Chapter 10: Practical Geometry

Exercise 10.1 (Page 196)

Q1. Draw a line, say AB, take a point C outside it. Through C, draw a line parallel to AB using ruler and compasses only.

Difficulty Level: Easy

What is given / known:
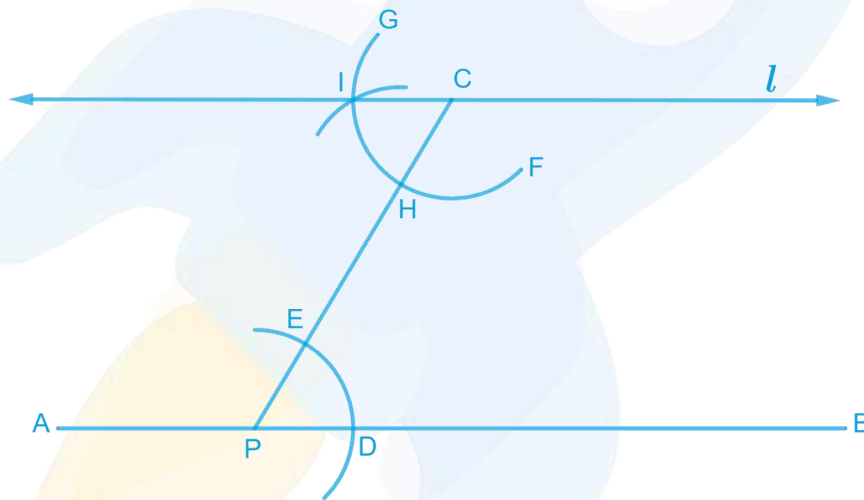A line AB and a point C outside it.

To construct:
A line through C parallel to AB using ruler and compasses.

Reasoning:
Draw a line AB and take a point C outside it. Draw line AB by using ruler and compasses, follow the steps given below.

Solution:

Steps of construction –

1) Draw a line AB, take a point C outside this line. Take any point P on AB. Join C to P.
2) Taking P as centre and a convenient radius draw an arc intersecting line AB at D and PC at E.
3) Taking C as the centre and the same radius in previous step, draw an arc FG intersecting PC at H.
4) Adjust the compasses up to the length of DE. Without changing the opening of compasses and taking H as the centre, draw an arc to intersect arc HG at point I.
5) Join the point C and I to draw a line *l*.

This is the required line *l* which is parallel to AB.

Q2. Draw a line *l*. Draw a perpendicular to *l* at any point on *l*. On this perpendicular choose a point X, 4 cm away from *l*. Through X, draw a line *m* parallel to *l*.

Difficulty Level: Easy

What is given / known:
A line *l* and *m* which are 4cm apart.

To construct:
A perpendicular at any point on line *l*, and then draw a line *m* parallel to *l* through X on the perpendicular which is 4 cm from the line *l*.

Reasoning:
Draw a line *l* and then a perpendicular to *l* at any point on *l*. On this perpendicular choose a point X, 4 cm away from *l*. Through X, draw a line *m* parallel to *l*. Follow the steps given below.

