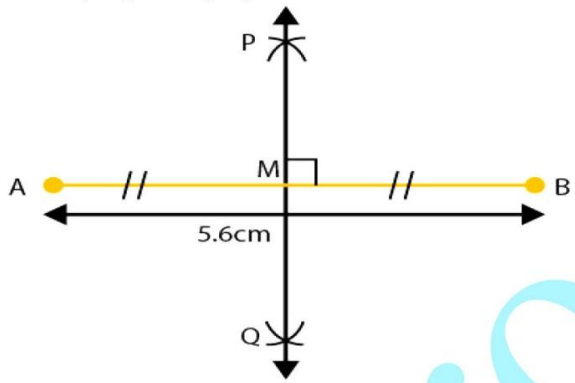
RS Aggarwal Solutions for Class 9 Maths Chapter 13 – Geometrical Constructions

EXERCISE 13 PAGE: 514

1. Draw a line segment AB = 5.6 cm and draw its perpendicular bisector. Measure the length of each part.
Solution:

Steps of Construction:
Construct a line segment AB = 5.6 cm
Considering A as centre and radius more than half of line segment AB, draw two arcs on the each side of the line segment AB
Considering B as centre and radius more than half of line segment AB, draw arcs which cuts the previous arcs at the points P and Q
Join the points PQ such that it intersects the line segment AB at the point M
Therefore, PQ is the perpendicular bisector of the line segment AB.

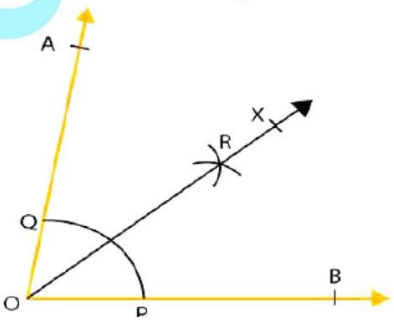


So the length of each part is AM = BM = 2.8 cm

2. Draw an angle of 80° with the help of a protractor and bisect it. Measure each part of the bisected angle.
Solution:

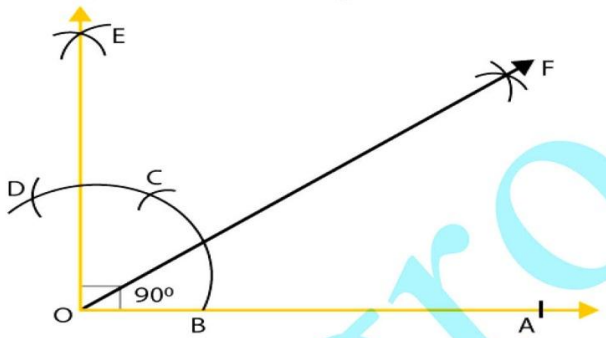
Steps of Construction:
Construct a ray OB
Using the protractor construct ∠AOB of 80°
Considering O as centre and convenient radius construct an arc cutting the sides OA and OB at the points Q and P
Considering Q as centre and radius more than half of the angle PQ, construct an arc
Considering P as the centre and radius more than half of the angle PQ, construct another arc which intersects the previous arc at the point R
Join the points OR and produce it in order to form a ray OX
Therefore, OX is the required bisector of the ∠AOB

So the measure of each part of the bisected angle is ∠AOX = ∠BOX = 40°



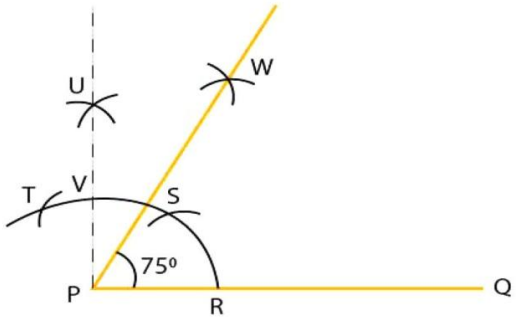
3. Construct an angle of 90° using ruler and compasses and bisect it.
Solution:

Steps of Construction:
Construct a line segment OA
Considering O as centre and suitable radius construct an arc cutting the line OA at the point B
Considering B as centre and suitable radius as before construct an arc to cut the previous arc at the point C
Considering C as centre and same radius cut the arc at point D
Considering C as centre and the radius more than half of CD construct an arc
Considering D as centre and same radius construct another arc to cut the previous arc at the point E
Join E so we get ∠AOE = 90°
Considering B as centre and radius more than half of CB construct an arc
Considering C as centre and same radius construct an arc which cuts the previous arc at the point F
Join OF
Therefore, F is the bisector of right ∠AOE

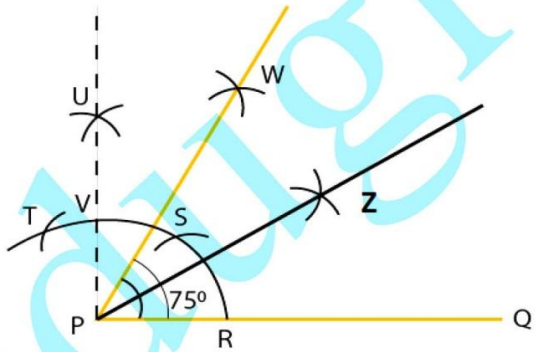


4. Construct each of the following angles, using ruler and compasses:
(i) 75°
(ii) 37.5°
(iii) 135°
(iv) 105°
(v) 22.5°
Solution:

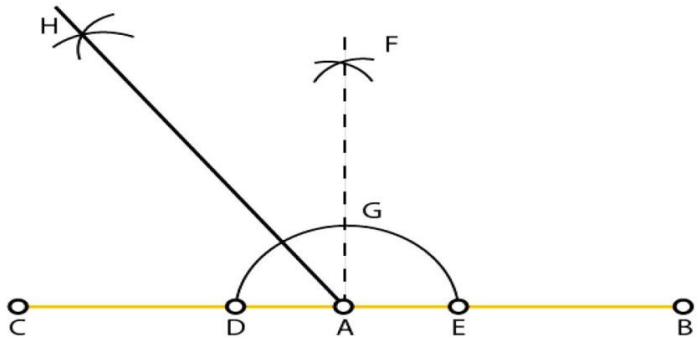
(i) Steps of Construction:
Construct a line segment PQ
Considering P as centre and any radius construct an arc which intersects the line PQ at the point R
Considering R as centre and same radius construct an arc which intersects the pervious arc at the point S
Considering S as centre and same radius construct an arc which intersects the pervious arc in step 2 at the point T
Considering T and S as centre and radius more than half of TS, construct arcs which intersects each other at the point U
Join the line PU which intersects the arc in step 2 at the point V
Considering V and S as centres and radius more than half of VS, construct arcs which intersects each other at the point W
Join the line PW
Therefore, we know that ∠WPQ = 75°



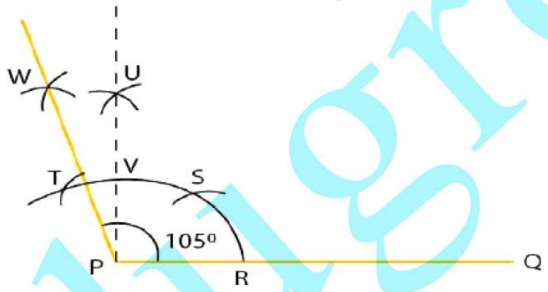
(ii) Steps of Construction:
Construct a line segment PQ
Considering P as centre and any radius, construct an arc which intersects the line PQ at the point R
Considering R as centre and any radius, construct an arc which intersects the previous arc at the point S
Considering S as centre and same radius, construct an arc which intersects the arc in step 2 at the point T
Considering T and S as centre and radius more than half of TS, construct arcs which intersects each other at the point U
Join the points PU which intersects the arc in step 2 at the point V
Considering V and S as cenntres and radius more than half of VS, construct arcs which intersect each other at the point W
Join the points PW and $\angle WPQ = 75^\circ$
Bisect the $\angle WPQ$
Therefore, we know that $\angle ZPQ = 37.5^\circ$



