{50^\circ}{2} \\d &= 25^\circ\end{aligned}$$

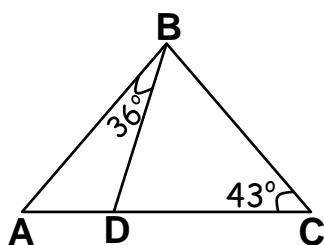
Approach 2



$$\begin{aligned}180^\circ - 110^\circ &= 70^\circ \\2d + 70^\circ &= 120^\circ \\2d + 70^\circ - 70^\circ &= 120^\circ - 70^\circ \\2d &= 50^\circ \\ \frac{2d}{2} &= \frac{50^\circ}{2} \\d &= 25^\circ\end{aligned}$$

Example 5

In triangle ABC, angle ABC = 91°, angle ACB = 43° and angle ABD = 36°. Find the size of angle ADB.



$$\angle DBC = 91^\circ - 36^\circ$$

$$\angle DBC = 55^\circ$$

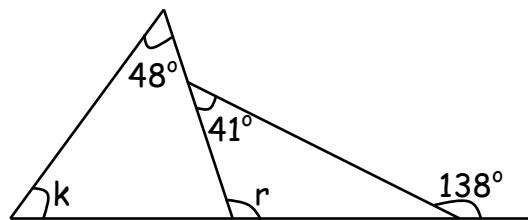
$$\angle ADB = \angle ACB + \angle DBC$$

$$\angle ADB = 55^\circ + 43^\circ$$

$$\angle ADB = 98^\circ$$

Example 6

Find the value of r and k



Value of r

$$r + 41^\circ = 138^\circ$$

$$r + 41^\circ - 41^\circ = 138^\circ - 41^\circ$$

$$r = 97^\circ$$

Value of k

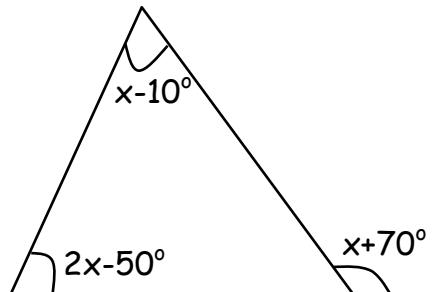
$$k + 48^\circ = 97^\circ$$

$$k + 48^\circ - 48^\circ = 97^\circ - 48^\circ$$

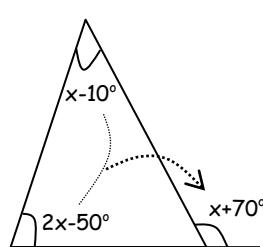
$$k = 49^\circ$$

Example 7

Find the value of x



Solution



$$\begin{aligned}2x - 50^\circ + x - 10^\circ &= x + 70^\circ \\2x + x - 50^\circ - 10^\circ &= x + 70^\circ \\3x - 60^\circ &= x + 70^\circ \\3x - x - 60^\circ &= x - x + 70^\circ \\2x - 60^\circ &= 70^\circ \\2x - 60^\circ + 60^\circ &= 70^\circ + 60^\circ \\2x &= 130^\circ \\ \frac{2x}{2} &= \frac{130^\circ}{2} \\x &= 65^\circ\end{aligned}$$

TOPIC 7: GEOMETRIC CONSTRUCTION

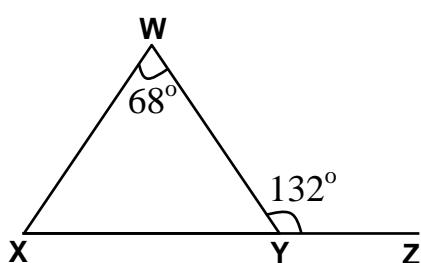


Exercise

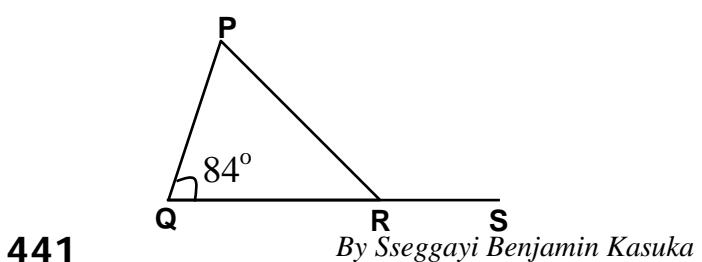
1. Find the value of the unknown angles.

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)
- k)
- l)
- m)
- n)
- o)
- p)
- q)
- r)
- s)
- t)

2. Find the size of angle WXY.



3. In the figure below, $\angle PRS$ is thrice $\angle QPR$. Find the size of $\angle PRS$.

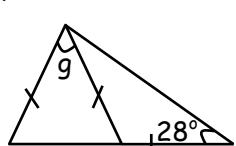


TOPIC 7: GEOMETRIC CONSTRUCTION

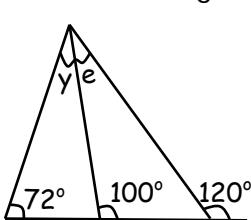


4. Find the value of the unknown angles.

a)



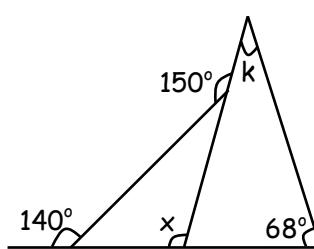
b)



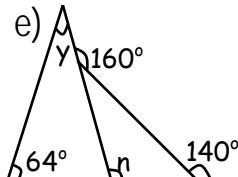
c)



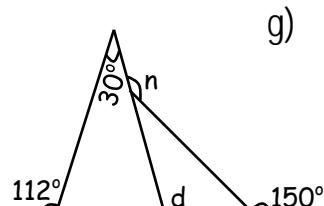
d)



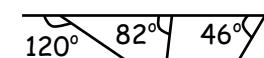
e)



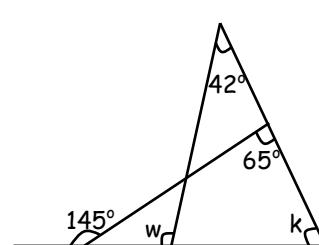
f)



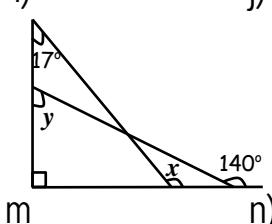
g)



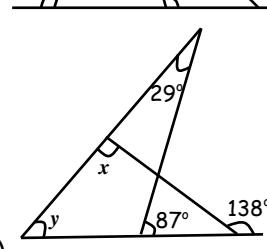
h)



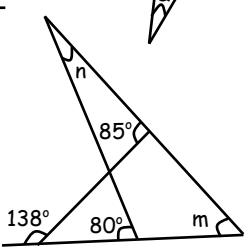
i)



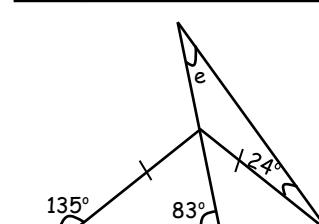
j)



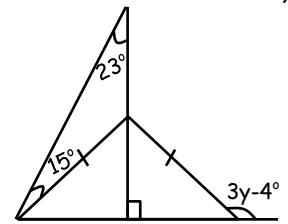
k)



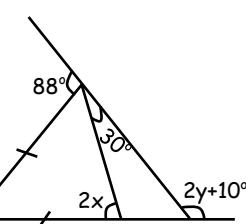
l)



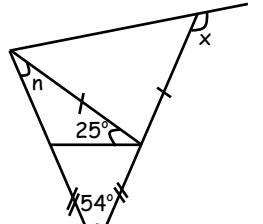
m)



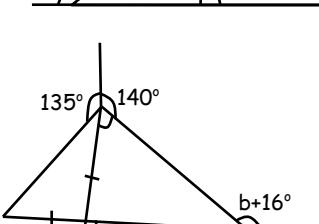
n)



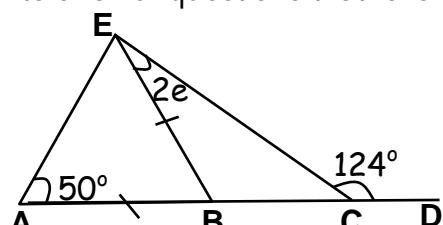
o)



p)

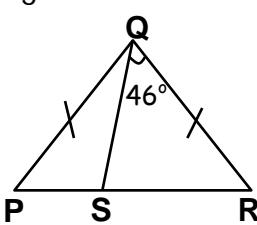


5. Study the figure below and use it to answer questions that follow.



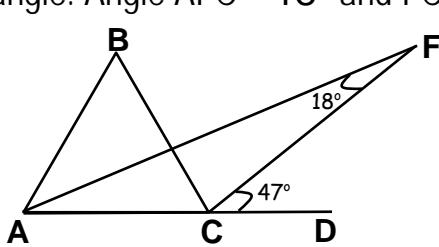
- Find the value of e .
- Find the size of angle AEC.

6. In triangle PQR, $PQ = QR$, angle PQS = 38° and angle SQR = 46°



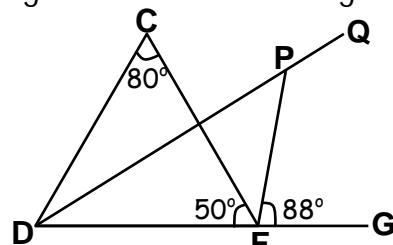
Find the size of angle QSP

7. In the figure below, ABC is an equilateral triangle. Angle AFC = 18° and FCD = 47°



Find the size of angle BAF in degrees.

8. In the figure below, DFG is a straight line. Line DQ bisects angle CDF, angle DCF = 80° , angle PFG = 88° and angle DFC = 50°



Find the size of angle FPQ.

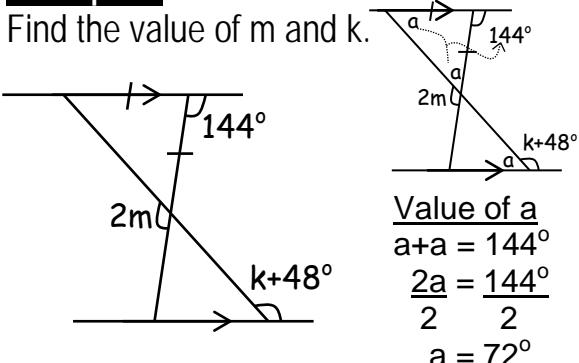
TOPIC 7: GEOMETRIC CONSTRUCTION



Angles in a triangle and on parallel lines

Example 1

Find the value of m and k .



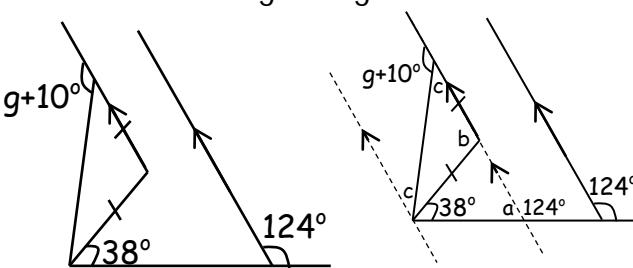
$$\begin{aligned} \text{Value of } a &= 144^\circ \\ a+a &= 144^\circ \\ \frac{2a}{2} &= \frac{144^\circ}{2} \\ a &= 72^\circ \end{aligned}$$

$$\begin{aligned} \text{Value of } m &= 2m+a = 180^\circ \\ 2m+72^\circ &= 180^\circ \\ 2m+72^\circ-72^\circ &= 180^\circ-72^\circ \\ 2m &= 108^\circ \\ \frac{2m}{2} &= \frac{108^\circ}{2} \\ m &= 54^\circ \end{aligned}$$

$$\begin{aligned} \text{Value of } k &= k+48^\circ+a = 180^\circ \\ k+48^\circ+72^\circ &= 180^\circ \\ k+120^\circ &= 180^\circ \\ k+120^\circ-120^\circ &= 180^\circ-120^\circ \\ k &= 60^\circ \end{aligned}$$

Example 2

Find the value of g in degrees.



$$\begin{aligned} \text{Value of } a &= a+124^\circ = 180^\circ \\ a+124^\circ-124^\circ &= 180^\circ-124^\circ \\ a &= 56^\circ \end{aligned}$$

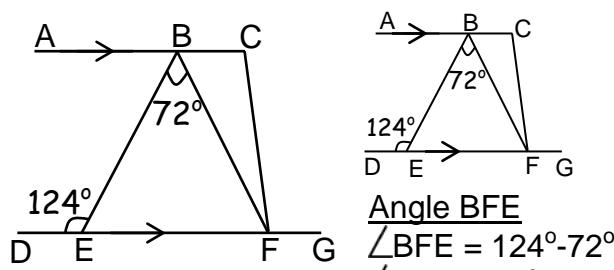
$$\begin{aligned} \text{Value of } b &= b = a+38^\circ \\ b &= 56^\circ+38^\circ \\ b &= 94^\circ \\ \text{Value of } c &= c+c+b = 180^\circ \\ 2c+94^\circ &= 180^\circ \\ 2c+94^\circ-94^\circ &= 180^\circ-94^\circ \\ 2c &= 86^\circ \\ \frac{2c}{2} &= \frac{86^\circ}{2} \\ c &= 43^\circ \end{aligned}$$

$$\begin{aligned} \text{Value of } g &= g+10^\circ+c = 180^\circ \\ g+10^\circ+43^\circ &= 180^\circ \\ g+53^\circ &= 180^\circ \\ g+53^\circ-53^\circ &= 180^\circ-53^\circ \\ g &= 127^\circ \end{aligned}$$

Example 3

In the figure below, line AC is parallel to DG. Angle DEB = 124° , EBF = 72° and angle GFC is thrice angle CFB.

Find the size of angle BCF.



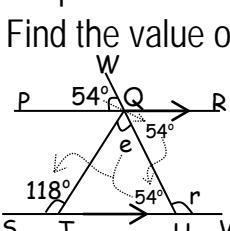
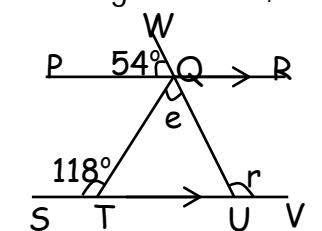
$$\begin{aligned} \text{Angle BFE} &= \angle BFE = 124^\circ - 72^\circ \\ \angle BFE &= 52^\circ \end{aligned}$$

$$\begin{aligned} \text{Let angle CFB be } y & \\ 3y+y+52^\circ &= 180^\circ \\ 4y+52^\circ &= 180^\circ \\ 4y+52^\circ-52^\circ &= 180^\circ-52^\circ \\ 4y &= 128^\circ \\ \frac{4y}{4} &= \frac{128^\circ}{4} \\ y &= 32^\circ \end{aligned}$$

$$\begin{aligned} \angle BCF &= \angle GFC \\ \angle BCF &= 3y \\ \angle BCF &= 3 \times 32^\circ \\ \angle BCF &= 96^\circ \end{aligned}$$

Example 4

In the figure below, line PR is parallel to line SV. Angle PQW = 54° and STQ = 118°



$$\begin{aligned} \text{Find the value of } e \text{ and } r & \\ \text{Value of } e &= e+54^\circ = 118^\circ \\ e+54^\circ-54^\circ &= 118^\circ-54^\circ \\ e &= 64^\circ \end{aligned}$$

$$\begin{aligned} \text{Value of } r &= r+54^\circ = 180^\circ \\ r+54^\circ-54^\circ &= 180^\circ-54^\circ \\ r &= 126^\circ \end{aligned}$$

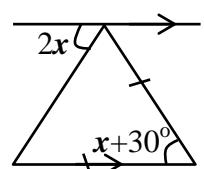
TOPIC 7: GEOMETRIC CONSTRUCTION



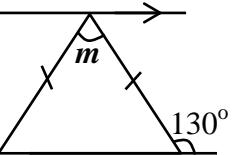
Exercise

1. Find the value of the unknown angles.

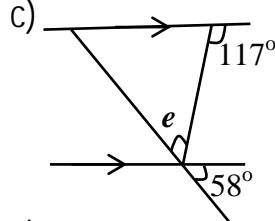
a)



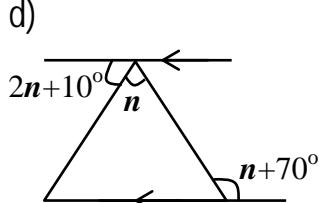
b)



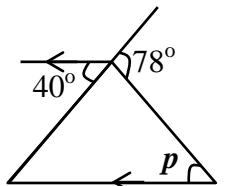
c)



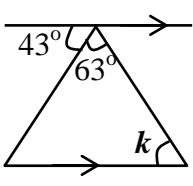
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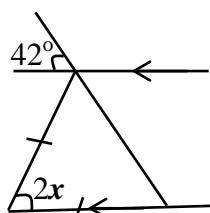
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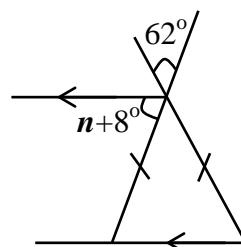
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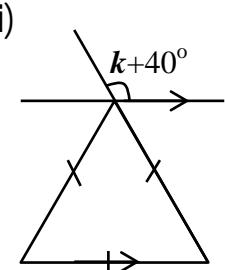
g)



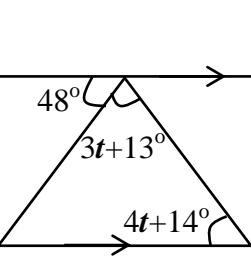
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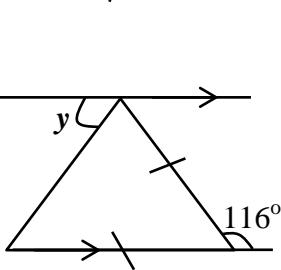
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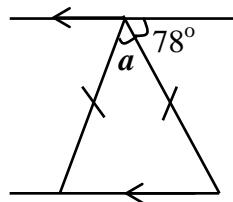
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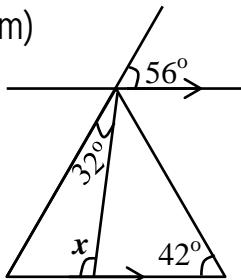
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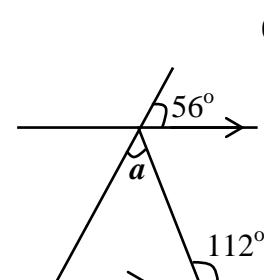
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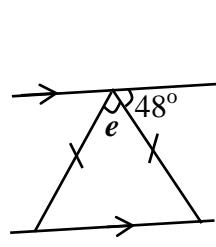
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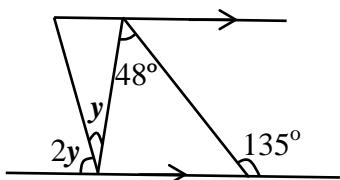
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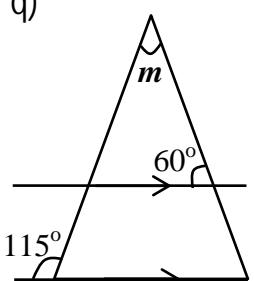
o)



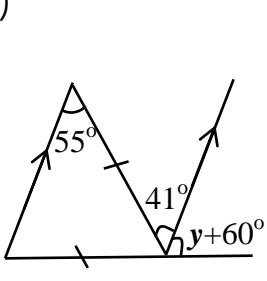
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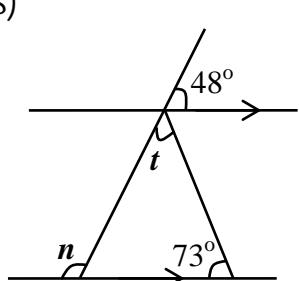
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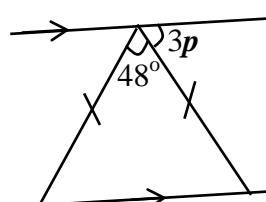
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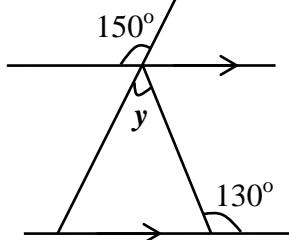
s)



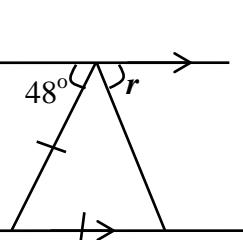
t)



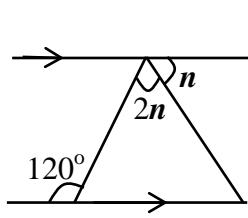
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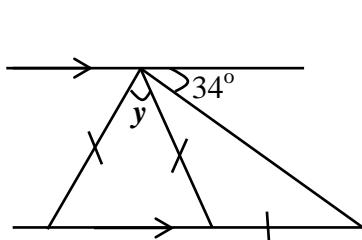
v)



w)



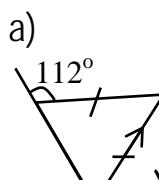
x)