Solution:
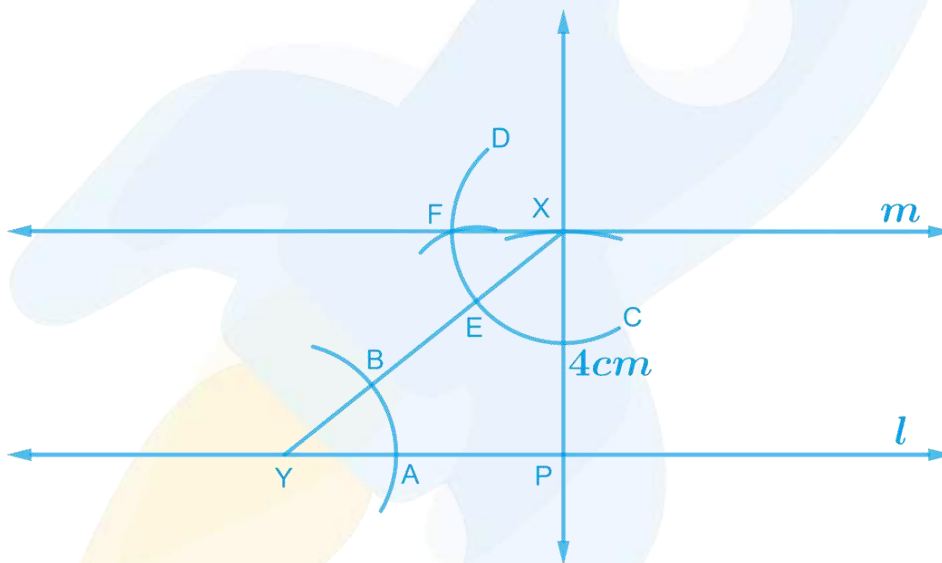
Steps of construction –

1) Draw a line *l*, take a point P on it. Draw a perpendicular passing through point P.
2) Now adjust the compass up-to the length of 4 cm. Draw an arc to intersect this perpendicular at point X choose any point Y on line *l*, join X to Y.
3) Taking Y as centre and with a convenient radius, draw an arc intersecting *l* at A and XY at B.
4) Taking X as centre and with the same radius as above, draw an arc CD cutting XY at E.
5) Adjust the compass up-to to the length of AB. Without changing the opening of compass and taking E as the centre, draw an arc to intersect the previously drawn arc CD at F.
6) Join the points X and F to draw a line *m*.

Line *m* is the required line which is parallel to *l*.

Q3. Let *l* be a line and P be a point not on *l*. Through P, draw a line *m* parallel to *l*. Now join P to any point Q on *l*. Choose any other point R on *m*. Through R, draw a line parallel to PQ. Let this meet *l* at S. What shape do the two sets of parallel lines enclose?

Difficulty Level: Medium

What is given / known:
A line *l* and a point P not on *l* and line *m* parallel to *l*.
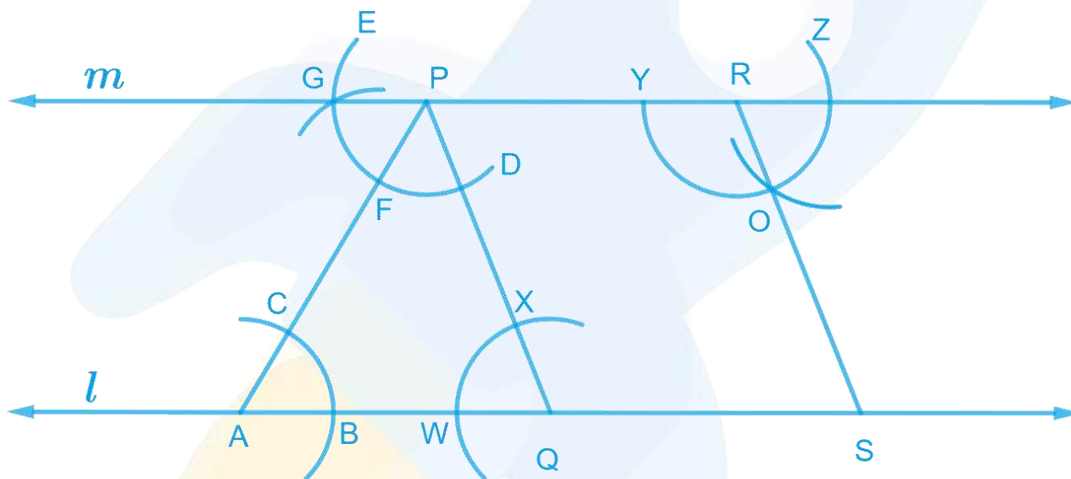
What is unknown:
Shape formed by two sets of two parallel lines.

Reasoning:
As line l is given and P is a point not on l. Through P, draw a line m parallel to l. Now join P to any point Q on l. Choose any other point R on m. Through R, draw a line parallel to PQ. Let this meet l at S.