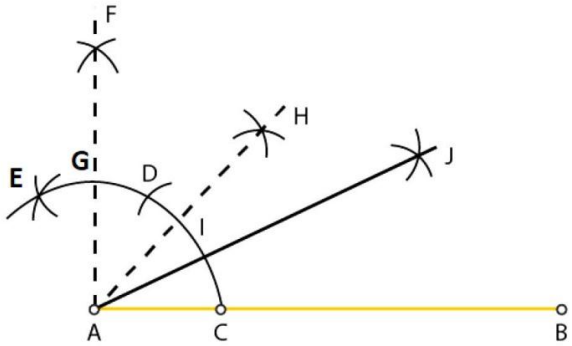
(iii) Steps of construction:
Construct a line segment AB and produce BA to C
Considering A as centre and any radius, construct an arc intersecting AC at point D and AB at point E
Considering D and E as centres and radius more than half of DE, construct two arch intersecting each other at the point F
Join the points FA which intersects the arc in step 2 at point G
Considering G and D as centres and radius more than half of GD, construct two arcs intersecting each other at the point H
Join HA
Therefore, we know that $\angle HAB = 135^\circ$



(iv) Steps of Construction:
Construct a line segment PQ
Considering P as centre and any radius, construct an arc which intersects PQ at the point R
Considering R as centre and same radius, construct an arc which intersects the previous arc at the point S
Considering S as centre and same radius, construct an arc which intersects the arc in step 2 at the point T
Considering T and S as centres and radius more than half of TS, construct arcs which intersects each other at point U
Join PU which intersects the arc in step 2 at point V
Considering T and V as centres and radius more than half of TV, construct arcs intersecting each other at the point W
Join PW which is makes 105° with the ray PQ
Therefore, we know that ∠WPQ = 105°



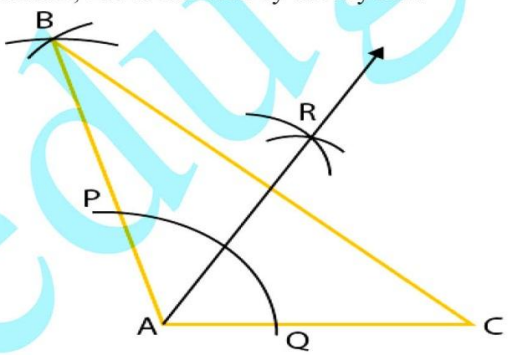
(v) Steps of Construction:
Construct a line segment AB
Considering A as centre and any radius, construct an arc which intersects AB at the point C
Considering C as centre and same radius, construct an arc which intersects the previous arc at the point D
Considering D as centre and same radius, construct an arc which intersects the arc in step 2 at the point E
Considering E and D as centres and radius more than half of ED, construct arcs which intersect each other at the point F
Join the points AF which intersects the arc in step 2 at the point G
Considering G and C as centres and radius more than half of GC, construct arcs intersecting each other at the point H
Join AH which intersects the arc in step 2 at the point I
Considering I and C as centres and radius more than half of IC, construct arcs which intersect each other at the point J
Join AJ
Therefore, we know that ∠JAB = 22.5°



5. Construct a △ ABC in which BC = 5cm, AB = 3.8cm and AC = 2.6cm. Bisect the largest angle of this triangle.
Solution:

Steps of Construction:
Construct line segment AC = 2.6 cm
Considering A as centre and radius 3.8cm, construct an arc
Considering C as centre and radius 5cm, construct an arc which intersects the previous arc at the point B
Join the points AB and BC
So we get △ ABC
From the figure we know that BC is the largest side of the triangle
BC = 5cm
We know that ∠A is the largest angle