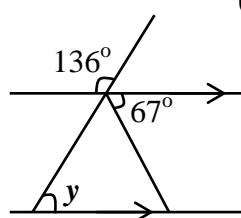
TOPIC 7: GEOMETRIC CONSTRUCTION



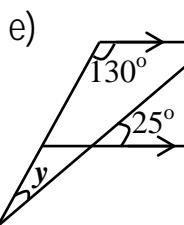
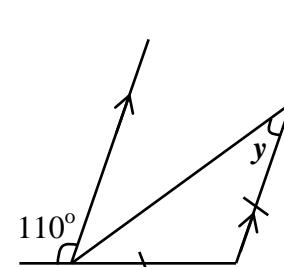
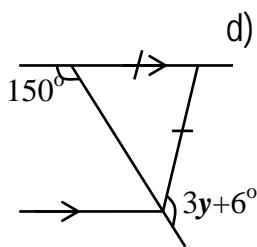
2. Find the value of y



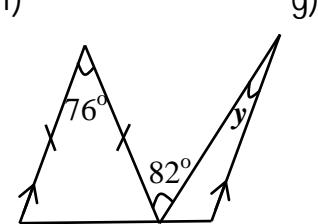
b)



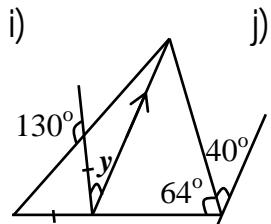
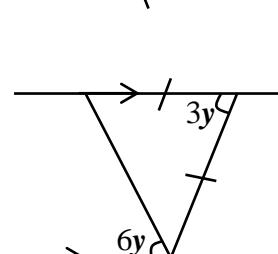
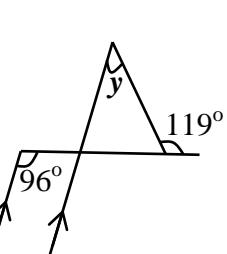
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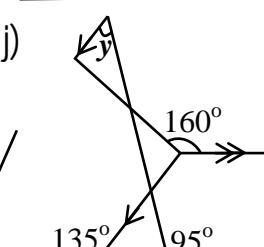
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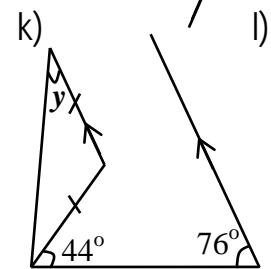
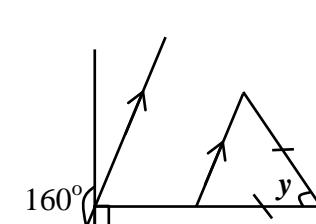
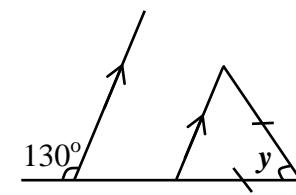
g)



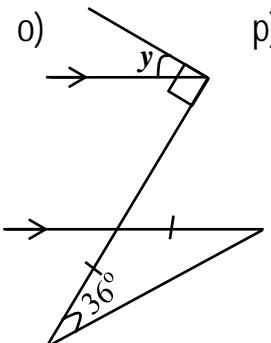
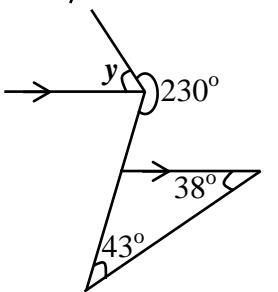
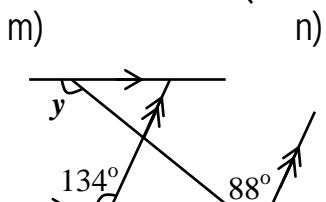
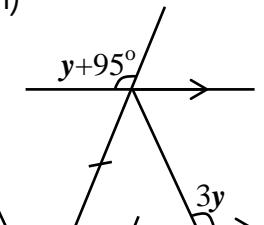
j)



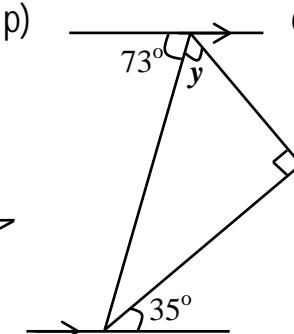
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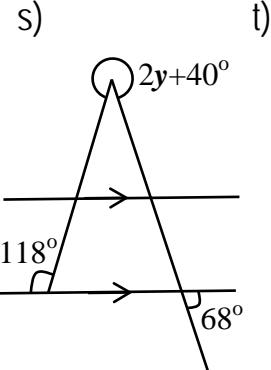
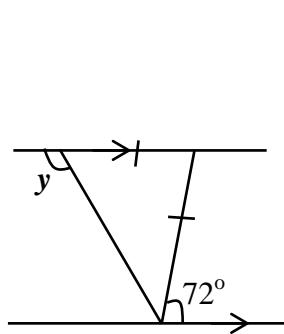
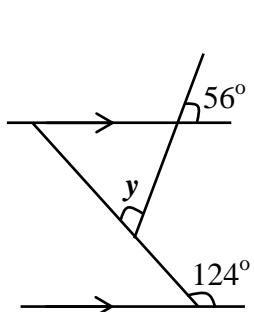
l)



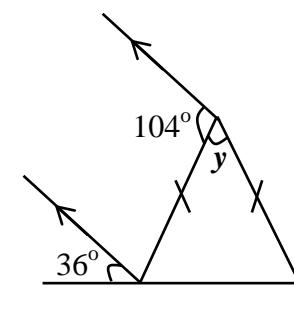
p)



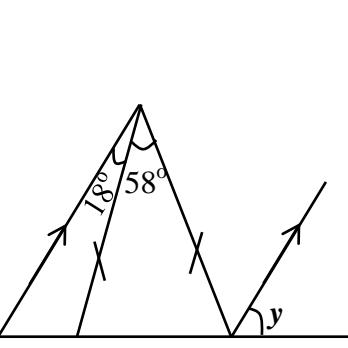
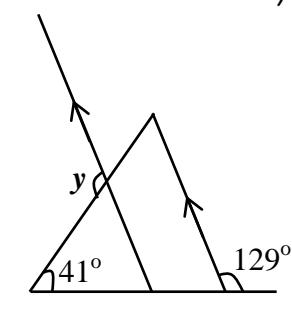
q)



t)



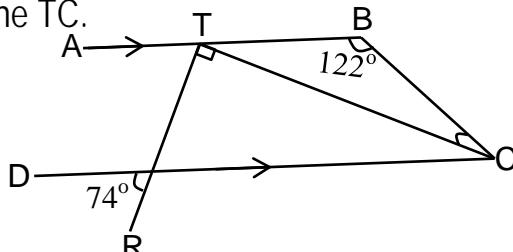
u)



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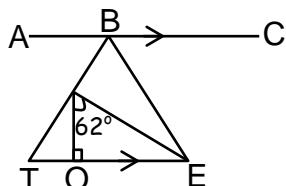


3. In the figure below, line AB is parallel to DC and line RT is perpendicular to line TC.



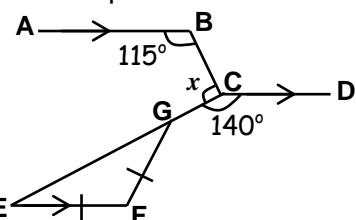
Find the size of angle TCB

4. In the figure below, AC is parallel to TE, TBE is an equilateral triangle and angle OKE = 62° . Study it carefully and answer the question that follows.



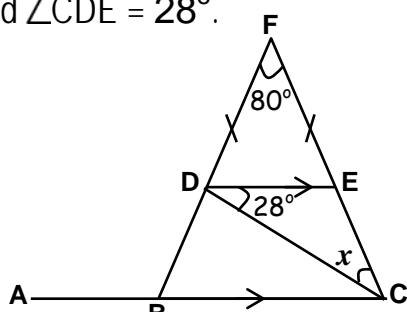
Find the size of angle KEB

5. Study the figure below and use it to answer the questions that follow.



- a) Find the value of x in degrees.
b) Find the size of angle EFG.

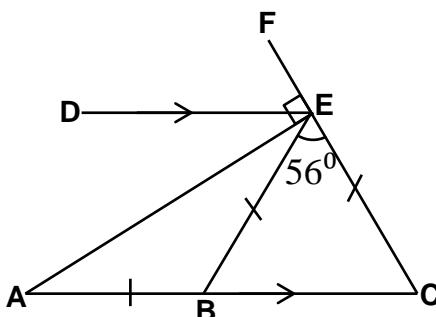
6. In the figure below DE is parallel to AC, DFE is an isosceles triangle, $\angle BFC = 80^\circ$ and $\angle CDE = 28^\circ$.



Find the value of x

Find the size of angle ABF

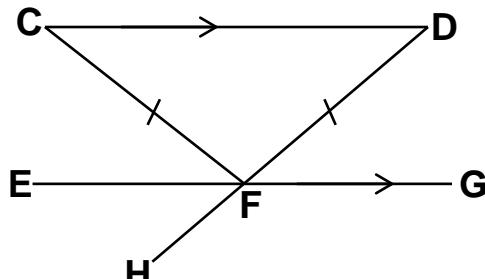
7. In the figure below line FC is perpendicular to line AE, line DE is parallel to line AC, line AB=BE=EC.



Find the size of angle

- i) ABE
ii) DEC

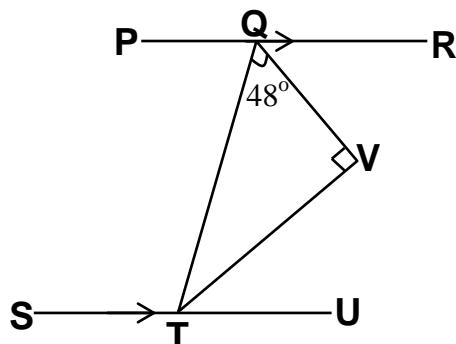
8. In the figure below, CFD is an isosceles triangle, line CD is parallel to line EG and $\angle CFD$ is 7times more than $\angle EFH$.



Find the size of angle

- i) CDF
ii) CFG

9. In the figure below PR is parallel to SU, $\angle TQV = 48^\circ$ and angle PQT is thrice angle VTU.

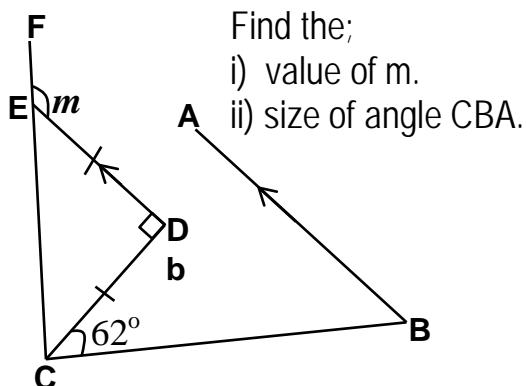


Find the size of angle STQ

TOPIC 7: GEOMETRIC CONSTRUCTION



10. Study the figure below and use it to answer questions that follow.



Angles in quadrilaterals

- A quadrilateral is a 4 sided shape.
- All the 4 angles inside any quadrilateral add up to 360° .
- Opposite angles of a parallelogram are equal.

Example 1

123° , 78° and 100° are angles in a quadrilateral. Find the size of the missing angle.

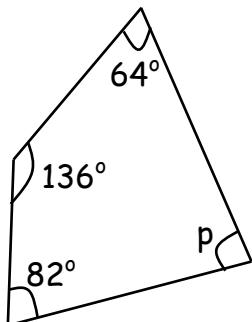
$$360^\circ - (123^\circ + 78^\circ + 100^\circ)$$

$$360^\circ - 301^\circ$$

$$59^\circ$$

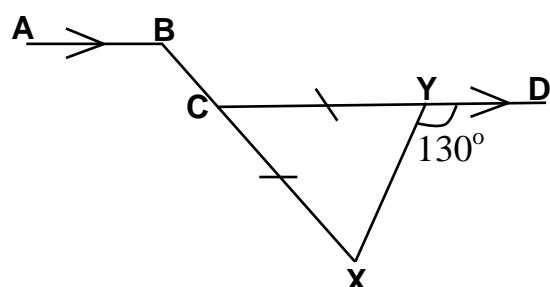
Example 2

Find the value of p .



$$\begin{aligned} p + 82^\circ + 136^\circ + 64^\circ &= 360^\circ \\ p + 282^\circ &= 360^\circ \\ p + 282^\circ - 282^\circ &= 360^\circ - 282^\circ \\ p &= 78^\circ \end{aligned}$$

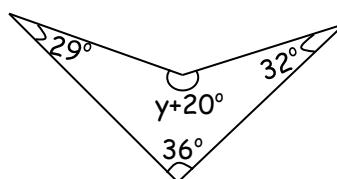
11. Study the figure below.



Find the size of angle ABX .

Example 3

Find the value of y .



$$y + 20^\circ + 32^\circ + 36^\circ + 29^\circ = 360^\circ$$

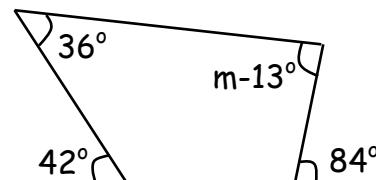
$$y + 117^\circ = 360^\circ$$

$$y + 117^\circ - 117^\circ = 360^\circ - 117^\circ$$

$$y = 243^\circ$$

Example 4

Find the value of m



$$180^\circ - 42^\circ = 138^\circ$$

$$180^\circ - 84^\circ = 96^\circ$$

$$m - 13^\circ + 36^\circ + 138^\circ + 96^\circ = 360^\circ$$

$$m + 257^\circ = 360^\circ$$

$$m + 257^\circ - 257^\circ = 360^\circ - 257^\circ$$

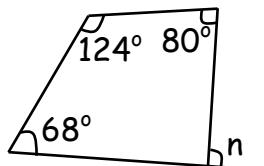
$$m = 103^\circ$$

TOPIC 7: GEOMETRIC CONSTRUCTION



Example 5

Find the value of n



$$360^\circ - (68^\circ + 124^\circ + 80^\circ)$$

$$360^\circ - 272^\circ$$

$$88^\circ$$

Value of n

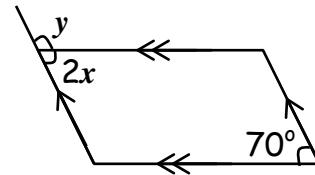
$$n+88^\circ = 180^\circ$$

$$n+88^\circ - 88^\circ = 180^\circ - 88^\circ$$

$$n = 92^\circ$$

Example 6

Find the value of x and y



Value of x

$$2x = 70^\circ$$

$$\frac{2x}{2} = \frac{70^\circ}{2}$$

$$x = 35^\circ$$

Value of y

$$y+70^\circ = 180^\circ$$

$$y+70^\circ - 70^\circ = 180^\circ - 70^\circ$$

$$y = 110^\circ$$

Exercise

1. Given below are angles in a quadrilateral. Find the size of the fourth angle.

a) $83^\circ, 160^\circ, 43^\circ$

b) $11^\circ, 93^\circ, 18^\circ$

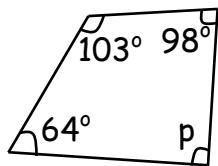
c) $90^\circ, 123^\circ, 69^\circ$

d) $163^\circ, 48^\circ, 71^\circ$

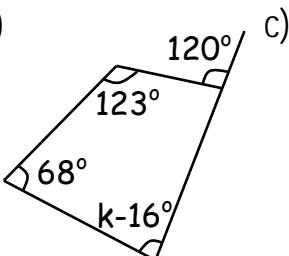
e) $24^\circ, 26^\circ, 30^\circ$

2. Find the value of the unknown.

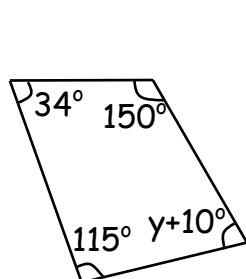
a)



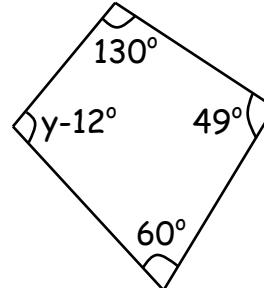
b)



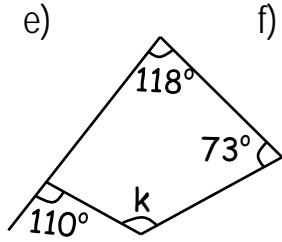
c)



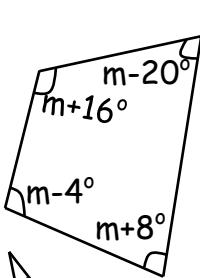
d)



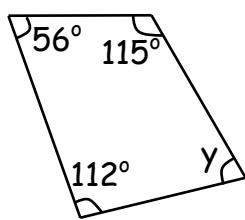
e)



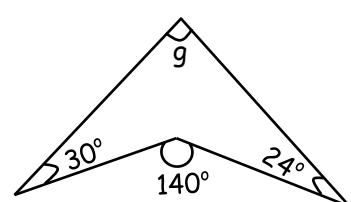
f)



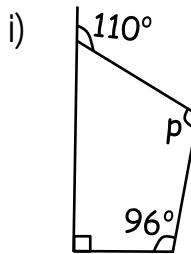
g)



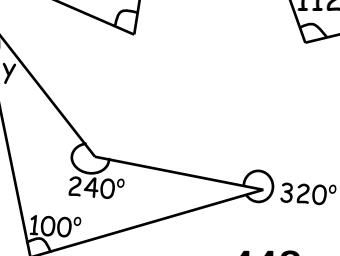
h)



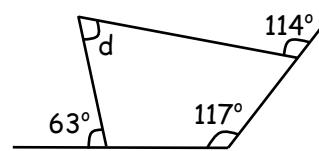
i)



j)



k)

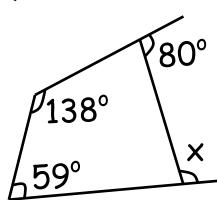


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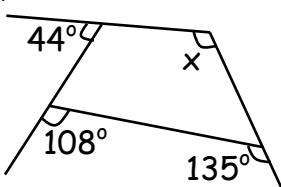


3. Find the value of x

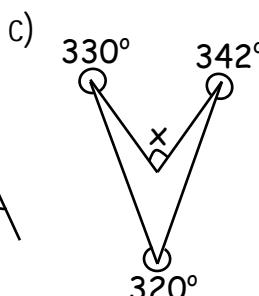
a)



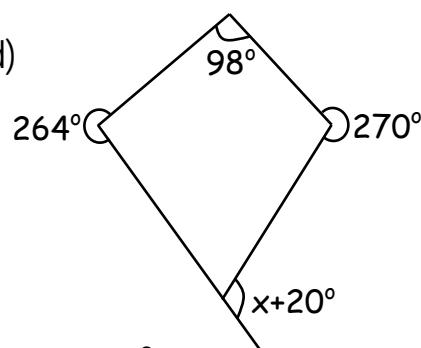
b)



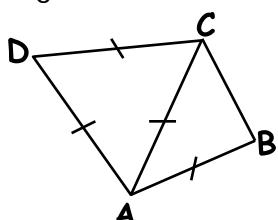
c)



d)



4. In the figure below, ABCD is a quadrilateral where angle DAB = 100°.

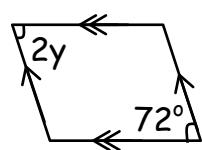


Find the size of angle BCD

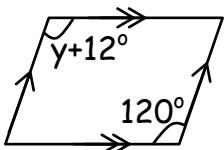
5. The four angles of a quadrilateral $x, 2x, 4x$ and $5x$. Find the value of x in degrees.

6. Find the value of y .

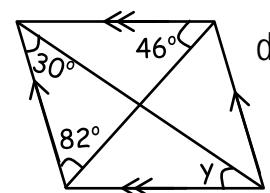
a)



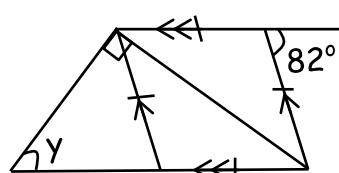
b)



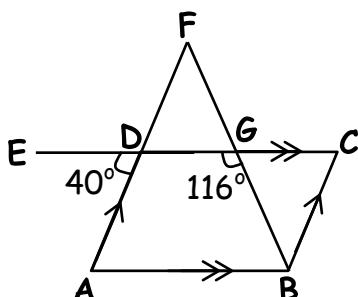
c)



d)



7. In the figure below, ABCD is a parallelogram, angle EDA = 40° and angle DGB = 116°

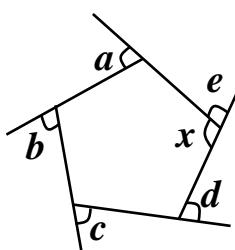


Find the size of angle FBC.

Exterior angles of regular polygons

- Exterior angles are formed outside of the polygon.
- The sum of the exterior angles of a polygon is 360° .
- The sum of the interior angle and the exterior angle at a vertex is 180° , they lie on the same straight line.

Study the figure below.



