What are Triangles?

A triangle is a simple closed curve or polygon which is created by three line-segments. In geometry, any three points, specifically non-collinear, form a unique triangle and separately, a unique plane (known as two-dimensional Euclidean space).

The basic elements of the triangle are sides, angles, and vertices.

Let's start with the constructions of triangles.

Let's Build Triangles

Classification of triangles based on sides and angles

Triangles can be classified based on their:

SIDES:

Equilateral triangle: All three sides are equal in measure.

Isosceles triangle: Two sides have equal measure.

Scalene triangle: All three sides have different measures.

ANGLES:

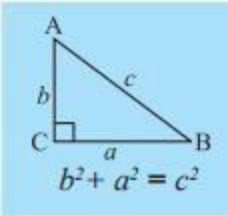
Acute triangle: All angles measure less than 90°.

Obtuse triangle: One angle is greater than 90°.

Right triangle: One angle is 90°.

Important properties of triangles

1) The exterior angle is equal to the sum of interior opposite angles.
2) The sum of all interior angles is 180°
3) Sum of the lengths of any two sides is greater than the length of the third side.
4) Pythagoras theorem: In any right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.



Triangles can be constructed if any of the following measurements are given

a) Three sides.
b) Two sides and an angle between them.
c) Two angles and a side between them.
d) The hypotenuse and a leg in case of a right-angled triangle.

CONSTRUCTION OF TRAINGLES

A triangle can be constructed if and only if the following conditions are satisfied

I) PROPERTIES OF TRIANGLES

a) The exterior angle of a Triangle is equal in measure to the sum of interior opposite angles.

b) The total measure of the three angles of a triangle is 180

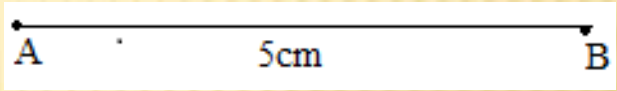
c) Sum of the lengths of any two sides of a triangle is greater than the length of the third side.

d) In any right angled triangle, the square of the length of hypotenuse is equal to the sum of the squares of the lengths of the other two sides.

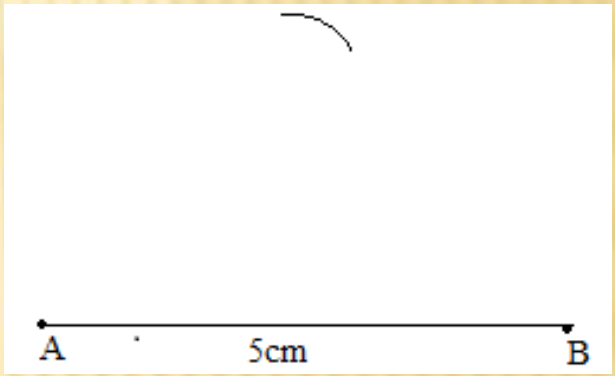
CONSTRUCTION OF AN EQUILATERAL TRIANGLE

Example: Construct △ ABC with each side of 5cm.

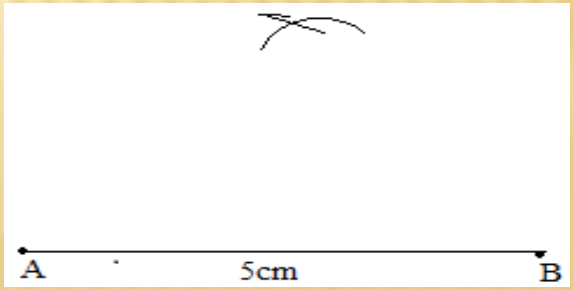
Step:1) Draw a line segment AB of length 5cm



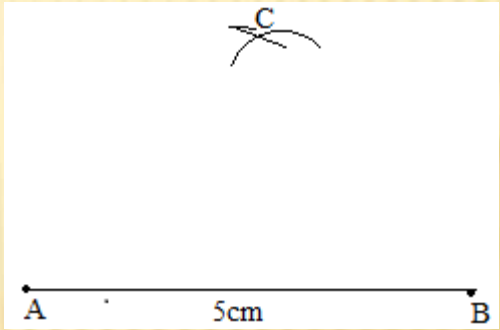
Step:2) Draw an arc of radius 5cm with ‘A’ as the centre



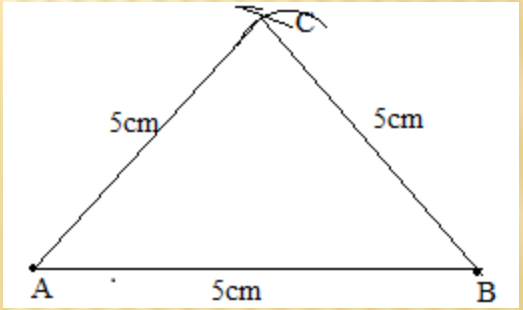
Step:3) Draw an arc of radius 5cm with ‘A’ as the centre



Step:4) Mark the point ‘C’ at the point of intersection of these two arcs.