Solution:

Steps of construction –

1. Draw a line *l*, take a point A on it. Take a point P not on *l* and join A to P.
2. Taking A as centre and with a convenient radius draw an arc cutting *l* at B and AP at C.
3. Taking P as the centre and with the same radius as before, draw an arc DE to intersect AP at F.
4. Adjust the compasses up to the length of BC. Without changing the opening of compasses and taking F as the centre, draw an arc to intersect the previous drawn arc DE at point G.
5. Join P to any point G to draw line *m*. Line *m* will be parallel to *l*.
6. Join P to any point Q on line *l*. Choose another point R on line *m*. Similarly, a line can be drawn through point R and parallel to PQ.
7. Let it meet line *l* at point S.

In quadrilateral PQSR, opposite lines are parallel to each other.
Thus, PQSR is a parallelogram.

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Exercise 10.2 (Page 199)

Q1. Construct ΔXYZ in which XY = 4.5 cm, YZ = 5 cm and ZX = 6 cm.

Difficulty Level: Medium

What is given / known:
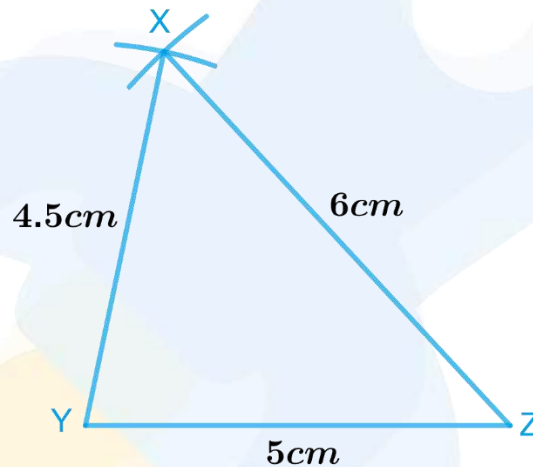Lengths of sides of a triangle XYZ are XY = 4.5 cm, YZ = 5 cm and ZX = 6 cm.

To construct:
A triangle XYZ in which XY = 4.5 cm, YZ = 5 cm and ZX = 6 cm.

Reasoning:
We will draw a rough sketch of ΔXYZ with the given measure. This will help us in deciding how to proceed. Then follow the steps given below.

Solution:

Steps of construction –

1) Draw a line segment YZ of length 5 cm.
2) From Y, point X is at a distance of 4.5cm. So, with Y as centre, draw an arc of radius 4.5cm (now X will be somewhere on this arc & our job is to find where exactly X is).
3) From Z, point X is at a distance of 6 cm. So, with Z as centre, draw an arc of radius 6cm (now X will be somewhere on this arc, we have to fix it).
4) X has to be on both the arcs drawn. So, it is the point of intersection of arcs. Mark the point of intersection of arcs as X. Join XY and XZ.

Thus, XYZ is the required triangle.

Q2. Construct an equilateral triangle of side 5.5 cm.

Difficulty Level: Easy
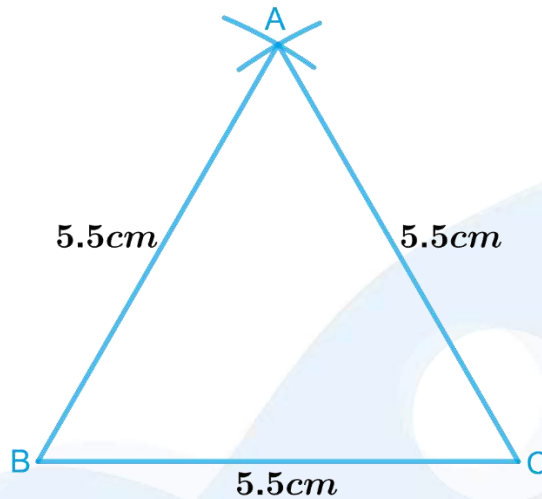
What is given / known:
Lengths of sides of an equilateral triangle are 5.5cm each.

To construct:
An equilateral triangle of side 5.5 cm.

Reasoning:
To construct an equilateral triangle of side 5.5 cm, follow the steps given below
Solution:

Steps of construction –

1) Draw a line segment BC of length 5.5 cm.
2) From B, point A is at a distance of 5.5cm. So, with B as centre, draw an arc of radius 5.5cm (Now A will be somewhere on this arc. Our job is to find where exactly A is).
3) From C, point A is at a distance of 5.5cm. So, with C as centre, draw an arc of radius 5.5cm (Now A will be somewhere on this arc, we have to fix it).
4) A has to be on both the arcs drawn. So, it is the point of intersection of arcs. Mark the point of intersection of arcs as A join AB and AC.