From the figure,

$$a + b + c + d + e = 360^\circ$$

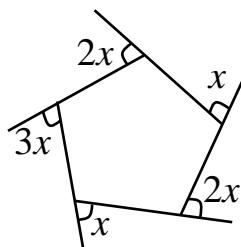
$$e + x = 180^\circ$$

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Example 1

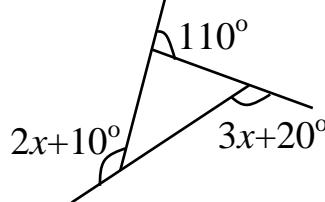
Find the value of x



$$\begin{aligned}2x + 3x + x + 2x + x &= 360^\circ \\9x &= 360^\circ \\ \frac{9x}{9} &= \frac{360^\circ}{9} \\x &= 40^\circ\end{aligned}$$

Example 2

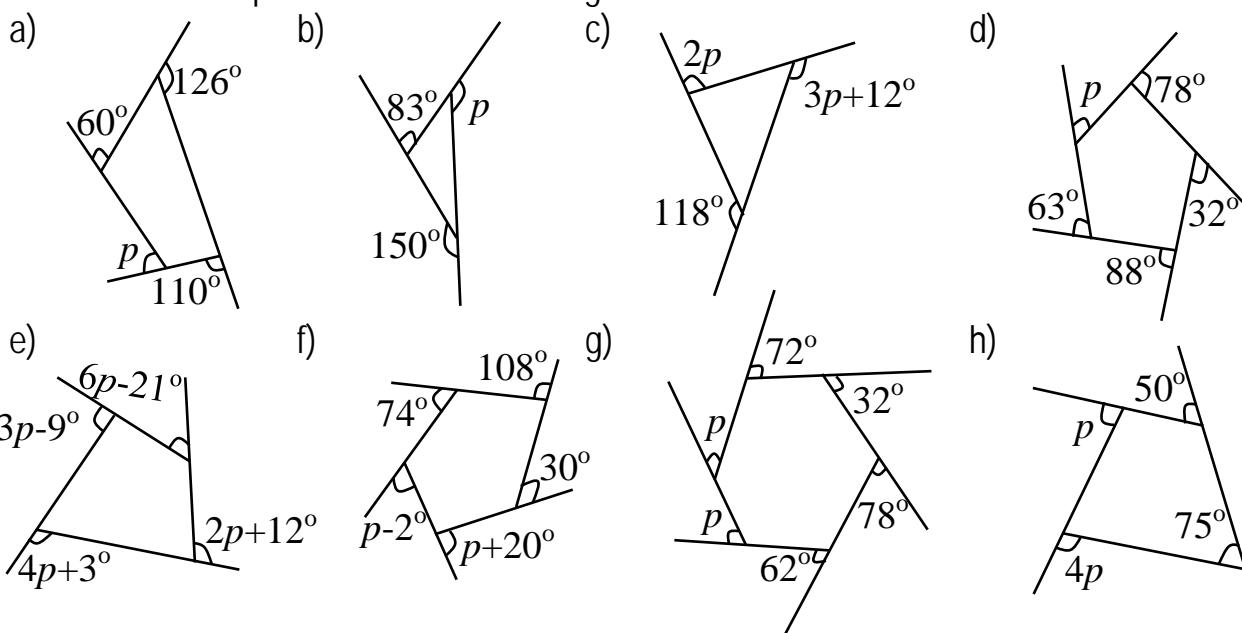
Find the value of x



$$\begin{aligned}2x+10^\circ+3x+20^\circ+110^\circ &= 360^\circ \\2x+3x+10^\circ+20^\circ+110^\circ &= 360^\circ \\5x+140^\circ &= 360^\circ \\5x+140^\circ-140^\circ &= 360^\circ-140^\circ \\ \frac{5x}{5} &= \frac{220^\circ}{5} \\x &= 44^\circ\end{aligned}$$

Exercise

Find the value of p in each of the following.



Finding exterior angles (Centre angles) of regular polygons.

- Since the interior angle of a regular polygon are all the same, the exterior angles must be equal to one another.
- To find the size of one exterior angle, we simply have to divide 360° by the number of sides in the polygon.

$$\text{Each exterior angle} = 360^\circ \div \text{number of sides}$$

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Example

Calculate the size of each exterior angle of a regular octagon.

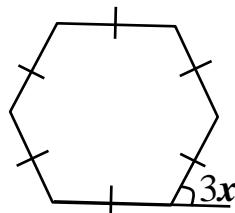
An octagon has 8 sides

$$\begin{aligned}\text{Each exterior angle} &= 360^\circ \div \text{number of side} \\ &= 360^\circ \div 8 \\ &= 45^\circ\end{aligned}$$

Exercise

1. Calculate the size of each exterior angle of a polygon with

a) 3 sides	c) 15 sides	e) 4 sides	g) 5 sides
b) 6 sides	d) 12 sides	f) 9 sides	h) 8 sides
2. If a polygon has 12 sides, find the size of each exterior angle.
3. Find the size of each exterior angle of:
 - a) a regular octagon.
 - b) a regular decagon.
 - c) a regular nonagon.
 - d) a regular pentagon.
 - e) a regular hexagon.
 - f) an equilateral triangle.
4. Find the value of x in the figure below:



5. Find the size of each centre angle of a square.

6. If a regular polygon has 36 sides, find the size of each centre angle.

Finding the number of sides of a regular polygon whose exterior angle is given.

$$\text{Number of sides} = 360^\circ \div \text{Each exterior angle}$$

Example

Each exterior angle of a regular polygon is 24° . Find the number of sides.

$$\begin{aligned}\text{Number of sides} &= \frac{360^\circ}{\text{Ext. } \angle} \\ &= \frac{360^\circ}{24^\circ} \\ &= 15 \text{ sides}\end{aligned}$$

Exercise

1. Calculate the number of sides of a polygon whose centre angle is

a) 120°	b) 60°	c) 72°	d) 40°	e) 45°	f) 18°
----------------	---------------	---------------	---------------	---------------	---------------
2. The size of each exterior angle of a regular polygon is 30° . Find the number of sides.
3. Each exterior angle of a regular polygon is 90° . Find the number of sides.
4. The sum of four exterior angles of a polygon is 180° . Name the polygon.

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Exterior angles and interior angles of a polygon

Note that, for any polygon, the interior angle and exterior angle at a vertex, they add up to **180°**. This means that we can work out the interior angle from the exterior angle and vice versa.

- **Interior angle + Exterior angle = 180°**
- **Interior angle = 180° - Exterior angle**
- **Exterior angle = 180° - Interior angle**

Example 1

The exterior angle of a regular polygon is 30° . Find the size of each interior angle.

Let the interior angle be y

$$\begin{array}{l} \text{Diagram: An angle } y \text{ is shown with an arc of } 30^\circ \text{ at its vertex.} \\ y + 30^\circ = 180^\circ \\ y + 30^\circ - 30^\circ = 180^\circ - 30^\circ \\ y = 150^\circ \end{array}$$

Example 2

The interior angle and exterior angle of a regular polygon are in the ratio of 7:2 respectively.

a) Find the size of each interior angle.

$$\begin{aligned} \text{Total ratio} &= 7+2 \\ &= 9 \end{aligned}$$

$$\begin{aligned} \text{Interior angle} &= \frac{7}{9} \times 180^\circ \\ &= 7 \times 20^\circ \\ &= 140^\circ \end{aligned}$$

b) Name the polygon.

$$\begin{aligned} \text{Exterior angle} &= \frac{2}{9} \times 180^\circ \\ &= 2 \times 20^\circ \\ &= 40^\circ \end{aligned}$$

$$\begin{aligned} \text{Number of sides} &= \frac{360^\circ}{40^\circ} \\ &= 9 \text{ sides} \end{aligned}$$

The polygon is a nonagon

Example 3

Name the polygon whose interior angle is 135°

Let the exterior angle be y

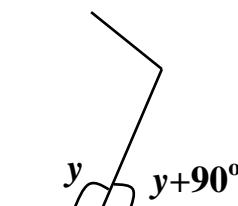
$$\begin{array}{l} \text{Diagram: An angle } y \text{ is shown with an arc of } 135^\circ \text{ at its vertex.} \\ y + 135^\circ = 180^\circ \\ y + 135^\circ - 135^\circ = 180^\circ - 135^\circ \\ y = 45^\circ \\ \text{Number of sides} = \frac{360^\circ}{45^\circ} \\ = 8 \text{ sides} \end{array}$$

The polygon is an octagon

Example 4

The interior angle of a regular polygon is 90° more than the centre angle. Find the size of each centre angle.

Let the centre angle be y



$$\begin{aligned} y + y + 90^\circ &= 180^\circ \\ 2y + 90^\circ &= 180^\circ \\ 2y + 90^\circ - 90^\circ &= 180^\circ - 90^\circ \\ 2y &= 90^\circ \\ \frac{2y}{2} &= \frac{90^\circ}{2} \\ y &= 45^\circ \end{aligned}$$

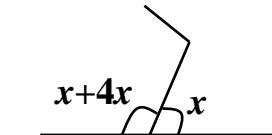
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Example 5

The interior angle of a polygon is 4 times more than the exterior angle.
Find the size of each interior angle.

Let the centre angle be x



$$\begin{aligned} x + x + 4x &= 180^\circ \\ 6x &= 180^\circ \\ \frac{6x}{6} &= \frac{180^\circ}{6} \\ x &= 30^\circ \end{aligned}$$

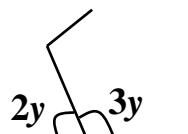
Interior angle

$$\begin{aligned} x + 4x \\ 30^\circ + (4 \times 30^\circ) \\ 30^\circ + 120^\circ \\ 150^\circ \end{aligned}$$

Example 6

The exterior angle of a polygon is $\frac{2}{3}$ of its interior angle. Name the polygon.

$$\frac{2}{3} = 2:3$$



$$\begin{aligned} 3y + 2y &= 180^\circ \\ 5y &= 180^\circ \\ \frac{5y}{5} &= \frac{180^\circ}{5} \\ y &= 36^\circ \end{aligned}$$

$$\begin{aligned} \text{Exterior angle} &= 2y \\ &= 2 \times 36^\circ \\ &= 72^\circ \end{aligned}$$

$$\begin{aligned} \text{Number of sides} &= \frac{360^\circ}{72^\circ} \\ &= 5 \text{ sides} \end{aligned}$$

The polygon is a pentagon

Exercise

1. Find the size of each interior angle of a polygon whose centre angle is;
 - a) 36°
 - b) 18°
 - c) 30°
 - d) 45°
 - e) 15°
 - f) 12°
 - g) 72°
 - h) 20°
2. The interior angle of a regular polygon is 140° .
 - a) Find the size of each exterior angle.
 - b) Name the polygon.
3. Name the polygon whose interior angle is 135° .
4. Find the number of sides of a polygon whose interior angle is 108° .
5. The interior angle of a polygon is 4 times the centre angle.
 - a) Find the size of each centre angle.
 - b) Name the polygon.
6. Calculate the number of sides of a polygon whose interior angle is equal to the exterior angle.
7. The interior angle of a polygon is twice the exterior angle.
 - a) Find the size of each interior angle.
 - b) Name the polygon.

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8. The interior angle is 5 times the exterior angle of a polygon.
 - a) Calculate the number of sides of a polygon.
 - b) Name the polygon.
9. The interior angle and exterior angle of a polygon are in the ratio of 3:1 respectively.
 - a) Find the size of each interior angle.
 - b) Calculate the number of sides of a polygon.
10. The ratio of the exterior angle to interior angle of a polygon is 1:5 respectively. Calculate the number of sides of a polygon.
11. The centre angle and interior angle of a polygon are in the ratio of 2:3 respectively.
 - a) Find the size of one interior angle.
 - b) Name the polygon.
12. Find the number of sides of a polygon whose exterior angle and interior angle are in the ratio of 2:13 respectively.
13. The centre angle of a polygon is half the interior angle.
 - a) Calculate the size of each interior angle.
 - b) Find the number of sides of the polygon.
14. The exterior angle is a quarter of the interior angle of a polygon.
 - a) Find the size of each exterior angle.
 - b) Name the polygon
15. The exterior angle of a regular polygon is two sevenths the interior angle. Name the polygon.
16. Name the regular polygon whose exterior angle is two thirds of its interior angle.
17. Calculate the number of sides of a polygon whose exterior angle is a ninth of its interior angle.
18. The exterior angle of a polygon is twice the interior angle. Name the polygon.
19. The interior angle of a polygon is 100° more than the exterior angle.
 - a) Find the size of one exterior angle.
 - b) Calculate the number of sides of the polygon.
20. The interior angle of a regular polygon is 108° more than the exterior angle.
 - a) Find the size of one interior angle.
 - b) Name the polygon.
21. The exterior angle of a polygon is 60° more than the exterior angle.
 - a) Find the size of each interior angle.
 - b) Name the polygon.
22. The exterior angle of a polygon is 90° less than the interior angle.
 - a) Find the size of each exterior angle.
 - b) Calculate the number of sides.
 - c) Name the polygon.
23. The exterior angle of a polygon is 120° less than the interior angle.
 - a) Find the interior angle.
 - b) Name the polygon.

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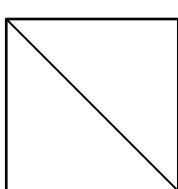
24. Find the number of sides of a polygon whose exterior angle is 150° less than its interior angle.
25. Name the polygon whose interior angle is 60° less than the exterior angle.
26. Given that the interior angle and exterior angle are $7x$ and $2x$ respectively.
- Find the value of x
 - Calculate the number of sides of the polygon.
27. The interior angle of a polygon is 10 times more than the exterior angle.
Calculate the number of sides of the polygon.
28. The interior angle of a polygon is 3 times more than the centre angle.
- Find the size of each centre angle
 - Name the polygon.
29. The interior angle of a polygon is 7 times more than the exterior angle.
- Find the size of each interior angle.
 - Find the number of sides of the polygon.
30. Calculate the number of sides of a polygon whose interior angle is 8 times more than the exterior angle.
31. Name the polygon whose interior angle is 4 times more than its exterior angle.
32. The interior angle of a polygon is 2 times more than the centre angle.
- Calculate the size of each interior angle.
 - Name the polygon.

Forming triangles from polygons

The division of a surface or plane polygon into a set of triangles is called triangulation

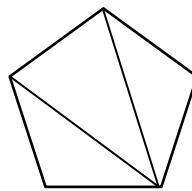
Study the figures below.

Quadrilateral



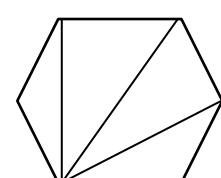
4 sides
2 triangles

Pentagon



5 sides
3 triangles

Hexagon



6 sides
4 triangles

► From the figures above, we take away 2 from the number of sides of a polygon to get the number of triangles.

Let " n " represent the number of sides of a polygon.

So, Number of triangles = *number of sides* – 2

$$= n - 2$$

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Example 1

Find the number of triangles that can be formed from a regular pentagon.

$$\begin{aligned}\text{Number of triangles} &= n - 2 \\ &= 5 - 2 \\ &= 3 \text{ triangles}\end{aligned}$$

Example 2

How many triangles can be formed from a polygon whose interior angle is 135° .

Let the interior angle be y

$$\begin{aligned}y + 132^\circ &= 180^\circ \\ y + 135^\circ - 135^\circ &= 180^\circ - 135^\circ \\ y &= 45^\circ\end{aligned}$$

$$\begin{aligned}\text{Number of sides} &= \frac{360^\circ}{45^\circ} \\ &= 8 \text{ sides}\end{aligned}$$

$$\begin{aligned}\text{Number of triangles} &= n - 2 \\ &= 8 - 2 \\ &= 6 \text{ triangles}\end{aligned}$$

Example 3

The exterior angle of a polygon is 132° less than the interior angles. Calculate the number of triangles that can be formed from that polygon.

Let the interior angle be y

$$\begin{aligned}y + y - 132^\circ &= 180^\circ \\ 2y - 132^\circ &= 180^\circ \\ 2y - 132^\circ + 132^\circ &= 180^\circ + 132^\circ \\ 2y &= \frac{312^\circ}{2} \\ y &= 156^\circ\end{aligned}$$

Exterior angle

$$\begin{aligned}y - 132^\circ \\ 156^\circ - 132^\circ \\ 24^\circ\end{aligned}$$

$$\begin{aligned}\text{Number of sides} &= \frac{360^\circ}{24^\circ} \\ &= 15 \text{ sides}\end{aligned}$$

$$\begin{aligned}\text{Number of triangles} &= n - 2 \\ &= 15 - 2 \\ &= 13 \text{ triangles}\end{aligned}$$

Example 4

Given that, 8 triangles can be formed from a polygon. Find the number of sides of the polygon.

$$\begin{aligned}n - 2 &= \text{Number of sides} \\ n - 2 &= 8 \\ n - 2 + 2 &= 8 + 2 \\ n &= 10\end{aligned}$$

The polygon has 10 sides

Exercise

1. Find the number of triangles that can be formed from;
 - a) a quadrilateral.
 - b) a regular decagon.
 - c) a regular octagon.
 - d) a regular heptagon.

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2. Find the number of triangles that can be formed from a polygon with.
 - a) 6 sides
 - b) 10 sides
 - c) 4 sides
 - d) 9 sides
 - e) 7 sides
 - f) 15 sides
 - g) 14 sides
 - h) 12 sides
 - i) 11 sides
 - j) 8 sides
 - k) 5 sides
 - l) 20 sides
 - m) 17 sides
 - n) 25 sides
 - o) 18 sides

3. How many triangles can be formed from a polygon whose centre angle is 36° ?
4. Calculate the number of triangles that can be formed from a polygon whose interior angle is 108° .
5. The interior angle of a regular polygon is 100° more than the exterior angle. How many triangles can be formed from the polygon?
6. The centre angle of a polygon is 120° less than the interior angle.
 - a) Name the polygon.
 - b) How many triangles can be formed from the polygon named in (a) above?
7. The exterior angle and interior angle of a polygon are in the ratio of 2:7 respectively.
 - a) Find the size of each exterior angle.
 - b) How many triangles can be formed from the polygon?
8. How many triangles can be formed from a polygon whose interior angle is 9 times its exterior angle?
9. Find the number of triangles that can be formed from a polygon whose exterior angle is two thirds the interior angle.
10. The interior angle of a polygon is 7 times more than its exterior angle.
 - a) Find the number of sides of the polygon.
 - b) How many triangles can be formed from the polygon?
11. Show and state the number of triangles that can be formed from each of the following polygons.
 - a)
 - b)
 - c)

12. Find the number of sides of polygons whose number of triangles are:
 - a) 6 triangles
 - b) 4 triangles
 - c) 10 triangles
 - d) 7 triangles
 - e) 5 triangles
 - f) 7 triangles
 - g) 11 triangles
 - h) 25 triangles

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13. A regular polygon has 9 triangles. Name the polygon.
14. If 6 triangles can be formed from a polygon, find the size of each exterior angle of the polygon.
15. Given that 3 triangles can be formed from a regular polygon. Calculate the size of each interior angle of the polygon.

Finding number of right angles in a polygon.

Since a triangle has 2 right angles, Number of right angles in a polygon is equal to the number of triangle ($n-2$) times 2.

$$\text{Number of right angles} = 2(n-2) \text{ or } 2n - 4$$

Example 1

Find the number of right angles in a polygon with 7 sides.

Approach 1

$$\begin{aligned}\text{Number of right angles} &= 2(n-2) \\ &= 2(7-2) \\ &= 2 \times 5 \\ &= 10 \text{ right angles}\end{aligned}$$

Approach 2

$$\begin{aligned}\text{Number of right angles} &= 2n - 4 \\ &= (2 \times 7) - 4 \\ &= 14 - 4 \\ &= 10 \text{ right angles}\end{aligned}$$

Example 2

The interior angle of a polygon is 144° . Find the number of right angles in the polygon.

Let the exterior angle be y

$$\begin{aligned}&\text{Diagram showing an interior angle } 144^\circ \text{ and an exterior angle } y. \\&y + 144^\circ = 180^\circ \\&y + 144^\circ - 144^\circ = 180^\circ - 144^\circ \\&y = 36^\circ\end{aligned}$$

<u>Number of sides</u>	<u>Number of right angles</u>
$\frac{360^\circ}{\text{Ext. } \angle} = \frac{360^\circ}{36^\circ}$ = 10 sides	$2(n-2)$ $2(10-2)$ 2×8 16 right angles

Example 3

A polygon has 14 right angles. Find the size of each exterior angle.

Number of sides

$$2n - 4 = \text{Number of right angles}$$

$$2n - 4 + 4 = 14 + 4$$

$$\begin{array}{rcl}2n & = & 18 \\ 2 & & 2 \\ n & = & 9 \text{ sides}\end{array}$$

Exterior angle

$$\begin{aligned}\frac{360^\circ}{\text{Sides}} &= \frac{360^\circ}{9} \\ &= 40^\circ\end{aligned}$$

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Example 4

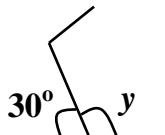
Find the size of each interior angle of a polygon with 20 right angles.