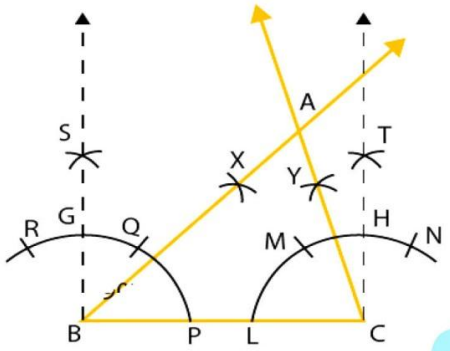
Considering A as centre and any radius, construct and arc which intersects AB at point P and AC at point Q
Considering P as centre and radius more than half of PQ, construct an arc
Considering Q as centre and same radius, construct an arc intersecting the previous arc at the point R
Join AR and extend it
Therefore, ∠A is bisected by the ray AR.



6. Construct a △ ABC in which BC = 4.8cm, ∠B = 45° and ∠C = 75°. Measure ∠A.
Solution:

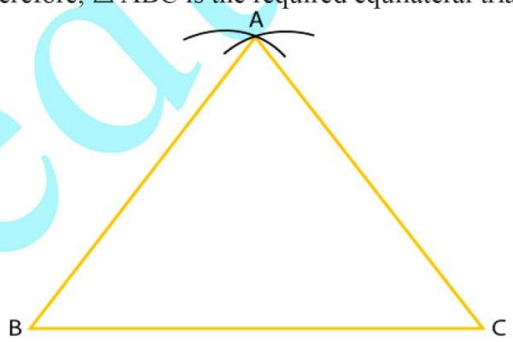
Steps of Construction:
Construct a line segment BC = 4.8cm
Considering B as centre and any radius, construct an arc which intersects BC at point P
Considering P as centre and same radius, construct an arc which intersects the previous arc at the point Q

Considering Q as centre and same radius, construct an arc which intersects the arc in step 2 at the point R
Considering R and Q as centres and radius more than half of RQ, construct arcs intersecting each other at the point S
Join BS which intersects the arc in step 2 at the point G so ∠SBC = 90°
Considering P as centre and radius more than half of PG, construct an arc
Considering G as centre and same radius, construct an arc which intersects the previous arc at the point X
Join B and extend it so ∠B = 45°
Draw ∠TCB = 90°
Considering M and H as centres and radius more than half of MH, construct arcs which intersect each other at point Y
Join CY and extend it so ∠C = 75°
BX and CY intersects at point A after extending
So, △ ABC is the required triangle
Therefore, ∠A = 60°



7. Construct an equilateral triangle, each of whose sides measures 5cm.
Solution:

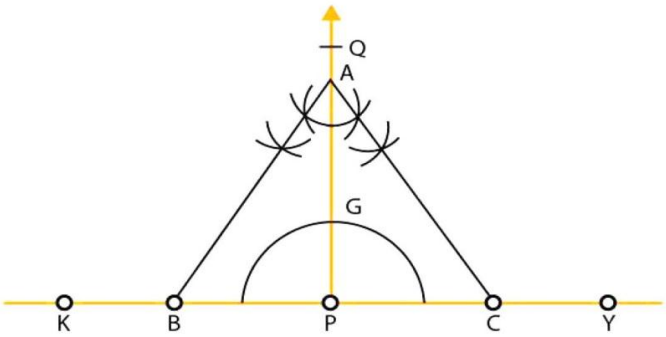
Steps of Construction:
Construct a line segment BC = 5cm
Considering B as centre and radius equal to BC, construct an arc
Considering C as centre and same radius, construct another arc which cuts the previous arc at the point A
Join the line AB and AC
Therefore, △ ABC is the required equilateral triangle,