Step:5) Join AC and BC

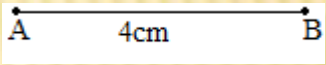


△ABC if the required equilateral triangle

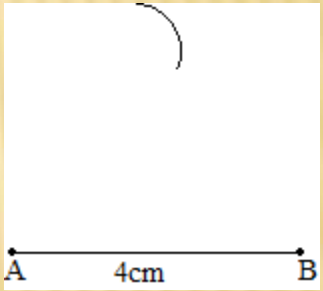
CONSTRUCTION OF AN ISOSCELES TRIANGLE

Example: Construct an isosceles triangle whose base is 4cm and each equal side is of length 5cm.

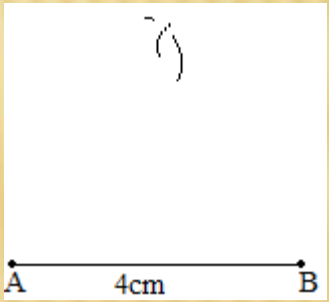
Step:1) Draw a line segment AB of length 4cm with the ruler.



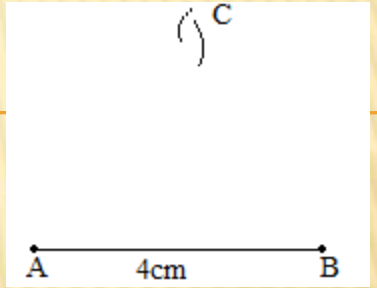
Step:2) Draw an arc of radius 5cm with ‘A’ as the centre.



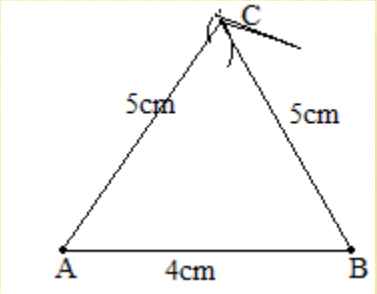
Step:3) Draw another arc of radius 5cm with ‘B’ as the centre



Step:4) Mark the point ‘C’ at the point of intersection of the arcs



Step:5) Join AC and BC



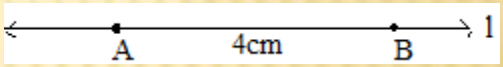
△ABC if the required isosceles triangle

CONSTRUCTION OF A RIGHT ANGLED TRIANGLE

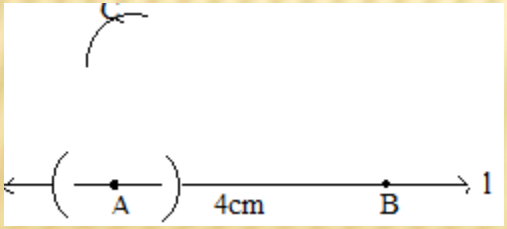
Example: Construct a right angled triangle whose hypotenuse is 5cm and one of its legs is 4cm.

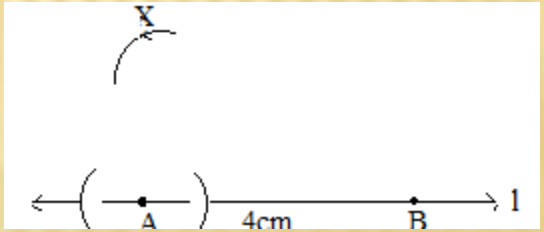
Step:1) Draw a line ‘l’

Step:2) Mark a point ‘A’ on it and with the help of ruler or with the compasses of radius, take a point ‘B’ on it at a distance of 4cm

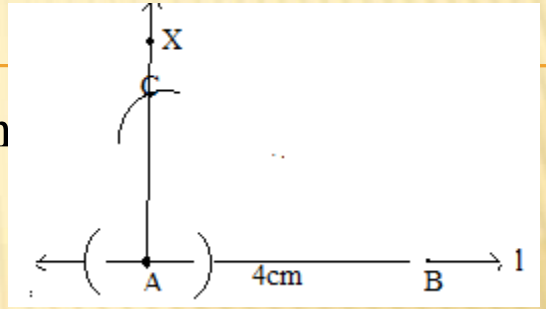


Step:3) Draw two arcs on either sides of the point ‘A’ of any radius and the with more than half the length between the arcs, draw two arcs with the point of Intersection of the line with the arcs, Let the arcs are meeting at a point ‘X’