Number of sides

$$\begin{aligned} 2n - 4 &= \text{Right angles} \\ 2n - 4 + 4 &= 20 + 4 \\ 2n &= 24 \\ 2 &\quad 2 \\ n &= 12 \text{ sides} \end{aligned}$$

$$\begin{aligned} \text{Exterior angle} &= \frac{360^\circ}{\text{Sides}} = \frac{360^\circ}{12} \\ &= 30^\circ \end{aligned}$$

Let the interior angle be y



$$\begin{aligned} y + 30^\circ &= 180^\circ \\ y + 30^\circ - 30^\circ &= 180^\circ - 30^\circ \\ y &= 150^\circ \end{aligned}$$

Exercise

1. Find the number of right angles of a polygon with

a) 6 sides	d) 10 sides	g) 14 sides
b) 11 sides	e) 4 sides	h) 15 sides
c) 7 sides	f) 9 sides	i) 24 sides
2. The exterior angle of a polygon is 72° .
 - Name the polygon.
 - Find the number of right angles in the polygon.
3. The interior angles of a polygon is 150° .
 - Find the size of one centre angle.
 - Find the number of right angles in a polygon.
4. Find the number of right angles in a polygon whose interior angle is 36° more than the exterior angle.
5. The exterior angles of a polygon is 140° less than the interior angle.
 - Find the size of each interior angle.
 - Find the number of right angles in the polygon.
6. Calculate the number of right angles in a polygon whose interior angle is 4 times the exterior angle.
7. The interior and exterior angle of a polygon are in the ratio of 2:1 respectively.
 - Name the polygon.
 - Find the number of right angles in the polygon.
8. The exterior angle of a polygon is a third of the interior angle. Calculate the number of right angles in the polygon.
9. Find the number of sides of a polygon whose right angles are;

a) 6 right angles	d) 20 right angles	g) 16 right angles
b) 10 right angles	e) 18 right angles	h) 32 right angles
c) 4 right angles	f) 8 right angles	

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10. A polygon has 12 right angles.
 - a) Name the polygon.
 - b) Find the size of each interior angle.
11. Name the polygon with 10 right angles.
12. A polygon has 14 right angles.
 - a) Find the number of sides of the polygon.
 - b) Calculate the size of each interior angles.

Sum of interior angles of polygons.

Sum of interior angles = Each interior angle × Number of sides

Example 1

Calculate the sum of the interior angles of a nonagon whose interior angle is 140° .

A nonagon has 9 sides

$$\begin{aligned}\text{Each interior angle} &= 140^\circ \times 9 \\ &= 1260^\circ\end{aligned}$$

Example 2

Find the interior angle sum of a regular hexagon whose exterior angle is 60° .

A hexagon has 6 sides

Each exterior angle is 60°

$$\begin{aligned}\text{Each interior angle} &= 180^\circ - 60^\circ \\ &= 120^\circ\end{aligned}$$

$$\begin{aligned}\text{Interior angle sum} &= 120^\circ \times 6 \\ &= 720^\circ\end{aligned}$$

Exercise

1. Each interior angle of a regular octagon is 135° . What is the sum of its interior angles?
2. Find the interior angle sum of a six sided polygon whose interior angle is 120° .
3. The size of each interior angle of a pentagon is 108° . Calculate the sum of its interior angles.
4. A regular nonagon has one of its exterior angle 40° .
 - a) Find the size of each interior angle.
 - b) Find the sum of all interior angles.
5. Akot drew a ten sided regular polygon.
 - a) Find the size of each exterior angle.
 - b) Find the size of one interior angle.
 - c) Calculate the total of all interior angles.
6. Each interior angle of a quadrilateral is 90° . Find the interior angle sum.
7. The interior angle sum of a regular polygon is 180° . If each interior angle is 60° .
 - a) Find the number of sides of the polygon.
 - b) Name the polygon.

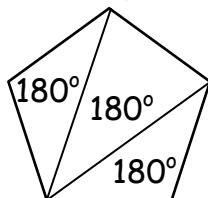
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More problems involving finding the interior angle sum of polygons

Note:

To find the sum of interior angles of a polygon, divide the polygon into triangles as shown below.



Interior angle sum

$$180^\circ + 180^\circ + 180^\circ \\ 540^\circ$$

Or

$$180^\circ \times 3 \\ 540^\circ$$

The number of triangles in each polygon is 2 less than the number of sides(n). The formula for calculating the sum of interior angles is **180°(n-2)** where n represents the number of sides of a polygon.

Example 1

Calculate the sum of the interior angles in an octagon.

An octagon has 8 sides

$$\begin{aligned} \text{Sum of interior angles} &= 180^\circ(n-2) \\ &= 180^\circ(8-2) \\ &= 180^\circ \times 6 \\ &= 1080^\circ \end{aligned}$$

Example 2

The interior angle of a polygon is 108° .

a) Find the size of each exterior angle.

Let each exterior angle be x



$$\begin{aligned} x+108^\circ &= 180^\circ \\ x + 108^\circ - 108^\circ &= 180^\circ - 108^\circ \\ x &= 72^\circ \end{aligned}$$

b) Calculate the sum of the interior angles

Number of sides	Interior angle sum
$\frac{360^\circ}{\text{Ext. } \angle} = \frac{360^\circ}{72^\circ}$ = 5sides	$180^\circ(n-2)$ $180^\circ(5-2)$ $180^\circ \times 3$ 540°

Example 3

The interior angle of a regular polygon is 100° more than the exterior angle. Find the total of all the interior angles of the polygon.

Let the exterior angle be y



$$y+y+100^\circ = 180^\circ$$

$$2y+100^\circ = 180^\circ$$

$$2y+100^\circ - 100^\circ = 180^\circ - 100^\circ$$

$$\frac{2y}{2} = \frac{80^\circ}{2}$$

$$y = 40^\circ$$

Number of sides

$$\frac{360^\circ}{\text{Ext. } \angle} = \frac{360^\circ}{40^\circ}$$

$$= 9 \text{sides}$$

Interior angle sum

$$\begin{aligned} &180^\circ(n-2) \\ &180^\circ(9-2) \\ &180^\circ \times 7 \\ &1260^\circ \end{aligned}$$

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Exercise

1. Find the sum of all interior angles of a regular
 - a) pentagon
 - b) octagon
 - c) decagon
 - d) heptagon
 - e) quadrilateral
 - f) nonagon
 - g) hendecagon
 - h) heptagon
2. Find the total of interior angles of a polygon with;
 - a) 7 sides
 - b) 12 sides
 - c) 5 sides
 - d) 4 sides
 - e) 3 sides
 - f) 8 sides
 - g) 9 sides
 - h) 11 sides
 - i) 18 sides
3. The exterior angle of a regular polygon is 60° .
 - a) Name the polygon.
 - b) Find the interior angle sum of the polygon.
4. The interior angle of a regular polygon is 140° .
 - a) Find the size of each exterior angle.
 - b) Find the sum of interior angles of the polygon.
5. A polygon has its interior angle as 165° . Calculate the total of all interior angles
6. The exterior angle of a regular polygon is twice the interior angle.
 - a) Calculate the size of one exterior angle.
 - b) Find the sum of interior angles of the polygon.
7. Find the sum of interior angles of a polygon whose interior angles is 4 times its exterior angle.
8. The interior angle of a polygon is 8 times the exterior angle.
 - a) Find the number of sides of the polygon.
 - b) Calculate the total of interior angles of the polygon.
9. The interior and exterior angles of a polygon are in the ratio of 3:2 respectively
 - a) Name the polygon.
 - b) Find the interior angle sum of the polygon.
10. The ratio of the size of the interior angle to the size of the exterior angle of a polygon is 13:2.
 - a) Find the number of sides of the polygon
 - b) Calculate the interior angle sum.
11. The exterior angle of a polygon is a fifth of the interior angle of the polygon.
 - a) Find the size of one interior angle.
 - b) Calculate the number of sides of the polygon.
 - c) Find the interior angle sum of the polygon.

TOPIC 7: GEOMETRIC CONSTRUCTION



12. The exterior angle of a polygon is two thirds of its interior angle.
- Name the polygon.
 - Calculate the interior angle sum of the polygon.
13. A regular polygon has its interior angle which is 60° less than the exterior angle.
- Find the size of each exterior angle.
 - Find the total of the interior angles of the polygon.
14. By measuring angles using a protractor, P.7 pupil found out that the interior angle of a polygon was 108° more than the exterior angle.
- Name the polygon.
 - Calculate the interior angle sum of the polygon.
15. The exterior angle of a polygon is 120° less than the interior angle.
- Find the size of each exterior angle.
 - Name the polygon.
 - Calculate the interior angle sum of the polygon.
16. Calculate the interior angle sum of a polygon whose exterior angle is 140° less than the interior angles.
17. The interior angle of a regular polygon is 3 times more than the centre angle.
- Name the polygon.
 - Calculate the interior angle sum of the polygon.
18. Find the sum of interior angles of a regular polygon whose interior angle is 2 times more than the exterior angle.
19. The interior angle of a polygon is 4 times more than the exterior angle.
- Find the number of sides.
 - Calculate the sum of the interior angles of the polygon.

Finding the number of sides when the sum of interior angles is given

Example 1

The interior angle sum of a regular polygon is 1260° .

- a) Find the number of triangles in the polygon.

$$\text{Number of triangles} = \text{Int.}\angle \text{ sum} \div 180^\circ$$

$$= \frac{1260^\circ}{180^\circ}$$

$$= 7 \text{ triangles}$$

- b) Find the number of sides

$$n - 2 = \text{Number of sides}$$

$$n - 2 = 7$$

$$n - 2 + 2 = 7 + 2$$

$$n = 9 \text{ sides}$$

TOPIC 7: GEOMETRIC CONSTRUCTION



Example 2

Find the number of sides of a regular polygon whose interior angle sum is 1800° .

Approach 1

$$\begin{aligned} 180^\circ(n - 2) &= \text{Interior angle sum} \\ 180^\circ(n - 2) &= 1800^\circ \\ 180^\circ n - 360^\circ &= 1800^\circ \\ 180^\circ n - 360^\circ + 360^\circ &= 1800^\circ + 360^\circ \\ 180^\circ n &= 2160^\circ \\ \frac{180^\circ n}{180^\circ} &= \frac{2160^\circ}{180^\circ} \\ n &= 12 \end{aligned}$$

The polygon has 12 sides

Approach 2

Number of triangles

$$\begin{aligned} \text{Int.}\angle \text{ sum} &\div 180^\circ \\ 1800^\circ \div 180^\circ &= 10 \text{ triangles} \end{aligned}$$

Number of sides

$$\begin{aligned} n - 2 &= \text{Number of sides} \\ n - 2 &= 10 \\ n - 2 + 2 &= 10 + 2 \\ n &= 12 \text{ sides} \end{aligned}$$

The polygon has 12 sides

Example 3

The interior angle sum of a regular polygon is 1080° .

- a) Find the number of triangles in the polygon.

$$\begin{aligned} \text{No. of triangles} &= \frac{\text{Int. } \angle \text{ sum}}{180^\circ} \\ &= \frac{1080^\circ}{180^\circ} \\ &= 6 \text{ triangles} \end{aligned}$$

- b) Name the polygon.

$$\begin{aligned} n - 2 &= \text{Number of sides} \\ n - 2 &= 6 \\ n - 2 + 2 &= 6 + 2 \\ n &= 8 \text{ sides} \\ \text{The polygon has 8 sides} \end{aligned}$$

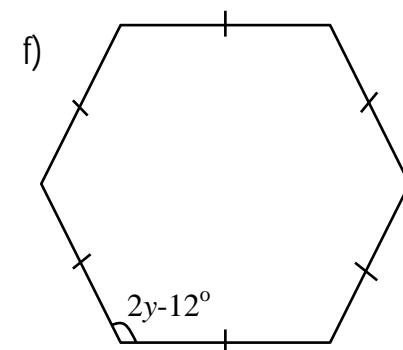
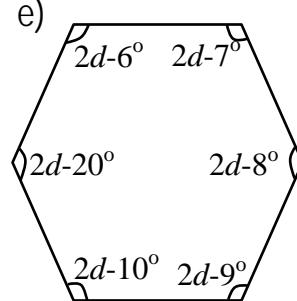
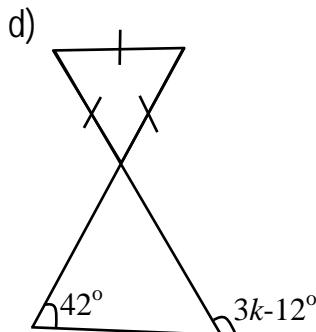
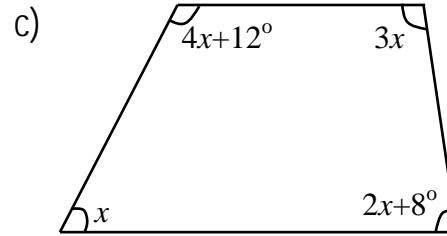
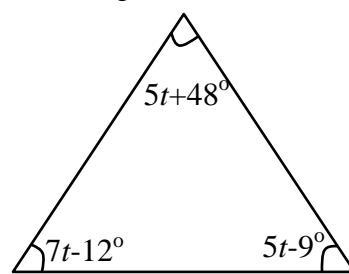
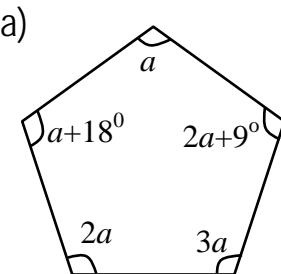
Exercise

- How many sides has a polygon whose interior angle sum is;
 - 360°
 - 720°
 - 540°
 - 900°
 - 1080°
 - 1440°
 - 1440°
 - 2700°
 - 5040°
 - 1260°
- Find the number of triangles in a polygon whose interior angle sum is;
 - 1080°
 - 900°
 - 360°
 - 1440°
 - 2700°
 - 2880°
 - 540°
 - 2160°
- The sum of interior angles of a polygon is 720° .
 - Find the number of triangles in the polygon.
 - Find the number of right angles in the polygon.
 - Calculate the size of each interior angle.
- Name the polygon whose interior angle sum is 900° .

TOPIC 7: GEOMETRIC CONSTRUCTION



5. The sum of interior angles of a polygon is 1620° .
 - a) Find the number of triangles in the polygon.
 - b) Name the polygon.
6. The number of the interior angles a regular polygon is 1800° .
 - a) Name the polygon.
 - b) How many right angles are in the polygon?
 - c) Find the size of each exterior angle.
7. The interior angle sum of a regular polygon is 1260° .
 - a) Find the number of right angles in the polygon.
 - b) Calculate the size of each exterior angle of the polygon.
 - c) Find the size of each interior angle.
8. Find the size of each exterior angle of a regular polygon whose interior angle sum is 1440° .
9. Given that the sum of interior angles of a regular polygon is 540° .
 - a) Find the number of sides of the polygon.
 - b) Name the polygon.
 - c) Calculate the size of each exterior angle of the polygon.
10. Find the size of each interior angle of a regular polygon whose interior angle sum is 2340° .
11. Using a ruler, a pencil and a pair of compass only, construct a polygon whose interior angle is 720° in a circle of radius 3.5cm.
12. The sum of interior angles of a regular polygon is 540° . Find the ratio of size of each exterior angle to each interior angle.
13. Given that the interior angle sum of a polygon is 1080° . By how many times is the interior angle more than the exterior angle?
14. The sum of interior angles of a polygon is 720° . By how many degrees is each interior angle more than the exterior angle?
15. Find the value of the unknown angles.

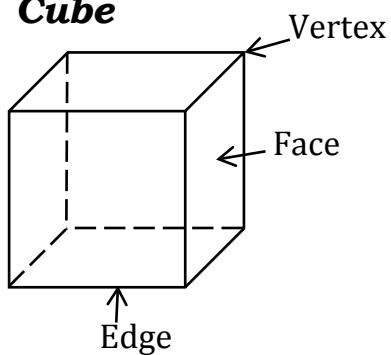


TOPIC 7: GEOMETRIC CONSTRUCTION

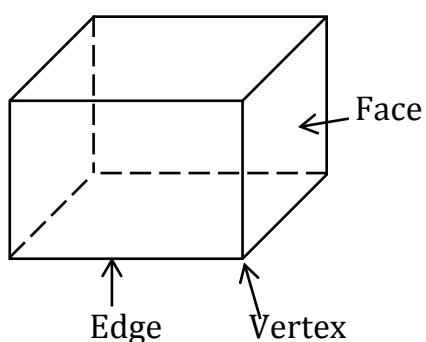


PRISMS AND THEIR PROPERTIES

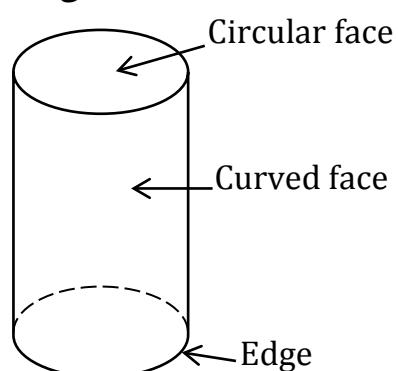
Cube



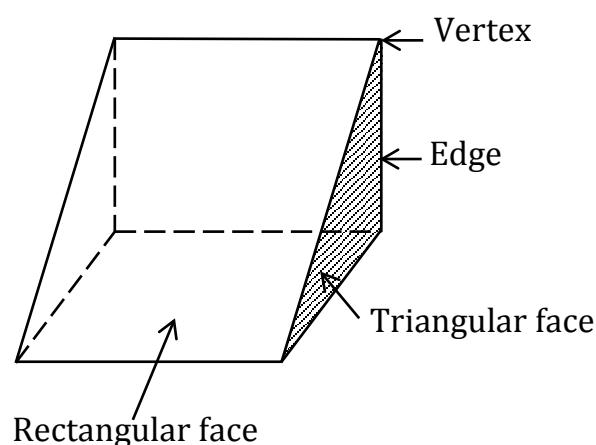
Cuboid



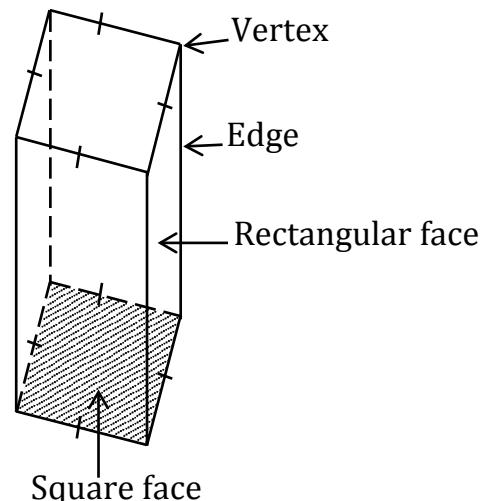
Cylinder



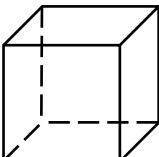
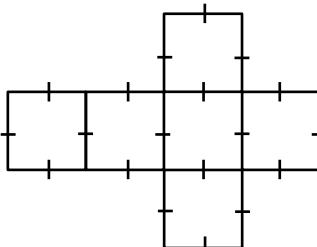
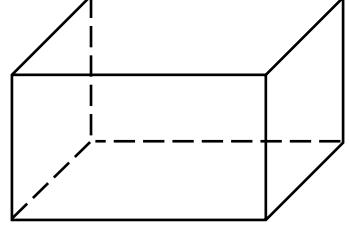
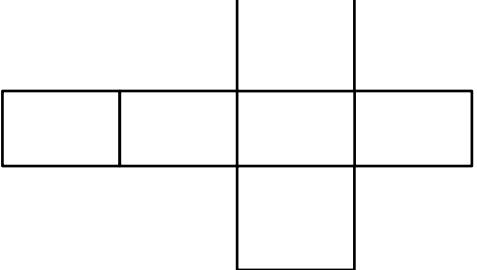
Triangular prism



Right prism



Study and complete the table below.

Prism	Properties	Net
 Cube	6 square faces _____ vertices _____ edges	
 Cuboid	_____ rectangular faces _____ vertices _____ edges	

TOPIC 7: GEOMETRIC CONSTRUCTION



Prism	Properties	Net
	3 faces — circular faces — edges	
	5 faces — rectangular faces — triangular faces — vertices — edges	
	7 faces — rectangular faces — pentagonal faces — vertices — edges	
	— faces — vertices — edges	
	— faces — vertices — edges	

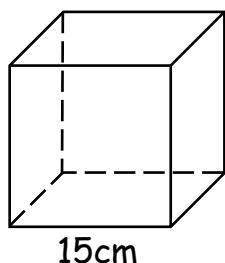
TOPIC 7: GEOMETRIC CONSTRUCTION



Finding the sum of length of edges of prisms

Example 1

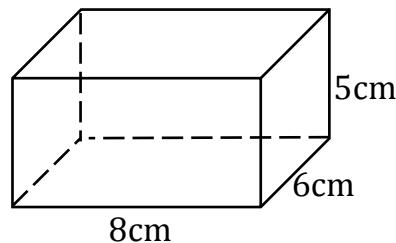
Find the length of the wire needed to make the cube below.



$$\begin{aligned}\text{Length} &= \text{Edges} \times \text{length of each edge} \\ &= 12 \times 15\text{cm} \\ &= 180\text{cm}\end{aligned}$$

Example 2

Find the sum of the length of all edges in the figure below.