8. Construct an equilateral triangle each of whose altitudes measures 5.4cm. Measure each of its sides.
Solution:

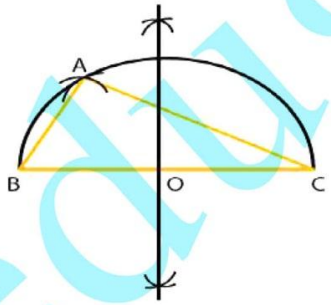
Steps of Construction:

Construct a line XY
Mark a point P on the line XY
From the point P, construct PQ perpendicular to XY
From the point P, mark the point PA = 5.4 cm, which cuts the line PQ at the point A
Draw ∠PAB = 30° and ∠PAC = 30° which meets the line XY at the points B and C
Therefore, ABC is the required equilateral triangle.



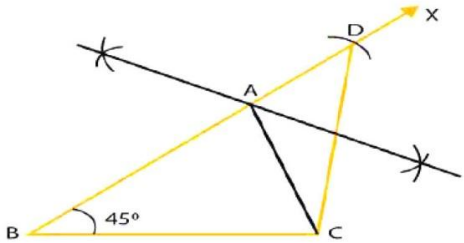
9. Construct a right-angled triangle whose hypotenuse measures 5cm and the length of one of whose sides containing the right angle measures 4.5cm.
Solution:

Steps of Construction:
Construct a line segment BC = 5cm
Mark the centre of the line BC as O
Considering O as centre and radius as OB, construct a semicircle on the line segment BC
Considering B as centre and radius 4.5 cm, construct an arc cutting the semicircle at the point A
Join the points AB and AC
Therefore, △ ABC is the required triangle.



10. Construct a △ ABC in which BC = 4.5cm, ∠B = 45° and AB + AC = 8cm. Justify your construction.
Solution:

Steps of Construction:
Construct a line BC = 4.5 cm
Construct ∠CBX = 45°
From BX, cut the line segment BD which is equal to AB + AC = 8 cm
Join the points CD
Construct a perpendicular bisector of CD which meets BD at the point A
In order to obtain the required triangle ABC join CA

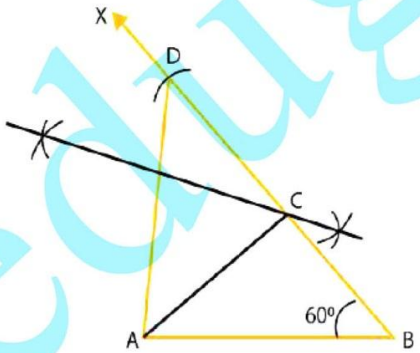


Justification:
We know that A lies on CD which is the perpendicular bisector
So we get
AC = AD
We know that BD = 8cm
It can be written as
BA + AD = 8cm
So we get
AB + AC = 8cm

Therefore, △ ABC is the required triangle.

11. Construct a △ ABC in which AB = 5.8cm, ∠B = 60° and BC + CA = 8.4cm. Justify your construction.
Solution:

Steps of Construction:
Construct AB = 5.8 cm
Construct ∠ABX = 60°
From BX, cut the line segment BD which is equal to BC + CA = 8.4 cm
Join the points AD
Construct a perpendicular bisector of AD which meets BD at the point C
In order to obtain the required triangle ABC join AC

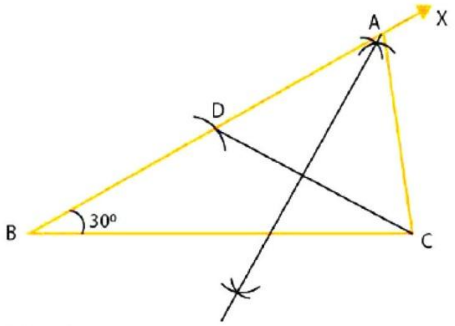


Justification:
We know that C lies on AD which is the perpendicular bisector
So we get
CA = CD
We know that BD = 8.4 cm
It can be written as
BC + CD = 8.4 cm
So we get
BC + CA = 8.4 cm

Therefore, △ ABC is the required triangle.