Thus, ABC is the required triangle.

Q3. Draw ΔPQR with PQ = 4 cm, QR = 3.5 cm and PR = 4 cm. What type of triangle is this?

Difficulty Level: Easy

What is given / known:
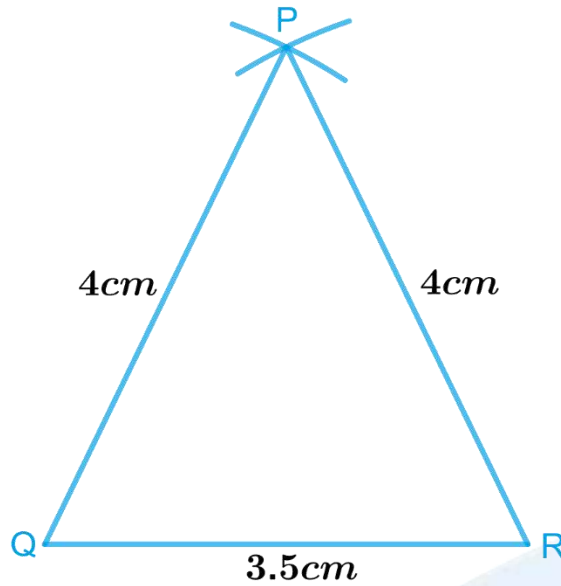Lengths of sides of a triangle are PQ = 4 cm, QR = 3.5 cm and PR = 4 cm.

To construct:
A ΔPQR with PQ = 4 cm, QR = 3.5 cm and PR = 4 cm.

Reasoning:
To construct a ΔPQR with PQ = 4 cm, QR = 3.5 cm and PR = 4 cm, follow the steps given below.

Steps of construction –

1) Draw a line segment QR of length 3.5 cm.
2) From Q, point P is at a distance of 4cm. So, with Q as centre, draw an arc of radius 4 cm (now P will be somewhere on this arc & our job is to find where exactly P is).
3) From R, point P is at a distance of 4cm. So, with R as centre, draw an arc of radius 4cm (now P will be somewhere on this arc, we have to fix it).
4) P has to be on both the arcs drawn. So, it is the point of intersection of arcs. Mark the point of intersection of arcs as P join PQ and PR.

Thus, PQR is the required triangle.

ΔPQR is an isosceles triangle as two of the sides are equal.

Q4. Construct ΔABC such that AB = 2.5 cm, BC = 6 cm and AC = 6.5 cm. Measure ∠B.

Difficulty Level: Easy

What is given / known:
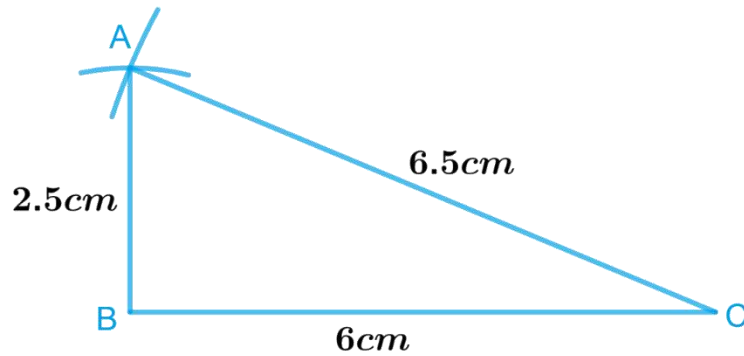Lengths of sides of a triangle are AB = 2.5 cm, BC = 6 cm and AC = 6.5 cm.

To construct:
A ΔABC such that AB = 2.5 cm, BC = 6 cm and AC = 6.5 cm. Measure ∠B.

Reasoning:
To Construct ΔABC such that AB = 2.5 cm, BC = 6 cm and AC = 6.5 cm. and to measure ∠B, follow the steps given below.