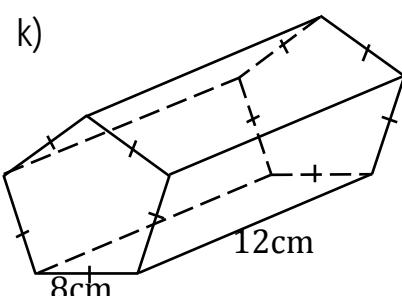
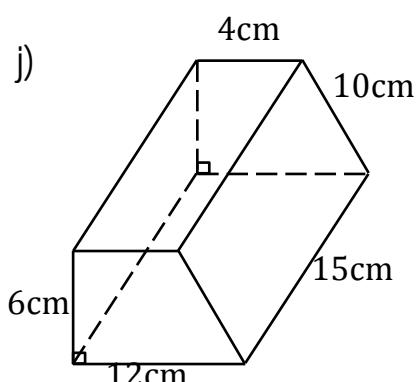
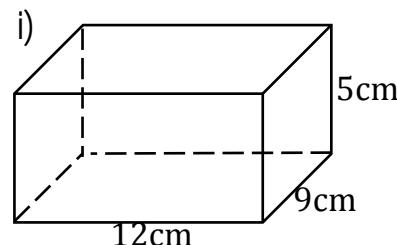
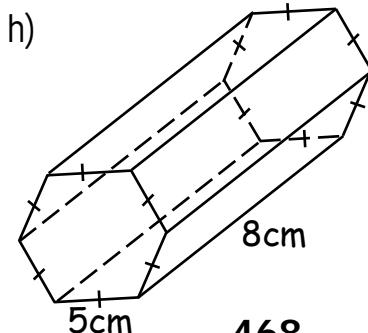
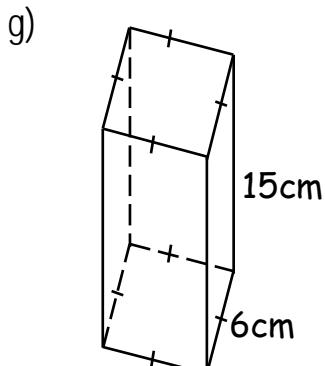
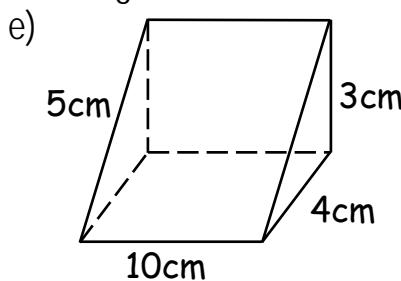
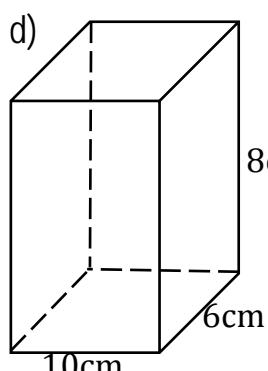
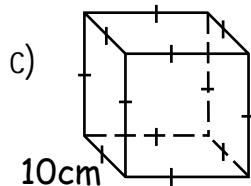
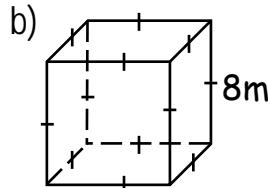
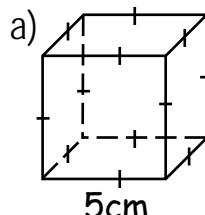


$$\begin{aligned}4l + 4w + 4h \\ (4 \times 8\text{cm}) + (4 \times 6\text{cm}) + (4 \times 5\text{cm}) \\ 32\text{cm} + 24\text{cm} + 20\text{cm} \\ 76\text{cm}\end{aligned}$$

The sum of length of all edges is 76cm

Exercise

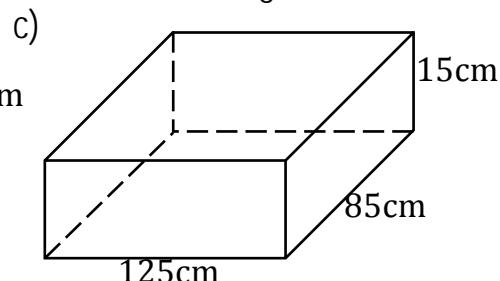
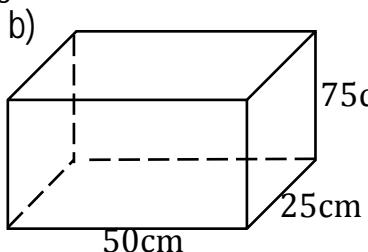
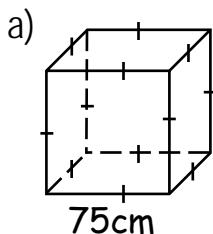
1. Find the sum of length of all edges of each of the solids below.



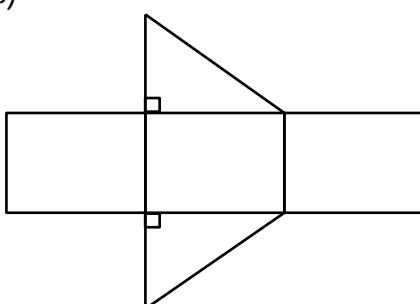
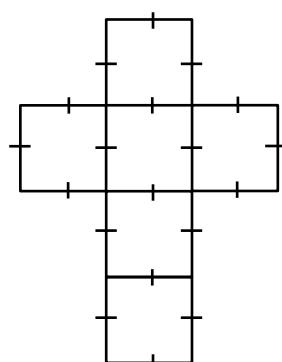
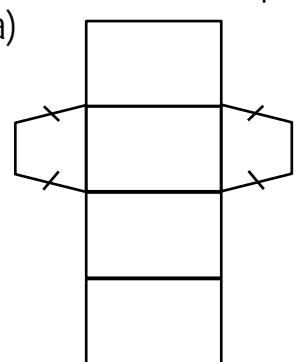
TOPIC 7: GEOMETRIC CONSTRUCTION



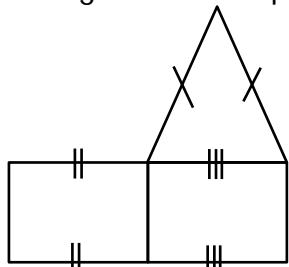
2. Find in metres, the length of wires used to make each of the following.



3. Name the solid shapes whose nets are drawn below:

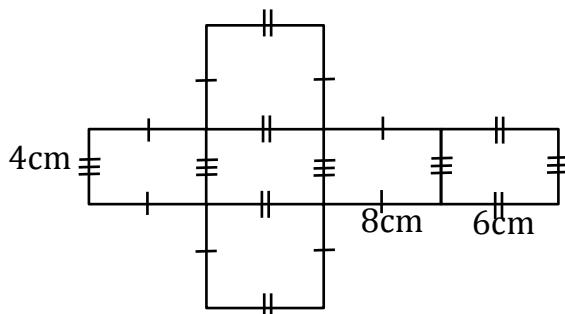


4. The figure below represents part of the net of a solid figure with 5 faces.



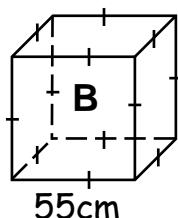
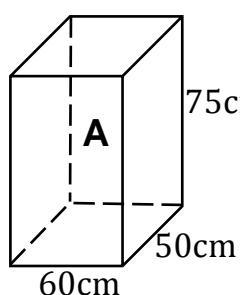
- a) Copy and complete the net
- b) Name the solid figure whose net is drawn.

5. Primary seven pupils formed a solid figure from the net shown in the drawing below.



- a) Name the solid figure formed.
- b) The solid figure has;
_____ edges
_____ vertices
- c) Calculate the total of length of all of its edges.

6. A welder buys a metallic pipe whose length was enough to make the edges of tank A. He decides to make tank B.



- a) Calculate the length of the metallic pipe that remained.
- b) Calculate the area of the metallic sheet needed to make the four walls of tank B.

TOPIC 7: GEOMETRIC CONSTRUCTION



More problems involving the sum of lengths of edges.

Example 1

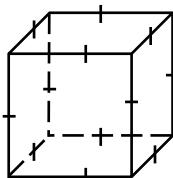
The total of length of all edges of a cube is 180cm. Find the length of each edge.

A cube has 12 edges

$$\text{Length of each edge} = 180\text{cm} \div 12 \\ = 15\text{cm}$$

Example 2

Mawaya used a wire of length 3 metres to make the edges of the prism below.



Find in centimetres, the length of each edge.

$$1\text{m} = 100\text{cm}$$

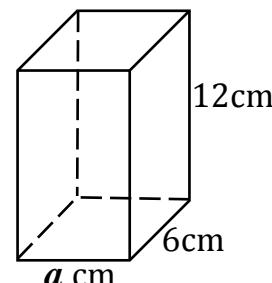
$$3\text{m} = 3 \times 100\text{cm} \\ = 300\text{cm}$$

$$300\text{cm} \div 12 = 25\text{cm}$$

The length of each edge is 25cm

Example 3

The sum of length of all edges of the prism below is 108cm. Find the value of a



$$\begin{aligned} \text{Heights} &= 4 \times 12\text{cm} & \text{Widths} &= 4 \times 6\text{cm} \\ &= 48\text{cm} & &= 24\text{cm} \end{aligned}$$

$$\text{Heights} + \text{Widths} = 48\text{cm} + 24\text{cm} \\ = 72\text{cm}$$

$$\text{Lengths} = 108\text{cm} - 72\text{cm} \\ = 36\text{cm}$$

Value of a

$$4 \times a\text{cm} = 36\text{cm}$$

$$\frac{4a\text{cm}}{4\text{cm}} = \frac{36\text{cm}}{4\text{cm}}$$

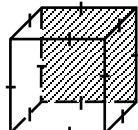
$$a = 9$$

Exercise

1. The sum of lengths of all edges of a cube is given below. Find the length of each edge.

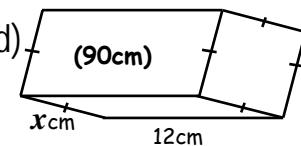
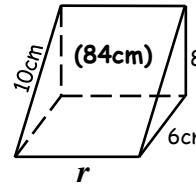
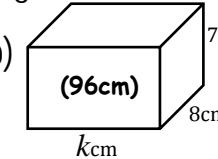
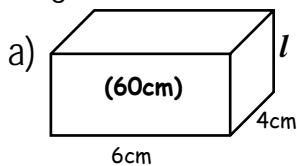
- a) 36cm b) 60cm c) 96cm d) 48cm e) 42cm f) 120cm

2. The sum of length of all edges of the prism below is 4.2 metres.

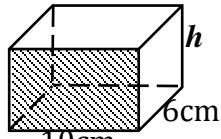
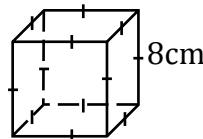


- a) Find in cm, the length of each edge.
b) Calculate the area of the shaded part.

3. The sum of lengths of edges of each of the prisms below is given in brackets. Find the length of the unknown edge.



4. The prisms below have the same sum of the length of all edges.



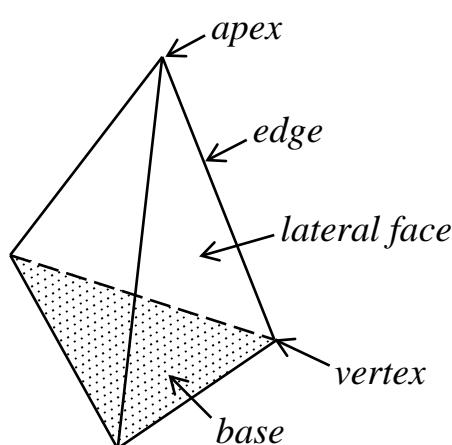
- a) Find the value of h .
b) Calculate the perimeter of the shaded part.

TOPIC 7: GEOMETRIC CONSTRUCTION

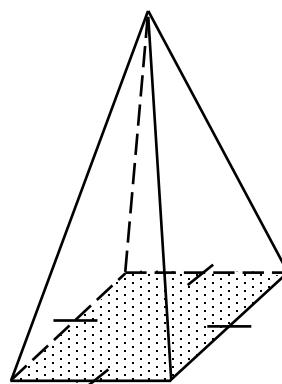


PYRAMIDS AND THEIR PROPERTIES

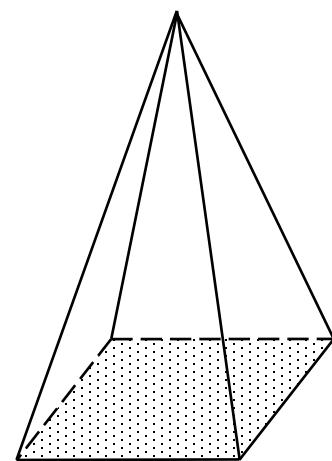
Pyramids are named after their bases. A pyramid with a triangular base is called a triangular pyramid.



Triangular pyramid
(Tetrahedron)



Square pyramid



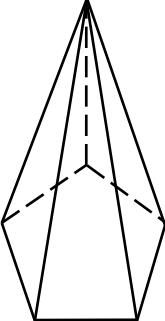
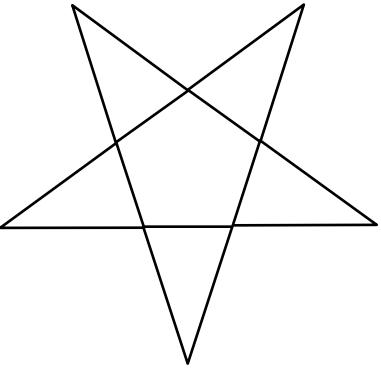
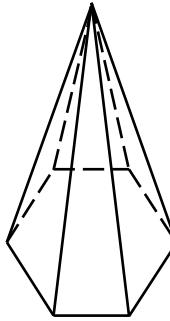
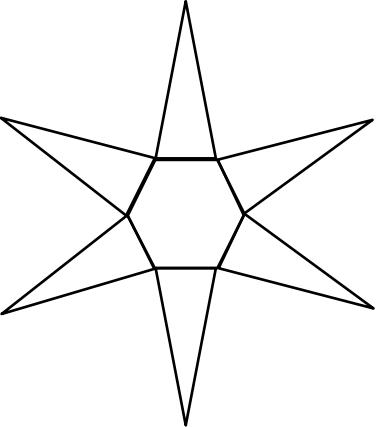
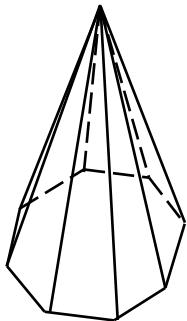
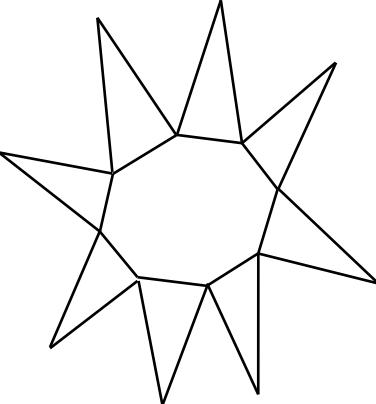
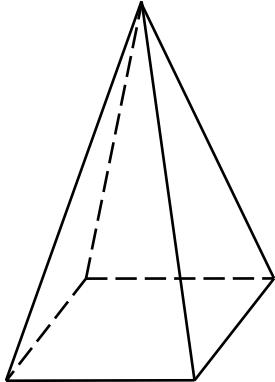
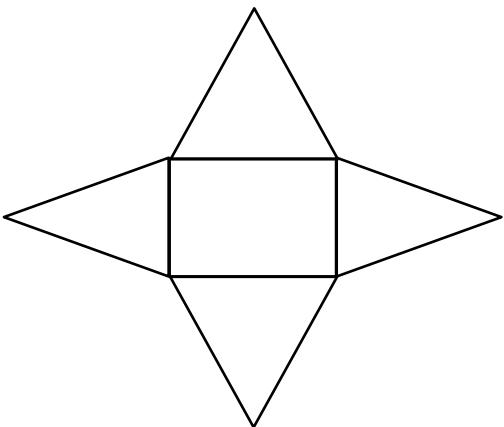
Rectangular pyramid

Study and complete the table below.

Pyramid	Properties	Net
 Triangular pyramid	4 faces 4 vertices 6 edges	
 Circular pyramid / cone	1 vertex 1 edge 2 faces	
 Square pyramid	_____ vertices _____ edges _____ faces	

TOPIC 7: GEOMETRIC CONSTRUCTION



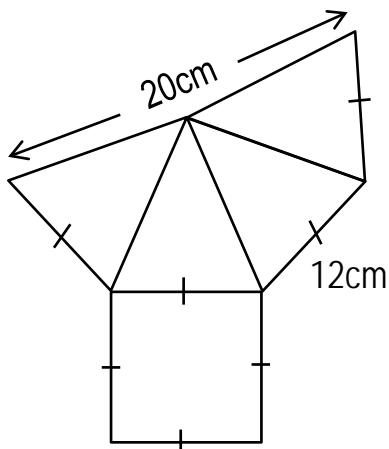
Pyramid	Properties	Net
	<ul style="list-style-type: none"> _____ vertices _____ edges _____ faces 	
Pentagonal pyramid		
	<ul style="list-style-type: none"> _____ vertices _____ edges _____ faces 	
Hexagonal pyramid		
	<ul style="list-style-type: none"> _____ vertices _____ edges _____ faces 	
Octagonal pyramid		
	<ul style="list-style-type: none"> _____ vertices _____ edges _____ faces 	
Rectangular pyramid		

TOPIC 7: GEOMETRIC CONSTRUCTION



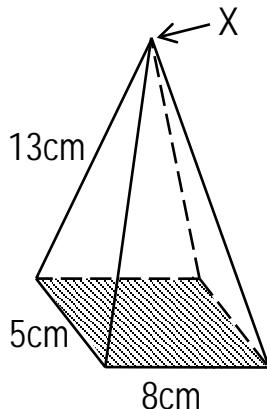
Exercise

1. Below is a net of a pyramid. Use it to answer questions that follow.



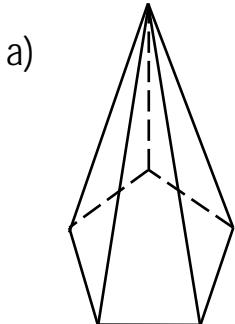
- Name the pyramid whose net is drawn above.
- State the number of edges, vertices and faces of pyramid named in (a) above.
 - edges
 - vertices
 - faces
- Find the area of the square face.
- Calculate the sum of the area of the triangular faces.

2. Study the figure below and use it to answer questions that follow.

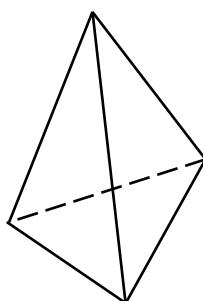


- Name the solid figure drawn above.
- Name part marked X.
- How many edges does the figure above has?
- Calculate the area of the shaded part.
- Find the sum of the length of all edges.

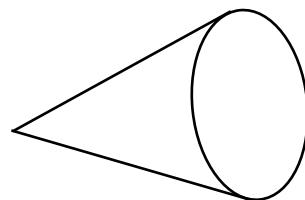
3. Draw nets of each of the following solid figures.



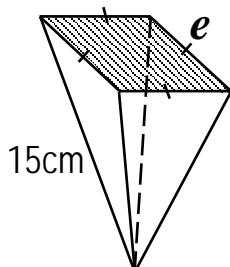
b)



c)



4. The sum of the length of edges of the pyramid below is 108 metres.



- Name the pyramid.
- Find the length of edge e.
- Calculate its base area.

TOPIC 7: GEOMETRIC CONSTRUCTION



Rotation /Revolution

Note

- One complete turn or revolution is equal to 360° . This is the same angle made by a minute hand of a clock to make 60 minutes.
- A half a turn or a straight angle is equal to 180°
- A quarter a turn is equal to 90°
- Three quarter a turn is equal to 270°

Example 1

How many degrees are there in a quarter a turn?

$$1 \text{ complete turn} = 360^\circ$$

$$\frac{1}{4} \text{ of a turn} = \frac{1}{4} \times 360^\circ \\ = 90^\circ$$

Example 3

Through what angle does a minute hand of a clock turn in 20 minutes.

$$20 \text{ min} = \frac{20}{60} \\ = \frac{1}{3}$$

$$\frac{1}{3} \times 360^\circ = 120^\circ$$

Example 2

Find the number of degrees in $\frac{3}{5}$ of a revolution.

$$1 \text{ revolution} = 360^\circ$$

$$\frac{3}{5} \text{ of a revolution} = \frac{3}{5} \times 360^\circ \\ = 216^\circ$$

Example 4

What turn is made in an angle of 270°

$$360^\circ = 1 \text{ complete turn}$$

$$1^\circ = \frac{1}{360} \text{ turn}$$

$$270^\circ = (\frac{1}{360} \times 270^\circ) \text{ turn}$$

$$= \frac{3}{4} \text{ turn}$$

Exercise

1. How many degrees are there in:

a) $\frac{3}{4}$ turn	d) $\frac{2}{5}$ revolution	g) $\frac{5}{12}$ turn
b) $\frac{2}{3}$ turn	e) $\frac{1}{2}$ rotation	h) $\frac{3}{8}$ revaluation
c) $\frac{1}{6}$ turn	f) $\frac{4}{5}$ turn	i) $\frac{7}{20}$ turn
2. Through what angle does a soldier turn when he is given the order "right turn"?
3. Through what angle does a minute hand of a clock turn in

i) 12 minutes	iii) 45 minutes
ii) 15 minutes	iv) 24 minutes
4. How many degrees will one turn to make 3 revolutions?
5. Find the angle turned by a minute hand at 25 minutes past.