12. Construct a △ ABC in which BC = 6cm, ∠B = 30° and AB – AC = 3.5cm. Justify your construction.
Solution:

Steps of Construction:
Construct BC = 6 cm
Construct ∠CBX = 30°
From BX, cut the line segment BD which is equal to AB - AC = 3.5 cm
Join the points CD
Construct a perpendicular bisector of CD which meets BX at the point A
In order to obtain the required triangle ABC join CA

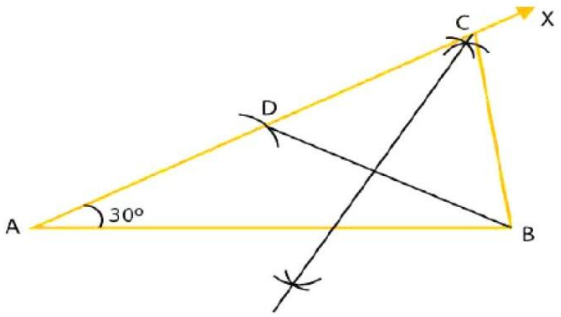


Justification:
We know that A lies on CD which is the perpendicular bisector
So we get
AD = AC
We know that BD = 3.5 cm
It can be written as
AB - AD = 3.5 cm
So we get
AB - AC = 3.5 cm

Therefore, △ ABC is the required triangle.

13. Construct a △ ABC in which base AB = 5cm, ∠A = 30° and AC – BC = 2.5cm. Justify your construction.
Solution:

Steps of Construction:
Construct AB = 5 cm
Construct ∠BAX = 30°
From AX, cut the line segment AD which is equal to AC - BC = 2.5 cm
Join the points BD
Construct a perpendicular bisector of BD which meets AX at the point C
In order to obtain the required triangle ABC join BC



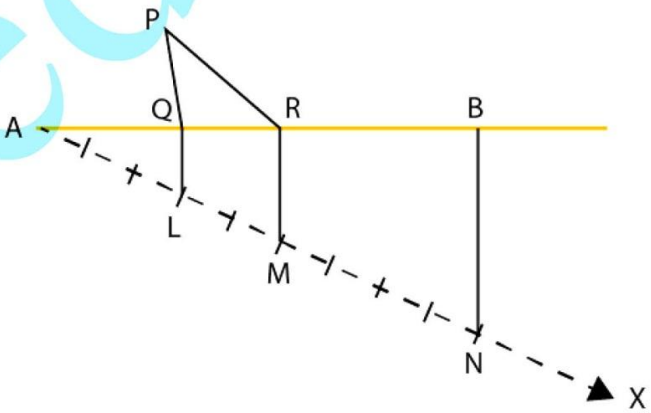
Justification:
We know that C lies on BD which is the perpendicular bisector
So we get
CD = BC
We know that AD = 2.5 cm
It can be written as
AC – CD = 2.5 cm
So we get
AC - BC = 2.5 cm

Therefore, △ ABC is the required triangle.

14. Construct a △ PQR whose perimeter is 12cm and the lengths of whose sides are in the ratio 3: 2: 4.
Solution:

Steps of Construction:
Construct a line segment AB = 12cm
Construct a ray AX which makes an acute angle with the line segment AB which is drawn in downward direction
From the point A set off (3 + 2 + 4) = 9 at equal distances along the line AX
The points L, M, N should be marked on AX where AL = 3 units, MN = 4 units and LM = 2 units
Join the points NB
From L and M, construct LQ || NB and MR || NB which cuts AB at the points Q and R
Consider Q as centre and AQ as radius, construct an arc
Consider R as centre and RB as radius, construct another arc which cuts the previous arc at the point P
Join the points PQ and PR