Solution:

Steps of construction –

1) Draw a line segment BC of length 6 cm.
2) From B, point A is at a distance of 2.5 cm. So, with B as centre, draw an arc of radius 2.5 cm (now A will be somewhere on this arc & our job is to find where exactly A is).
3) From C, point A is at a distance of 6.5 cm. So, with C as centre, draw an arc of radius 6.5 cm (now A will be somewhere on this arc, we have to fix it).
4) A has to be on both the arcs drawn, so it is the point of intersection of arcs. Mark the point of intersection of arcs as A join AB and AC.

Thus, ABC is the required triangle.

Measure angle B with the help of protractor.

It is the right-angled triangle ABC, where ∠B = 90°.

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Exercise 10.3 (Page 200)

Q1. Construct ΔDEF such that DE = 5 cm, DF = 3 cm and m∠EDF = 90°.

Difficulty Level: Medium

What is given / known:
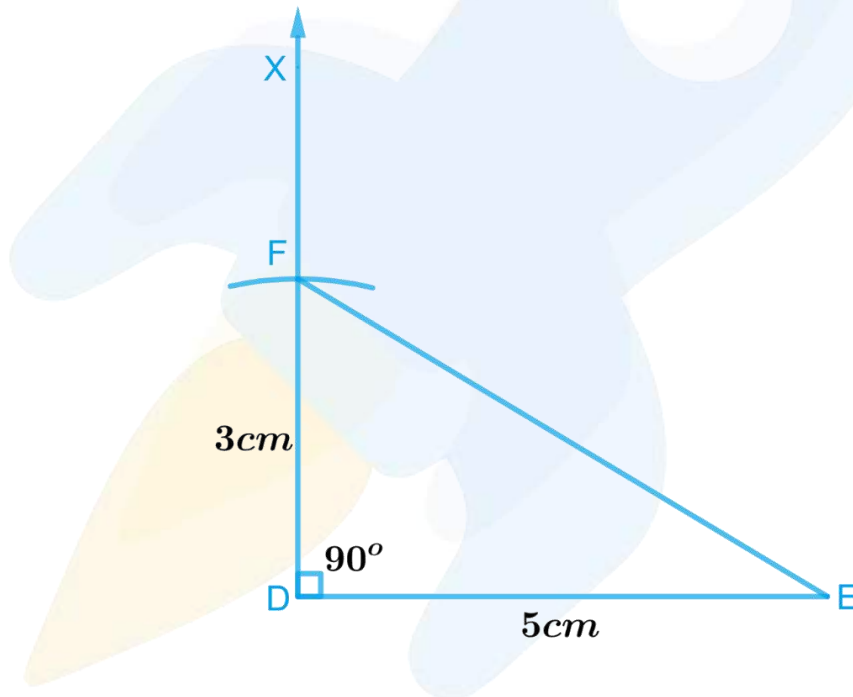Lengths of sides of a triangle DEF and measure of one of the angles.

To construct:
A triangle ΔDEF such that DE = 5 cm, DF = 3 cm and ∠EDF = 90°.

Reasoning:
To construct a ΔDEF first, we draw a rough sketch with the given measure such that DE = 5 cm, DF = 3 cm and ∠EDF = 90o, then follow the steps given below.

Solution:

Steps of construction –

1) Draw a line segment DE of length 5 cm.
2) At D, draw DX making 90° with DE.
3) With D as centre, draw an arc of radius 3cm. It cuts DX at the point F.
4) Join EF to get the required triangle.

ΔDEF is the required triangle.

Q2. Construct an isosceles triangle in which the lengths of each of its equal sides is 6.5 cm and the angle between them is 110°.
Difficulty Level: Medium

What is given / known:
Lengths of each of its equal sides is 6.5 cm and the angle between them is 110°.

To construct:
An isosceles triangle in which the lengths of each of its equal sides is 6.5 cm and the angle between them is 110°.

Reasoning:
To construct an isosceles triangle in which the lengths of each of its equal sides is 6.5 cm and the angle between them is 110°, follow the steps given below.