TOPIC 7: GEOMETRIC CONSTRUCTION

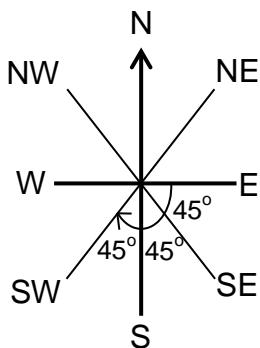


6. In 24 hours, the earth makes one complete turn about its axis. Through what angle does it turn about its axis in 18 hours?
7. A bicycle travelled 3 metres during one complete turn of each wheel. Through what angle does each wheel turn when the bicycle travels?
 - a) 3 metres
 - b) 1 metre
 - c) $\frac{1}{2}$ metres
 - d) 12 metres
8. Find the fraction of a revolution representing these degrees.
 - a) 270°
 - b) 240°
 - c) 90°
 - d) 144°

Angles on a compass

Example 1

What is the smaller angle between East and south west?

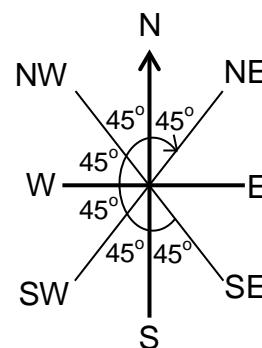


$$45^\circ + 45^\circ + 45^\circ = 135^\circ$$

The smaller angle is 135°

Example 2

What is the larger angle between North East and South East?



$$45^\circ + 45^\circ + 45^\circ + 45^\circ + 45^\circ + 45^\circ = 270^\circ$$

The larger angle is 270°

Exercise

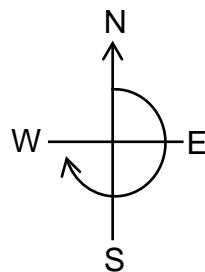
1. What is the smaller angle between;
 - a) North and NW
 - b) North and East
 - c) South and SE
 - d) SE and North
 - e) SW and East
 - f) NW and East
 - g) NW and SW
 - h) SW and SE
2. What is the larger angle between;
 - a) NE and SE
 - b) South and SW
 - c) SE and West
 - c) North and west
3. What is the size of the angle between North and Southeast through West?

TOPIC 7: GEOMETRIC CONSTRUCTION

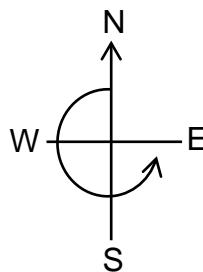


Clockwise and anticlockwise turn

Study the figures below.



Clockwise turn



Anti-clockwise turn

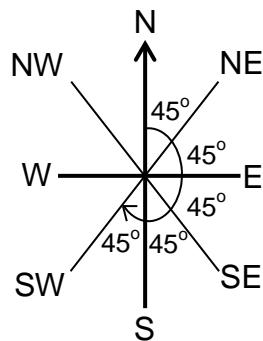
Opening a bottle of water



Example 1

Obonyo was facing North. She turned clockwise to face Southwest.

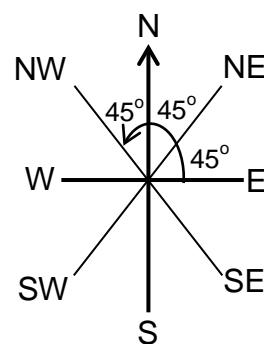
What angle did she make?



$$45^\circ + 45^\circ + 45^\circ + 45^\circ + 45^\circ = 225^\circ$$

Example 2

Tokiyya was facing west. He turned anti-clockwise through an angle of 135° . In which direction did he face?



He faced in the Northwest

Exercise

1. Hakim is facing North. What angle will be made if he turns clockwise to face Southeast?
2. A boy is facing Southwest, what angle will be made if he turns anti-clock wise to face Northwest?
3. What angle will I make, if I turned anti-clockwise from

a) Northeast to south.	d) North to Northeast.
b) South to Northwest.	e) East to Northwest.
c) Southeast to west.	f) North to Southwest.
4. What angles will a girl make if she turned clockwise from

a) South to North	d) West to North East
b) North to west	e) East to North west
c) Northeast to South	f) North to south
5. Ankunda was facing Northeast. She turned anti-clock wise through an angle of 90° . In which direction did she face?

TOPIC 7: GEOMETRIC CONSTRUCTION



6. Aminah was facing North. She turned clockwise through an angle of 225° . In which direction did she face?
7. Medi is facing Northwest. In which direction will he face if he turned through:
- | | |
|-------------------------------|-------------------------------|
| a) 135° clockwise | d) 45° anti-clockwise |
| b) 90° clockwise | e) 315° clockwise |
| c) 225° anti-clockwise | f) 270° anti-clockwise |

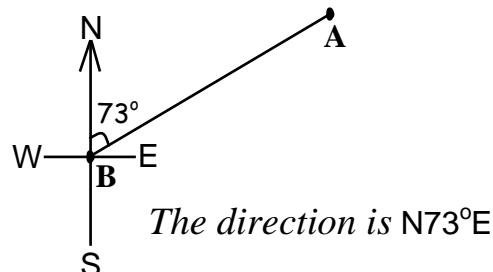
Telling direction

Note:

The acute angle used when describing direction is measured either from North or South.

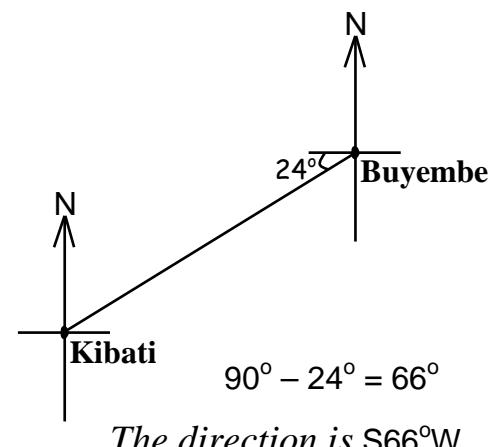
Example 1

What is the direction of A from B.



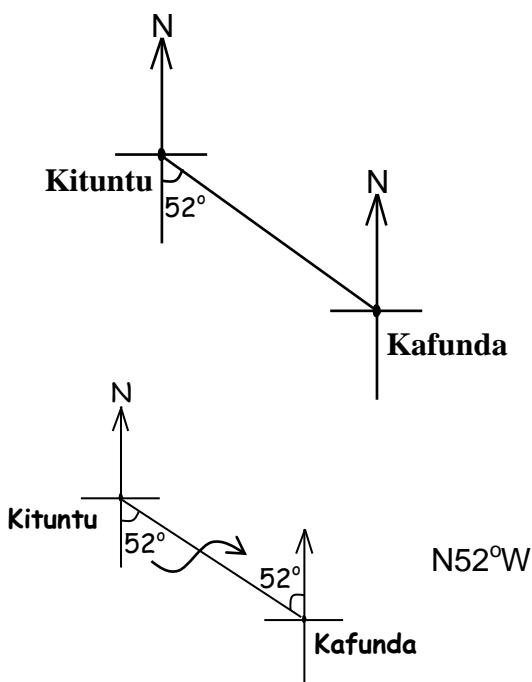
Example 2

Find the direction of Kibati from Buyembe



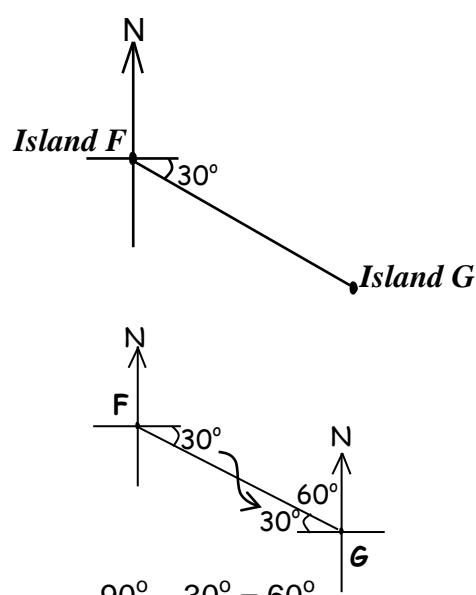
Example 3

State the direction of Kituntu from Kafunda.



Example 4

Find the direction of Island F from Island G.

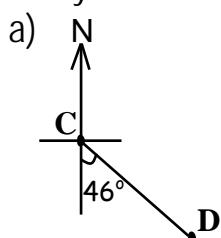


TOPIC 7: GEOMETRIC CONSTRUCTION

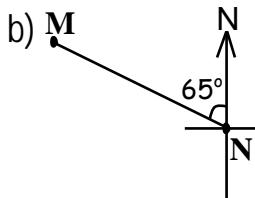


Exercise

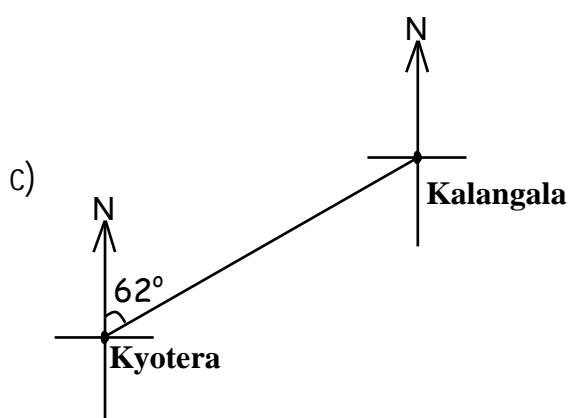
1. Study the drawing below.



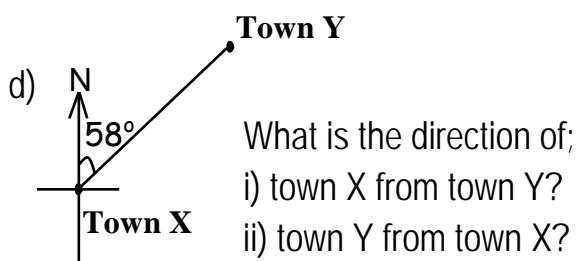
What is the direction of:
i) D from C?
ii) C from D?



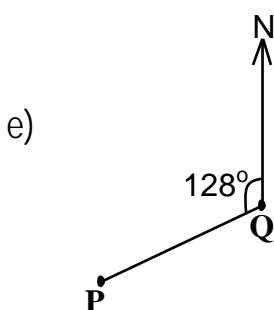
What is the direction of:
i) M from N?
ii) N from M?



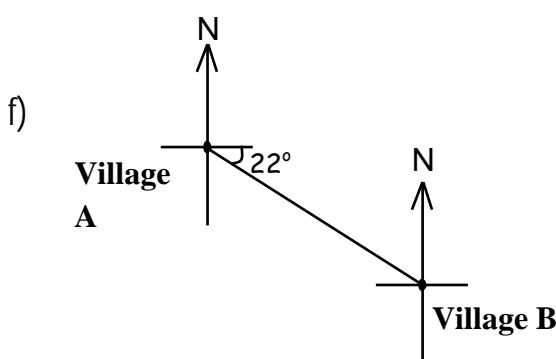
What is the direction of:
i) Kalangala from Kyotera?
ii) Kyotera from Kalangala?



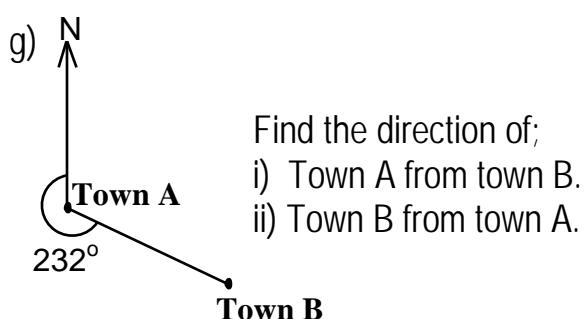
What is the direction of:
i) town X from town Y?
ii) town Y from town X?



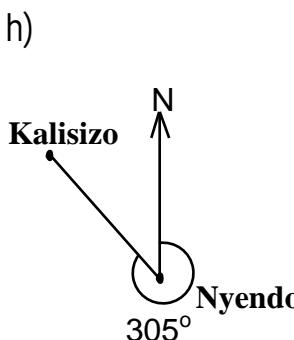
Find the direction of
i) P from Q
ii) Q from P



Find the direction of:
i) Village A from village B
ii) Village B from village A



Find the direction of:
i) Town A from town B.
ii) Town B from town A.

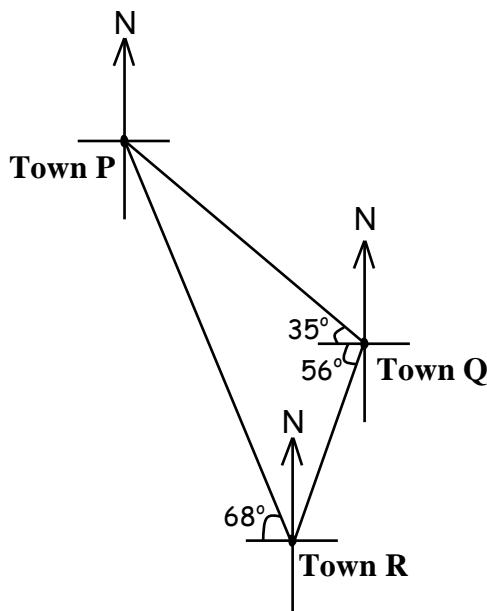


Find the direction of:
i) Kalisizo from Nyendo
ii) Nyendo from Kalisizo

TOPIC 7: GEOMETRIC CONSTRUCTION

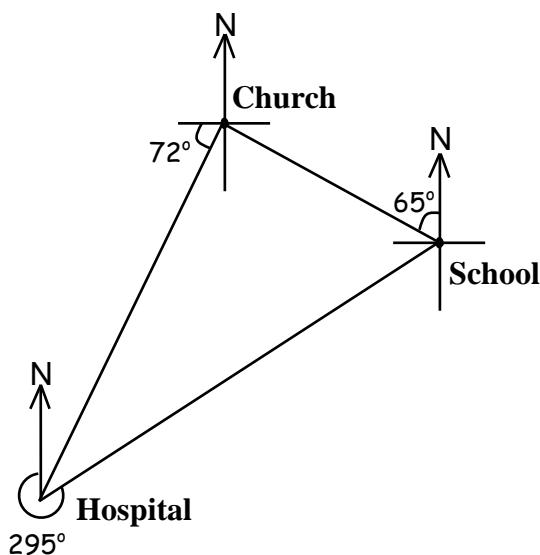


2. The drawing below shows the location of three towns.



- Find the direction of
- Town P from town Q.
 - Town R from town Q.
 - Town P from town R.
 - Town R from town P.
 - Town Q from town R.
 - Town Q from town P.

3. The drawing below shows the location of the church, school and hospital. Use it to answer the questions that follow.

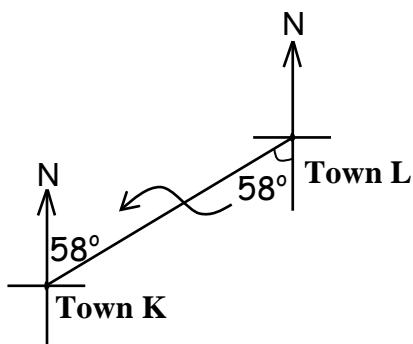


- Find the direction of
- the school from the church.
 - the church from the school.
 - the hospital from the church.
 - the church from the hospital.
 - the school from the hospital.
 - the hospital from the school.

Opposite direction

Example

The direction of town K from town L is S 58° W. Find the direction of town L from town K.



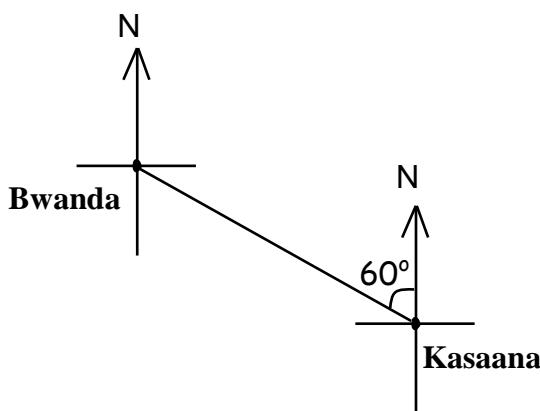
The direction of town L from town K is N 58° E.

TOPIC 7: GEOMETRIC CONSTRUCTION

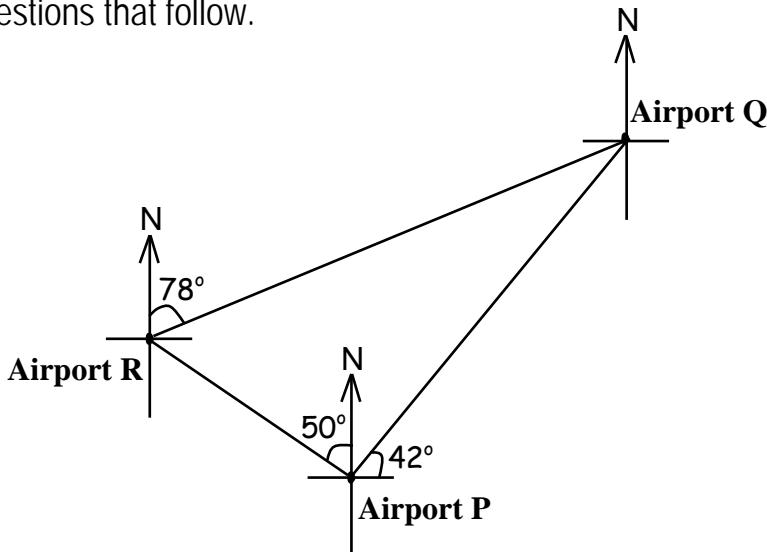


Exercise

1. Give the opposite direction for;
 - a) S 75° E
 - b) N 16° E
 - c) N 47° W
 - d) S 57° E
 - e) S 48° W
 - f) N 83° W
2. The direction of the kitchen from the staffroom is S 34° W. State the direction of the staffroom from the kitchen.
3. The direction of Gomba from Buddu is N 55° E. Find the direction of Buddu from Gomba.
4. Use the figure below to state the direction of Kasaana from Bwanda.



5. The direction of town C from town D is S 14° E. State the direction of town D from town C.
6. The figure below shows the location of three Airports. Study it carefully and use it to answer questions that follow.



- i) Find the direction of Airport P from Airport R.
- ii) Airport Q from Airport P.
- iii) Airport R from Airport Q.

TOPIC 7: GEOMETRIC CONSTRUCTION



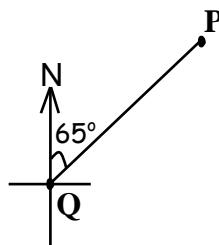
BEARING

Note:

- True bearing is measured from North in clockwise direction only.
- Bearing is written in three digits i.e. 000° , 025° , 120° , 076° , etc.
- The bearing of North is 000° or 360° .

Example 1

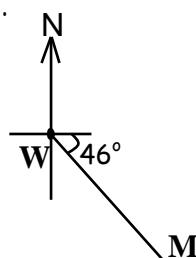
Find the bearing of town P from town Q.



The bearing of town P from town Q is 060°

Example 2

State is the bearing of Island M from Island W.

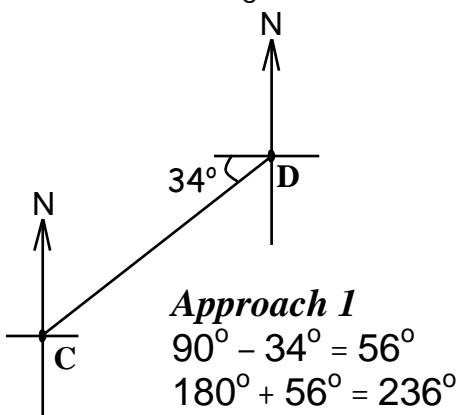


$$90^\circ + 46^\circ = 136^\circ$$

The bearing of Island M from Island W is 136°

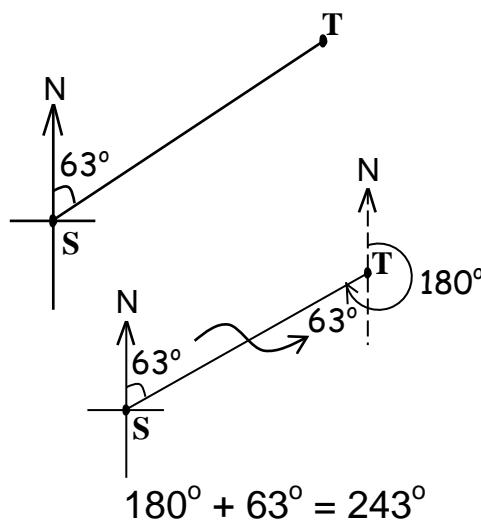
Example 3

Find the bearing of C from D.