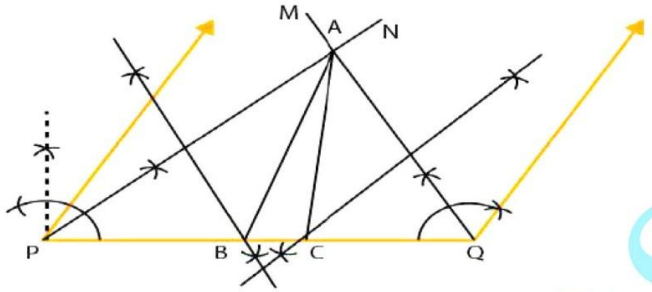
Therefore, △ PQR is the required triangle.



15. Construct a triangle whose perimeter is 10.4cm and the base angles are 45° and 120°.
Solution:

Steps of construction:
Construct a line segment PQ = 10.4cm
Draw a 45° and bisect it to obtain ∠NPQ
Draw a 120° and bisect it to obtain ∠MQP
Rays PN and QM intersect at the point A
Draw the perpendicular bisectors of PA and QA which intersects PQ at the points B and C
Join the point AB and AC

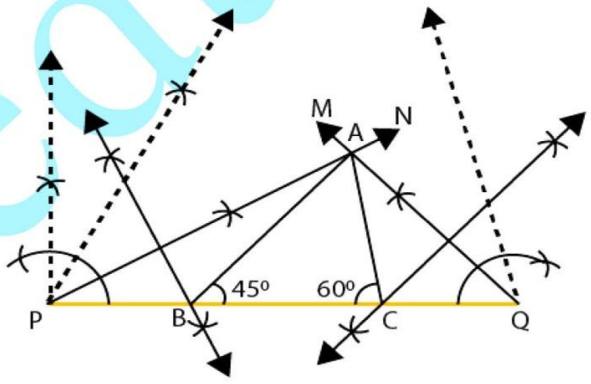
Therefore, △ ABC is the required triangle.



16. Construct a △ ABC whose perimeter is 11.6cm and the base angles are 45° and 60°.
Solution:

Steps of construction:
Construct a line segment PQ = 11.6cm
Draw a 45° and bisect it to obtain ∠NPQ
Draw a 60° and bisect it to obtain ∠MQP
Rays PN and QM intersect at the point A
Draw the perpendicular bisectors of PA and QA which intersects PQ at the points B and C
Join the point AB and AC

Therefore, △ ABC is the required triangle.



17. In each of the following cases, given reasons to show that the construction of △ ABC is not possible:
(i) AB = 6cm, ∠A = 40° and (BC + AC) = 5.8cm
(ii) AB = 7cm, ∠A = 50° and (BC – AC) = 8cm

(iii) BC = 5cm, ∠B = 80°, ∠C = 50° and ∠A = 60°
(iv) AB = 4cm, BC = 3cm and AC = 7cm.
Solution:

(i) It is given that AB = 6cm, ∠A = 40° and (BC + AC) = 5.8cm
The sum of any two sides of a triangle is greater than the third side
It can be written as
BC + AC < AB

Therefore, construction of △ ABC for the measurements given is not possible.

(ii) It is given that AB = 7cm, ∠A = 50° and (BC – AC) = 8cm
The sum of any two sides of a triangle is greater than the third side
It can be written as
AB + AC > BC
Subtracting AC both sides
AB + AC – AC > BC – AC
So we get
AB > BC – AC
According to the question AB < BC – AC

Therefore, construction of △ ABC for the measurements given is not possible.