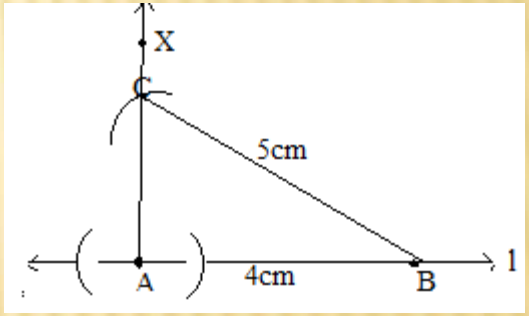




Step:4) Draw a perpendicular through ‘A’ and ‘X’ to the lin

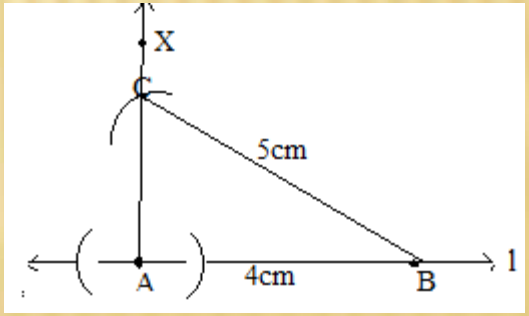


Step:5) With the centre ‘B’ and radius 5cm, draw an arc so that the arc cuts the perpendicular at the point ‘C’



Step:6) Join BC


ABC if the required right angled triangle



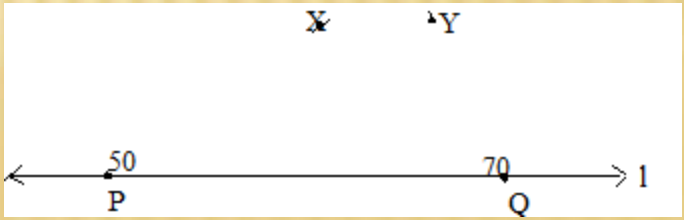
CONSTRUCTION OF A TRIANGLE WITH THE GIVEN THREE MEARURES OF ANGLES

Example: Construct a triangle with measures $50^0 60^0, 70^0$

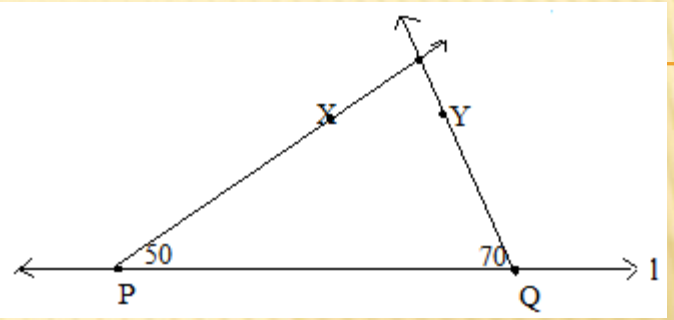
Step: 1) Draw a line 'l'

Step:2) Mark two points 'P' and 'Q' on it

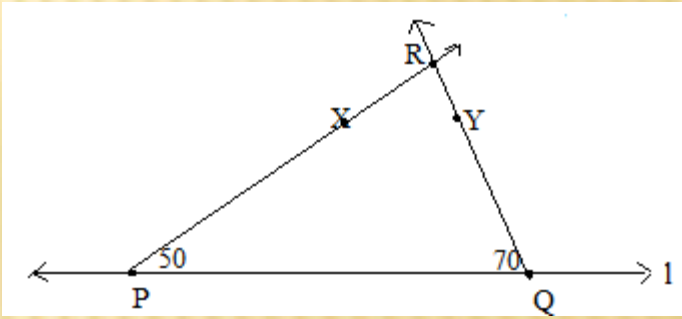
Step: 3) With the help of protractor, take 50^0 from point 'P' and 70^0 from 'Q'



Step: 4) Draw the rays from ‘P’ and ‘Q’ through the angles taken respectively



Step:5) Mark ‘R’ at the point of intersection of the rays.



ΔPQR if the required triangle

Note:
Any angle of the given three angles can be taken from the Points marked on the line.

For example, in the above construction, measure of 60 can be taken from any of the points ‘P’ or ‘Q’, which is to be drawn using compasses because the measure of angle is a multiple of 15.

Construction of a triangle after verifying whether the properties of a triangle is satisfied

Example: Examine whether $\triangle DEF$ such that $EF=7.2cm$ m $\angle E=110^0$ and m $\angle F=80^0$ Justify your answer.

Answer: $m\angle E + m\angle F=110^\circ+80^\circ=190^\circ$, so as the given data is not satisfying the angle sum property of the triangle, the construction is not possible

Example: Examine whether ΔABC such that $BC=2cm$ $AB=4cm$ and $AC=2cm$. Justify your answer.

Answer: $2+4=6> 2$, $4+2=6> 2$ but $2+2=4$ so, as the given data is not satisfying the triangle inequality property, it is not possible to construct the triangle

END OF MODULE - 2

THANK YOU

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