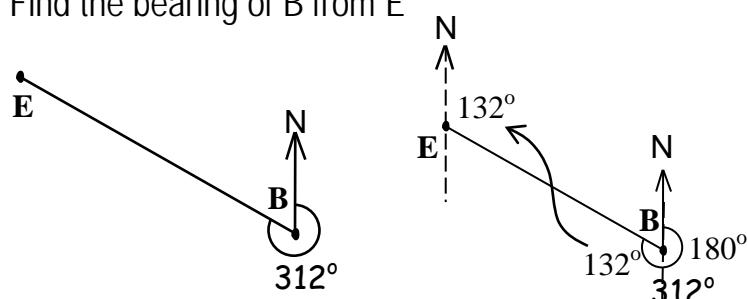
Example 4

Find the bearing of S from T



Example 5

Find the bearing of B from E



$$312^\circ - 180^\circ = 132^\circ$$

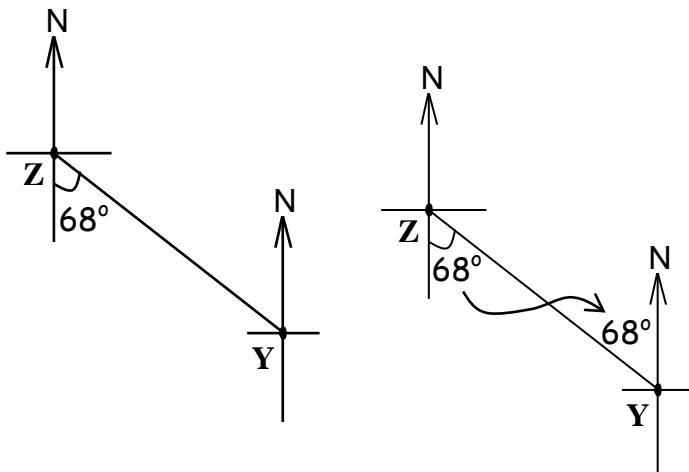
The bearing of B from E is 132°

TOPIC 7: GEOMETRIC CONSTRUCTION



Example 6

Find the bearing of Z from Y

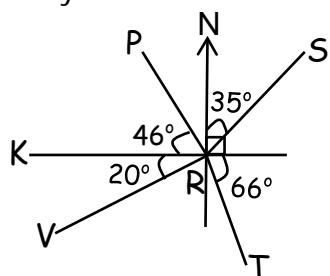


$$360^\circ - 68^\circ = 292^\circ$$

The bearing of Z from Y is 292°

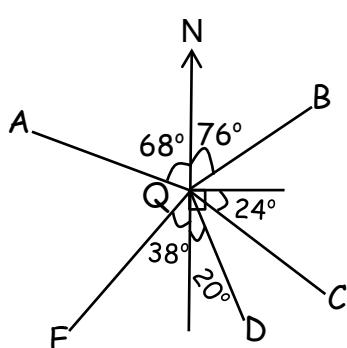
Exercise

1. Study the below.



- Find the bearing of
- i) S from R
 - ii) T from R
 - iii) P from R
 - iv) V from R
 - v) K from R
 - vi) R from T

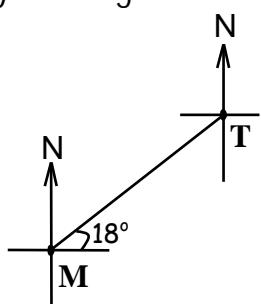
2. Study the drawing below.



- Find the bearing of
- i) B from Q
 - ii) C from Q
 - iii) E from Q
 - iv) A from Q
 - v) D from Q
 - vi) Q from B
 - vii) Q and A
 - viii) Q from E
 - ix) Q from C
 - x) Q from D

3. Study the diagrams below.

a)



Find the bearing of T from M.

b)

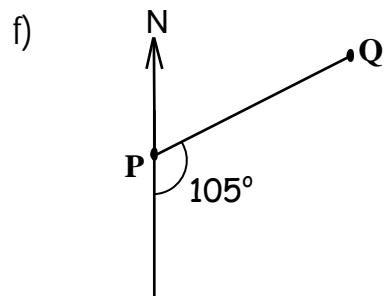
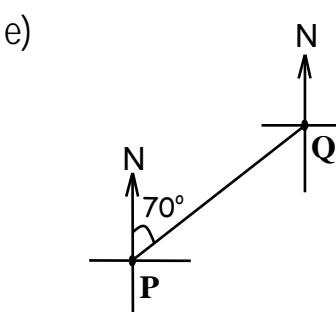
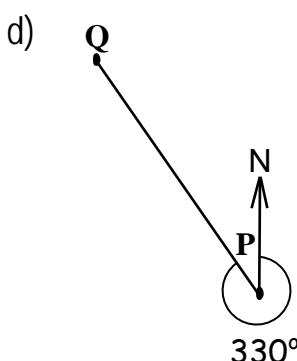
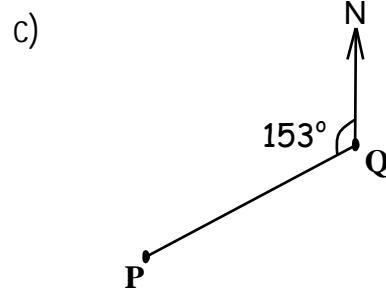
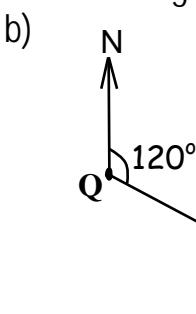
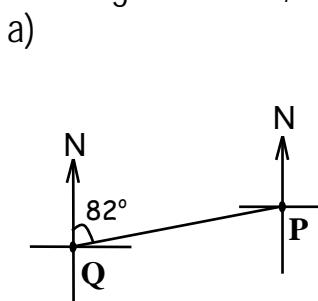


Find the bearing of P from Q.

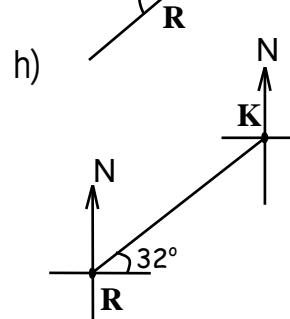
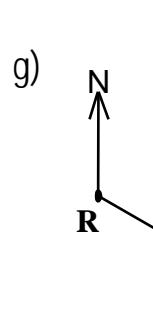
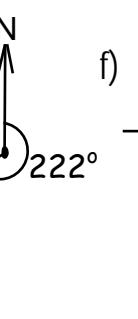
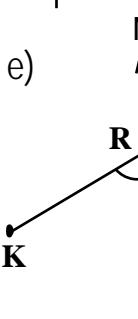
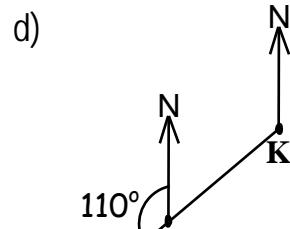
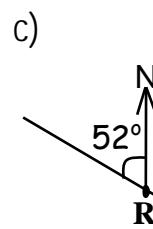
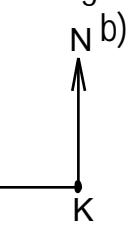
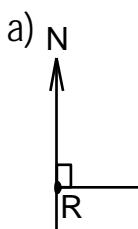
TOPIC 7: GEOMETRIC CONSTRUCTION



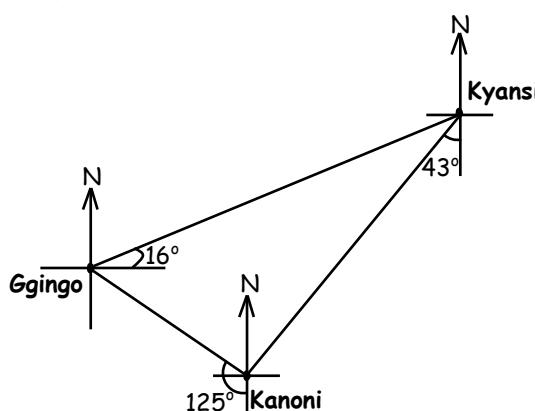
4. In the figures below, find the bearing of P from Q.



5. Find the bearing of R from K.



6. The figure below shows the location of three places. Find the bearing of:



- a) Kyansi from Kanoni.
- b) Kyansi from Ggingo.
- c) Ggingo from Kanoni.
- d) Kanoni from Kyansi.
- e) Ggingo from Kyansi.
- f) Kanoni from Ggingo.

TOPIC 7: GEOMETRIC CONSTRUCTION



Opposite bearing

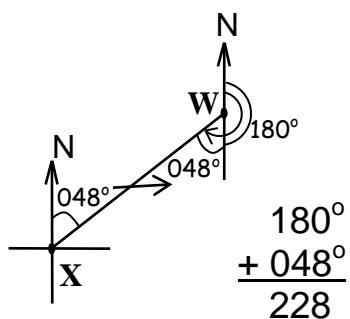
Note:

- When the given bearing is less than 180° , add 180° to the given angle to get its opposite bearing.
- If the given bearing is greater than 180° , subtract 180° from it to get its opposite bearing.

Example 1

The bearing of town W from town X is 048° .

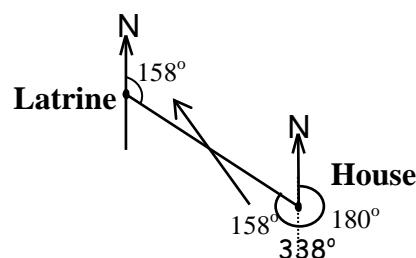
Find the bearing of **Town X** from **Town W**.



The bearing of town X from town W is 228°

Example 2

The bearing of the latrine from the house is 338° . Find the bearing of the house from the latrine.



$$338^\circ - 180^\circ = 158^\circ$$

The bearing is 158°

Exercise.

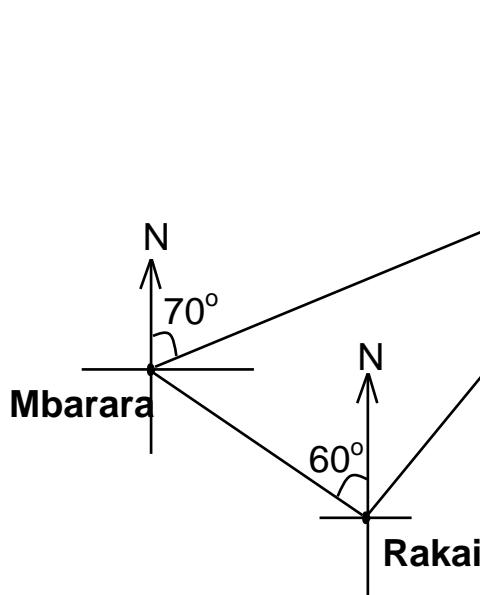
1. The bearing of X from Y is 042° . Find the bearing of Y from X.
2. The bearing of town P from town Q is 173° . Find the bearing of town Q from town P.
3. The bearing of island M from island N is 068° . Find the bearing of Island N from Island M.
4. The bearing of A from B is 235° . Find the bearing of B from A.
5. The bearing of Kikajo from Seguku is 349° . Find the bearing of Seguku from Kikajo.
6. Find the opposite bearing:

a) 049°	d) 091°	g) 215°	j) 197°
b) 072°	e) 105°	h) 344°	k) 358°
c) 060°	f) 157°	i) 186°	l) 300°
7. The bearing of L. Victoria from L. Albert is 126° . Find the bearing of L. Albert from L. Victoria.
8. Kedo is on a bearing of 188° from Fene. Find the bearing of Fene from Kedo.
9. Two pupils; Kalori and Katongole stood a distance apart such that Kaloli was on bearing of 279° from Katongole. Find the bearing of Katongole from Kaloli
8. Town X is East of town Y. Find the bearing of town Y from town X.
9. My home is $S45^\circ E$ of the church. Find the bearing of the church from my home.
10. The direction of Somalia from Uganda is $N68^\circ E$. Find the bearing of Uganda from Somalia.

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11. Town P is North of town Q. Find the bearing of town Q from town P.
 12. The diagram below shows the location of three districts in Uganda .

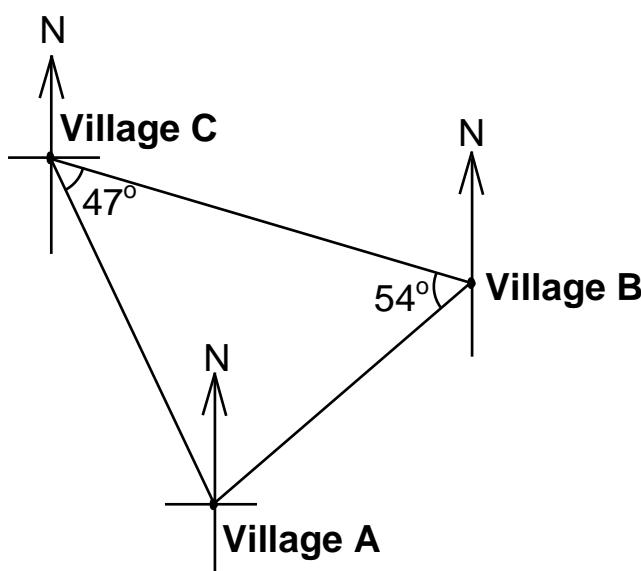


- a) Find the bearing of
 i) Rakai from Mbarara.
 ii) Masaka from Rakai.
 iii) Mbarara from Rakai.
 b) Find the direction of Rakai from Masaka.

13. Copy and complete the table below.

Direction	Opposite direction	Bearing	Opposite bearing
S 40° W			
N 55° W			
N 48° E			
S 60° E			

14. The direction of Moroto from Mpigi is N 58° E. Find the true bearing of Mpigi from Moroto.
 15. The diagram below shows the location of three villages; A, B and C. **Village A** is on a bearing of 164° from **Village C**. Use the diagram to answer questions that follow.



- a) Find the bearing of;
 i) village B from village A.
 ii) village A from village B.
 iii) village B from village C.
 iv) village C from village B.
 v) village C from village A.
 b) In which direction is village C from village A?

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SCALE

Example 1

The distance between two towns is 90km, this distance is represented by 5cm on a map. Find the scale.

5cm represent 90km

1cm represents $\frac{90}{5}$ km

1cm represents 18km

Example 2

Using a scale of 1cm to represent 10km, find the actual length of the following.

a) 5cm b) 3.5cm

$5 \times 10\text{km}$

50km

$3.5 \times 10\text{km}$

$\frac{35}{10} \times 10\text{km} = 35\text{km}$

Example 3

Given that 1cm represents 20km. Find the distance on the map that represents the given actual distance.

a) 120km

1cm represents 20km

$(120 \div 20)\text{cm} = 6\text{cm}$

6cm represent 120km

b) 70km

1cm represents 20km

$(70 \div 20)\text{cm} = 3.5\text{cm}$

3.5cm represent 70km

c) 150km

1cm represents 20km

$(150 \div 20)\text{cm} = 7.5\text{cm}$

7.5cm represent 150km

Exercise

1. The actual distance between two islands is 200km. It is represented by 4cm on a map. Find the scale.
2. A distance of 75 kilometres is represented by 5cm on a map. Find the scale.
3. A square plot of land of side 160m was represented on a map by a square whose perimeter is 32cm. What scale was used.
4. Find the actual ground distance represented by the following length on the map given that 1cm represents 10km.

a) 8cm	d) 4cm	g) 2.5cm
b) 12cm	e) 117cm	h) 8.75cm
c) 13cm	f) 708cm	i) 14.25 cm
5. Calculate the distance on the map that represents the given actual distance if 1cm represents 10km.

a) 80km	d) 1020km	g) 17km
b) 100km	e) 115km	h) 25.5km
c) 150km	f) 248km	i) 124.25km.
7. The distance between town T and town S is 255 kilometres from Entebbe to Mutukula. Find the map distance if 1cm represents 34 kilometres.
8. On a map, 1cm represents 170 metres. Two towns are 1020 metres apart. How far apart are the two towns on the map?

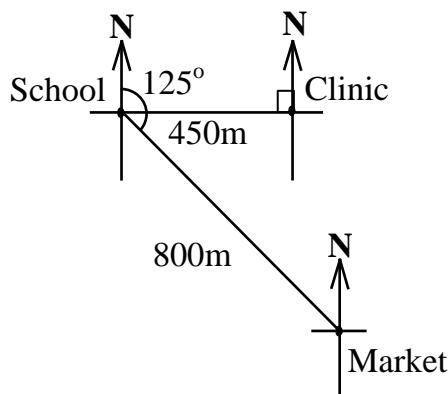
TOPIC 7: GEOMETRIC CONSTRUCTION



SCALE DRAWING

Example 1

The diagram below shows the location of three places in Buikwe town. Use it to answer questions that follow.



- a) Using a scale of 1cm to represent 100metres, draw an accurate diagram showing the three places.

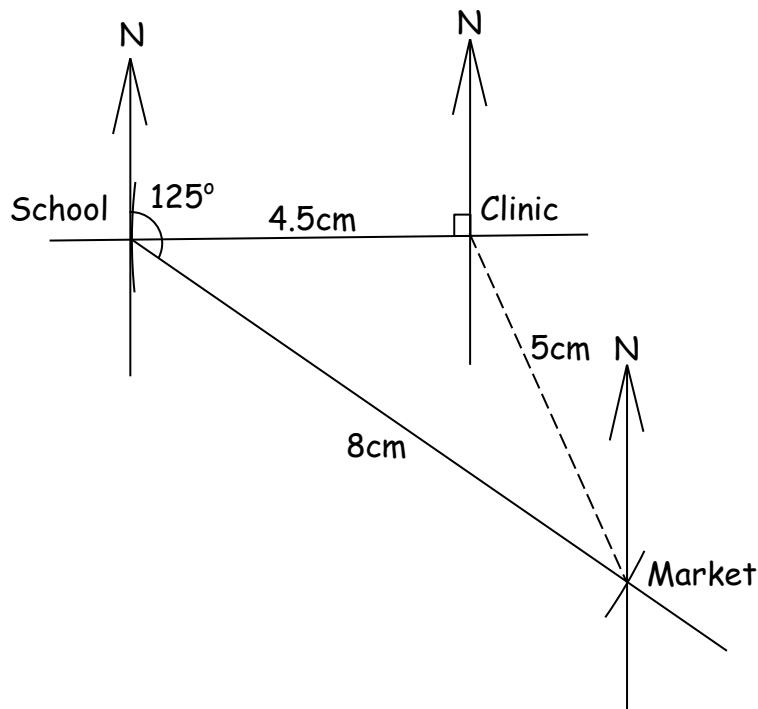
Drawing distance

Clinic to School

$$\left(\frac{450}{100}\right)\text{cm} = 4.5\text{cm}$$

School to Market

$$\left(\frac{800}{100}\right)\text{cm} = 8\text{cm}$$



- b) Find the shortest distance between the market and the clinic.

$$5 \times 100\text{m} = 500\text{m}$$

The shortest distance between the market and the clinic is 500 meters

- c) Find the bearing of the market from the clinic.

The bearing of the market from the clinic is 156°

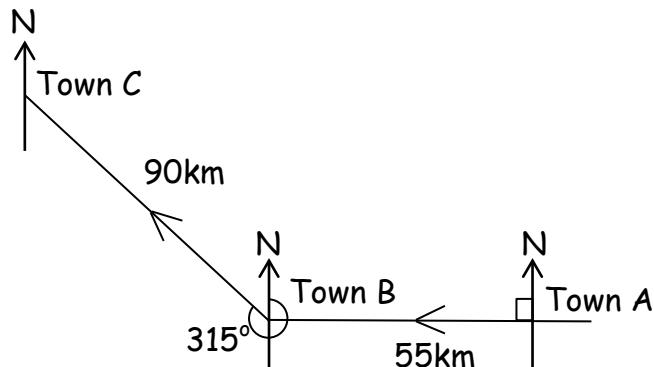
TOPIC 7: GEOMETRIC CONSTRUCTION



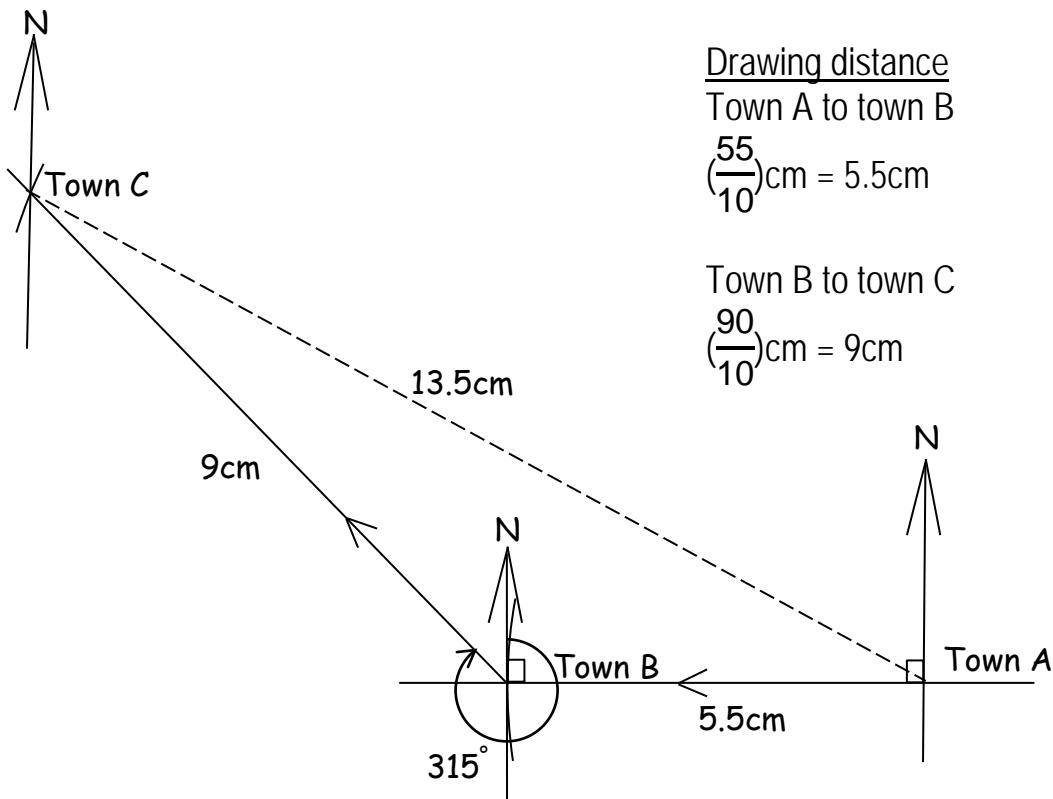
Example 2

A tourist left town A and travelled 55 kilometres westwards to town B. He then turned on a bearing of 315° from town B and travelled to town C which is a distance of 90 kilometres.