(iii) It is given that BC = 5cm, ∠B = 80°, ∠C = 50° and ∠A = 60°
The sum of any two sides of a triangle is greater than the third side
It can be written as
∠A + ∠B + ∠C = 60° + 80° + 50°
So we get
∠A + ∠B + ∠C = 190° > 180°

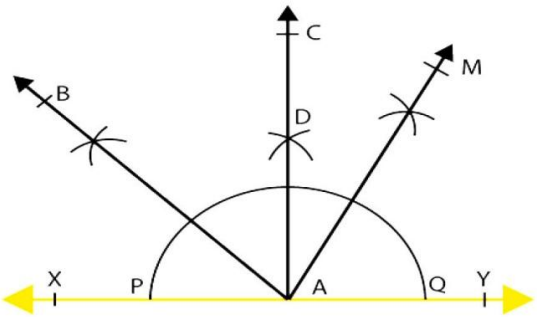
Therefore, construction of △ ABC for the measurements given is not possible.

(iv) It is given that AB = 4cm, BC = 3cm and AC = 7cm
The sum of any two sides of a triangle is greater than the third side
Based on the given measurements we get
AB + BC = AC

Therefore, construction of △ ABC for the measurements given is not possible.

18. Construct an angle of 67.5° by using the ruler and compasses.
Solution:

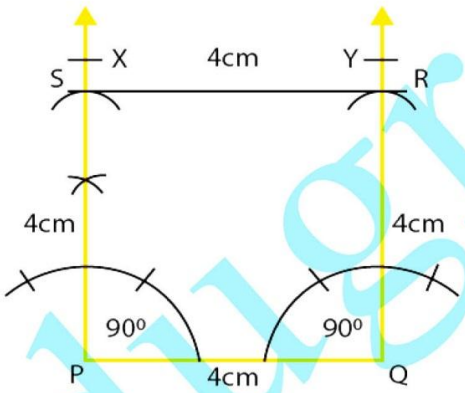
Steps of Construction:
Construct a line XY
Mark a point A on the line XY
Considering A as centre, construct a semi-circle cutting the line XY at the points P and Q
Draw ∠YAC = 90°
Construct the bisector AB of ∠XAC where ∠YAB = 135°
Construct the bisector AM of ∠YAB where ∠YAM = 67.5°



19. Construct a square of side 4cm.
Solution:

Steps of Construction:
Construct a line segment PQ = 4cm
Draw ∠QPX = 90° and ∠PQY = 90°
Cut the arc PS = 4cm and QR = 4cm and join the line SR

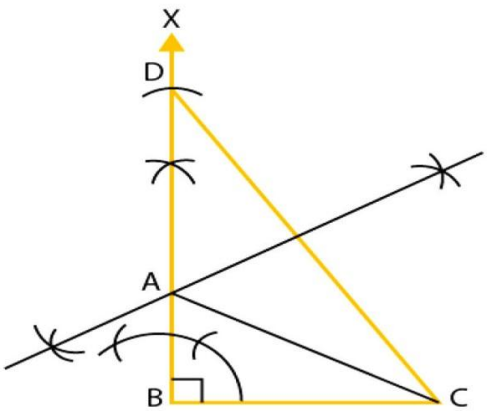
Therefore, PQRS is the required square.



20. Construct a right triangle whose one side is 3.5cm and the sum of the other side and the hypotenuse is 5.5cm.
Solution:

Steps of Construction:
Construct BC = 3.5cm
Construct ∠CBX = 90°
From BX cut off line segments BD = AB + AC = 5.5 cm
Join the points CD
Construct the perpendicular bisector of CD which meets the line BD at point A
Join AC

Therefore, △ ABC is the required triangle.



21. Construct a △ ABC in which ∠B = 45°, ∠C = 60° and the perpendicular from the vertex A to base BC is 4.5cm.
Solution:

Steps of Construction:
Construct a line XY
Consider a point P on the line XY and draw PQ perpendicular to the line XY
Along with PQ set off PA = 4.5 cm
From the point A, construct LM parallel to XY
Draw ∠LAB = 45° and ∠MAC = 60° which meets the line XY at the points B and C

Therefore, △ ABC is the required triangle.