- a) Draw a sketch diagram to show the tourist's movement.



- b) Using a scale of 1 centimetre to represent 10 kilometres, draw an accurate diagram to show the tourist's journey.



- c) Find in kilometres, the shortest distance between town C and town A.

$$\left(\frac{135}{10} \times 10\right) \text{ km} = 135 \text{ km}$$

- d) On which bearing is town C from town A?

$$180^\circ + 118^\circ = 298^\circ$$

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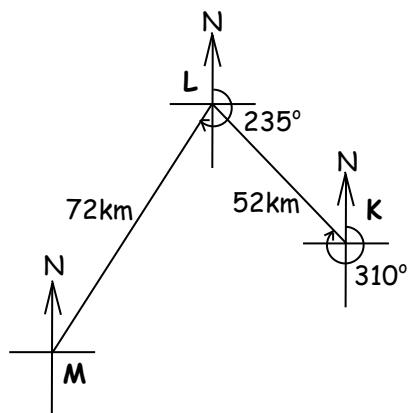


Example 3

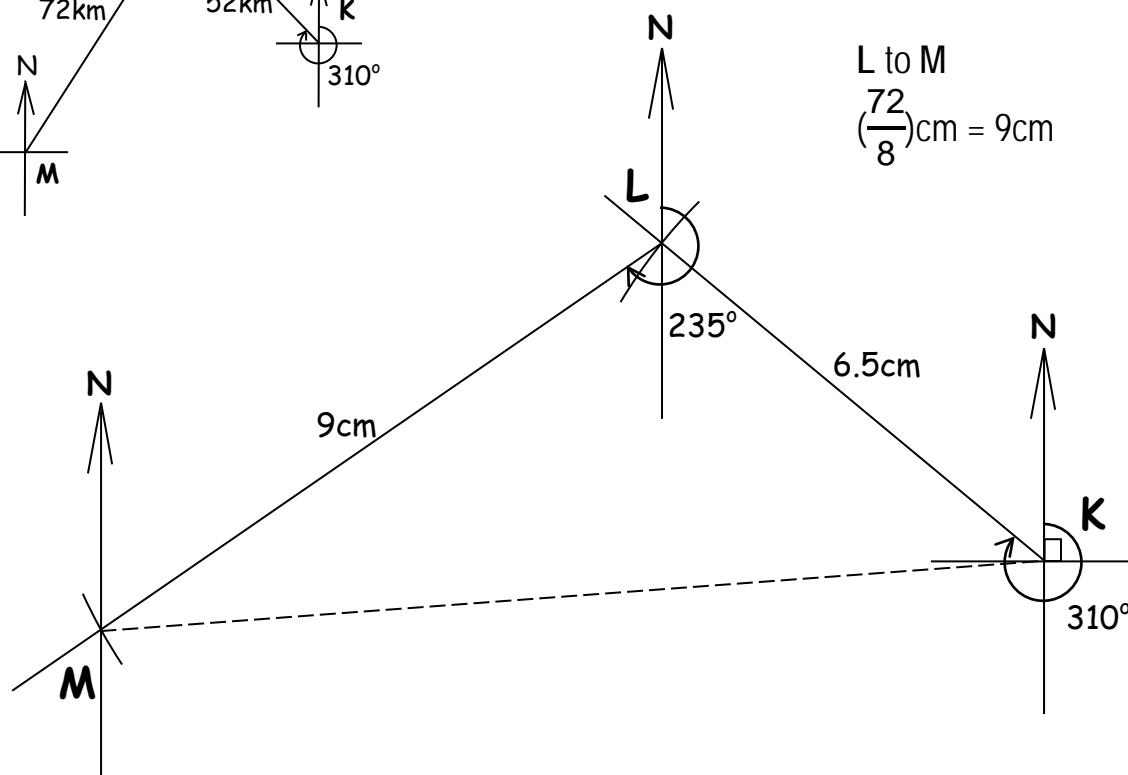
A boat sailed from Port K on a bearing of 310° a distance of 52 kilometres to Port L. It then left Port L and sailed on a bearing of 235° to Port M for 72 kilometres.

- a) Using a scale 1 centimetre to represent 8 kilometres, draw an accurate diagram to show the route of the boat.

Sketch



Accurate diagram



- b) Find the bearing of Port M from Port K.

$$180^\circ + 86^\circ = 266^\circ$$

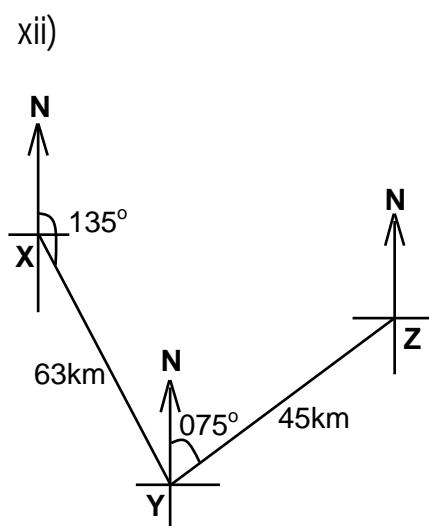
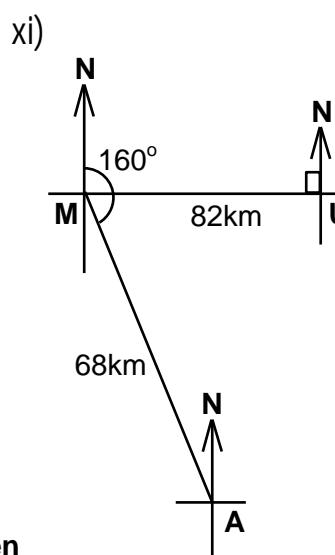
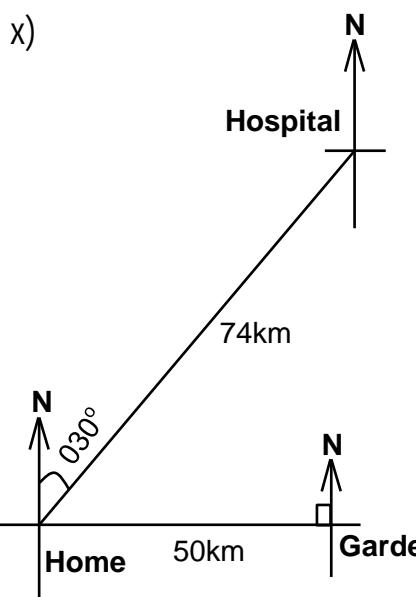
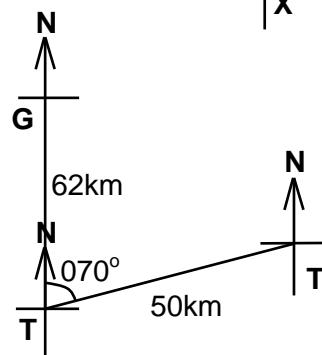
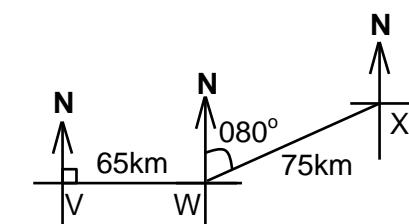
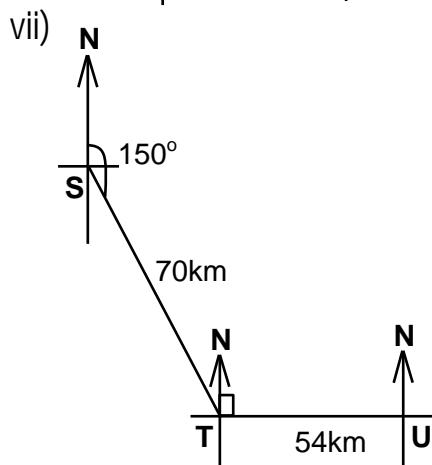
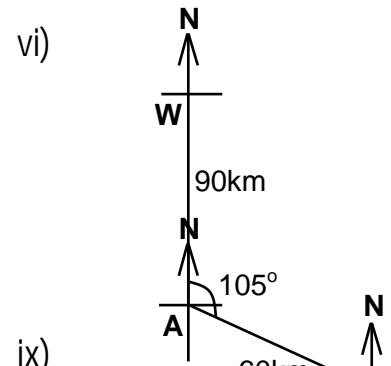
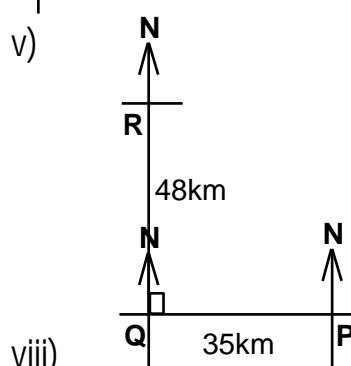
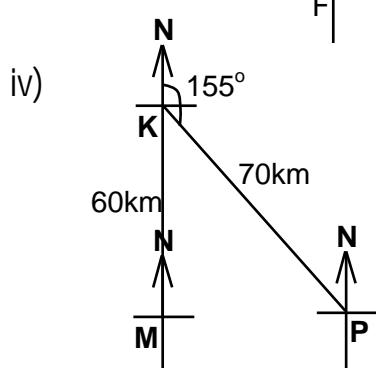
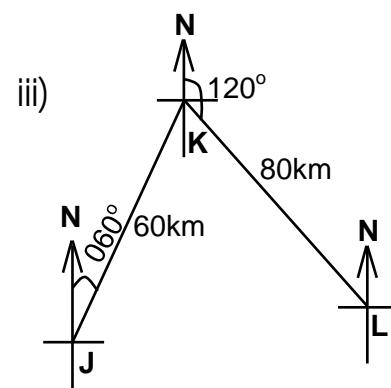
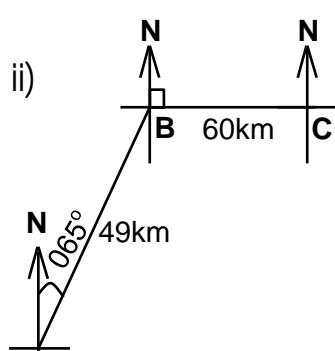
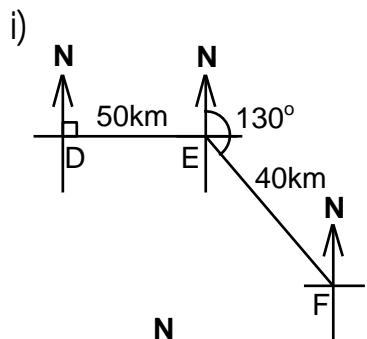
- c) Find the shortest distance between Port M and Port K.

$$\left(\frac{125}{10} \times 8\right)\text{km} = 100\text{km}$$

TOPIC 7: GEOMETRIC CONSTRUCTION



1. Use 1 centimetre to represent 10 kilometres, draw an accurate diagram for each of the following:



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2. Amos moved from point A for 160 metres eastward to point B. He then turned northward and moved 200 metres to point C. Finally, he turned westward and moved 80 metres to point D.
 - a) Using a scale drawing of 1 cm to represent 20 metres, draw an accurate diagram to show the man's movements.
 - b) Measure the distance between A and D.
 - c) What is the size of angle BAD?
3. Timothy left village X and drove westward to village Y, a distance of 30km. He then drove southwards from village Y to village Z, a distance of 24km and returned directly from Z to X.
 - a) Using a scale of 1 cm to represent 6 km, draw an accurate diagram to show Timothy's journey.
 - b) Find the shortest distance from X to Z in Kilometres (km).
4. The bearing of town B from town A is 120° and town B is 4 km from A. The bearing of town C from B is 60° and town C is 5km from B.
 - a) Draw an accurate diagram showing the three towns. (Use scale: 1 cm = 1 km).
 - b) Find the shortest distance between A and C in kilometres.
5. A tourist left town A and travelled 55 km westwards to town B. He then turned on a bearing of 215° and travelled to town C which is a distance of 65 km.
 - a) Draw a sketch diagram to show the tourist's journey.
 - b) Using a scale of 1cm to represent 10km, draw an accurate diagram to show the tourist's journey.
 - c) Find the shortest distance from town C to A in km.
6. A school library is 70 metres east of the main hall. The staff room is 60 metres from the library on a bearing of 240° .
 - a) Using a scale of 1 centimetre to represent 10 metres, show the three places on an accurate diagram.
 - b) Find the shortest distance between the main hall and the staff room.
7. Town Q is 72km away from town P on a bearing of 250° and town C is 45km away from town Q on a bearing of 320° .
 - a) Using a scale of 1 cm to represent 9km, draw an accurate diagram to show the 3 towns.
 - b) Find the bearing of town C from town P.
8. Village B is 60km away from village A on a bearing of 320° . Village C is 84km from B on a bearing of 250° . Using a scale of 1cm to represent 12km, draw an accurate diagram to show the location of the three villages.
9. A rectangular piece of land measures 60 metres by 40 metres. Using a scale of 1 centimetre to represent 10 metres, make a scale drawing of the plot. Hence find the length of the diagonal.

TOPIC 7: GEOMETRIC CONSTRUCTION



10. Fly Emirates plane left Entebbe airport on a bearing of 270° for Morocco a distance of 600km. It then left Morocco for Accra on a bearing of 240° a distance of 500km.
 - a) Using a scale of 1cm to represent 100km, draw an accurate diagram to show the flight of the plane.
 - b) Find the shortest distance between Entebbe and Accra in km.
11. Town A is 30km west of town B and town C is 40km from B on a bearing of 150° .
Using a scale of 1cm = 10km.
 - a) Draw a sketch to show the above information.
 - b) Draw an accurate diagram showing the three places.
(Using a scale 1 cm to represent 20 km)
 - c) Find the shortest distance between A and C in km.
12. Town P is 50km west of town Q and town R is 40km from town Q on a bearing of 150° .
 - a) Using the scale of 1 cm = 10km, draw a rough sketch showing the three towns.
 - b) Draw an accurate diagram showing the three places.
13. Towns P and Q are 120km apart and town Q is on a bearing of 120° from P.
 - a) Draw a sketch diagram to show the above information.
 - b) Construct an accurate diagram to show the towns.
 - c) From your diagram, find the bearing of P from Q.
14. Town R is 40km west of town K and town M is 60km from K on a bearing of 225° .
 - a) Using the scale of 1cm = 10km, draw a rough sketch to show the above information.
 - b) Construct an accurate diagram showing the three places.
 - c) Find the shortest distance in km.
15. Town P is 40km on a bearing of 120° from town X and town R is 50km on a bearing of 270° from town P.
 - a) Using the scale of 1cm = 10km, draw a sketch to show the three towns.
 - b) Construct an accurate diagram showing the three places.
16. A tourist left town A and travelled 55km westwards to town B. He then turned on a bearing of 215° from town B and travelled to town C which is a distance of 65km.
 - a) Draw a sketch diagram to show the tourist's journey.
 - b) Using a scale of 1cm to represent 10km, draw an accurate diagram to show the tourist's journey,
 - c) Find the shortest distance from town C to A in km.
17. Town M is 60km in the North East of town N. Town L is 40km on a bearing of 120° from town N.
 - a) Draw a rough sketch for the above, taking a scale of 1cm:10km.
 - b) Draw an accurate diagram to show the three towns.

TOPIC 7: GEOMETRIC CONSTRUCTION

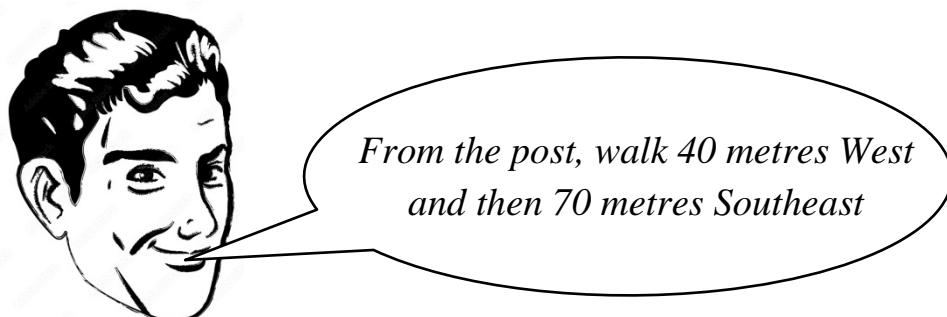


18. Town C is on a bearing of 150° from town A which is 40km away and town C is 50km from town B on a bearing of 070° . Using a scale of 1cm = 10km, draw a sketch then an accurate diagram. What is the shortest distance between A and B in km?
19. The bearing of Kasalu from Kitovu is 285° . The two towns are 400km apart. Lambu is 140km from Kitovu on a bearing of 025° .
 - a) Using a scale of 1cm to represent 40km, draw an accurate diagram to show the location of the three towns.
 - b) Find the shortest distance between Kasalu and Lambu.
 - c) What is the bearing of Kasalu from Lambu?
20. A ship leaves a port and sets sail on a bearing of 060° . After 40km, it alters its course to a bearing of 325° and continues in this direction for 50km. Use a scale of 1cm = 6.25km.
 - a) Draw an accurate diagram to show the ship's movement.
 - b) Find
 - i) the distance of the ship from the port.
 - ii) its bearing from the port.
21. There is a road running for 2500m from Zakayo's home on a bearing of 000° . The road then goes 3000m on a bearing of 305° and it ends at a market.
 - a) Use a scale 1cm : 500 metres, draw an accurate diagram.
 - b) How far is the market from Zakayo's home?
22. A squad of scouts is $2\frac{1}{2}$ km from a school on a bearing of 027° . Another squad is $3\frac{1}{2}$ km from the same school on a bearing of 304° . Use a scale 1cm : 0.5km to draw an accurate diagram, then find the distance between the two squads.
23. A helicopter flew from town A to town B 360km away on a bearing of 240° . It then flew to town C 450 km away on a bearing of 300° .
 - a) Draw a sketch to show the helicopter's flight.
 - b) Using a scale of 1cm to represent 60km, draw an accurate diagram to show the helicopter's flight.
 - c) What is the bearing of town A from town C?
24. A ship sailed from port A 350km on a bearing of 120° to port B. It changed direction and sailed 420 m to port C on a bearing of 215° .
 - a) Draw a sketch map showing the above information.
 - b) Using a scale, 1cm to represent 70km, draw an accurate figure showing the three places.
 - c) Find the shortest distance between ports A and C.

TOPIC 7: GEOMETRIC CONSTRUCTION



25. A boy walks 6km from point P to point Q on a bearing of 065° . He then walks from point Q to point R a distance of 10km on a bearing of 120° .
- Draw a sketch showing the above information.
 - Using a scale, 1cm to represent 2km, draw an accurate diagram showing the boy's movement.
 - What is the bearing of point P from point R?
26. A ship sails 70km due east from point P to point A. It then sails 30km due south from point A.
- Draw a sketch for the given information.
 - Use a scale $1\text{cm} : 10\text{km}$, draw an accurate diagram to show the location of the three places.
27. A Uganda Air Force pilot flew from Entebbe Air Base for a distance of 60km on a bearing of 204° , then flew 102km on a bearing of 345° to Kyankwanzi.
- Using a scale of 1cm to represent 12km, draw an accurate diagram to show the location of Kyankwanzi.
 - Find the bearing of Kyankwanzi from Entebbe Air Base.
28. Kenneth's father has hidden Kenneth's birthday present in a field near their house. He has given him instructions to help him find it.



Kenneth has decided to draw an accurate map to help using a scale of $1\text{cm} : 10\text{m}$.

- Draw his route.
 - How far is his house from field?
29. An animal passed by a hunter's home. He chased it Southwards for 300 metres to the church. It then ran for 450 metres on a bearing of 335° from the church to the main road where it was knocked by a speeding car.
- Using a scale ($1\text{cm} : 50\text{m}$), draw an accurate diagram.
 - How far is the hunter's home from the main road?
30. Hill A and Hill B are 70km apart. The direction of Hill B from Hill A is $S35^\circ E$. Hill C is 95km East of Hill B.
- Draw an accurate diagram ($1\text{cm} : 10\text{km}$).
 - Find the bearing of Hill A from Hill C.