Solution:
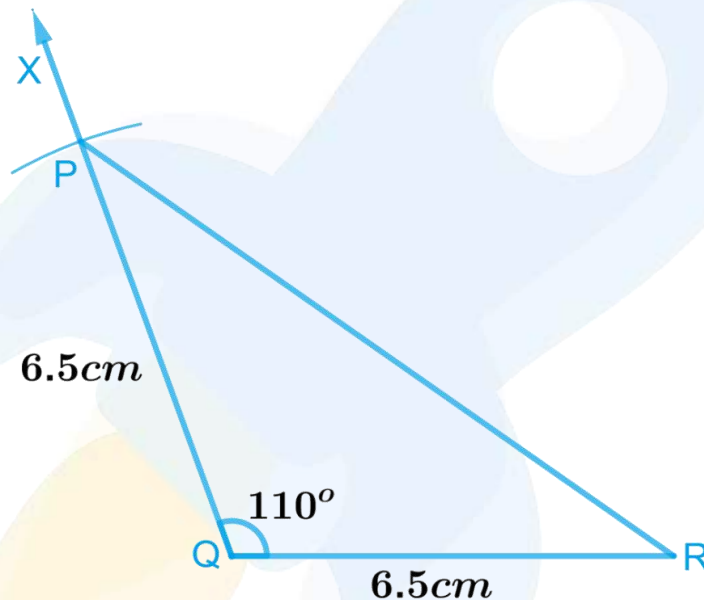
Steps of construction –

    1) Draw a line segment QR of length 6.5cm.
    2) At Q, draw QX making an angle of 110° with QR.
    3) With Q as centre, draw an arc of radius 6.5cm. It cuts QX at the point P.
    4) Join PR.

Triangle PQR is the required isosceles triangle.

Q3. Construct ΔABC with BC = 7.5 cm, AC = 5 cm and m∠C = 60°.

Difficulty Level: Medium

What is given / known:
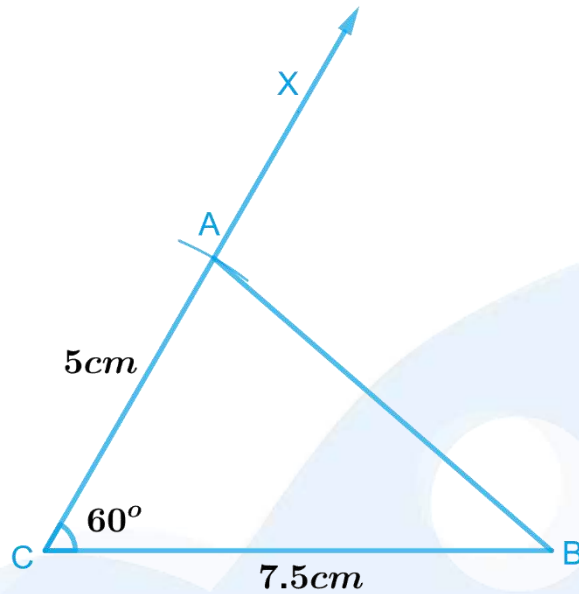Lengths of sides of a triangle are BC = 7.5 cm, AC = 5 cm and ∠C = 60°.

To construct:

A triangle ΔABC with BC = 7.5 cm, AC = 5 cm and ∠C = 60°.

Reasoning:

To construct a triangle ΔABC with BC = 7.5 cm, AC = 5 cm and ∠C = 60°, follow the steps given below.

Solution:

Steps of construction –

1) Draw a line segment BC of length 7.5cm.
2) At C, draw CX making 60° with BC.
3) With C as centre, draw an arc of radius 5cm. It cuts CX at the point A.
4) Join AB.

Triangle ABC is the required triangle.

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Exercise 10.4 (Page 202)

Q1. Construct ΔABC, given m∠A = 60°, m∠B = 30° and AB = 5.8 cm.

Difficulty Level: Medium

What is given / known:
Length of side of a triangle ABC, AB = 5.8cm and ∠A = 60°, ∠B = 30°.

To construct:
A triangle ΔABC, given ∠A = 60°, ∠B = 30° and AB = 5.8 cm.

Reasoning:
To Construct a ΔABC such that ∠A = 60°, ∠B = 30° and AB = 5.8 cm., follow the steps given below.

Solution:
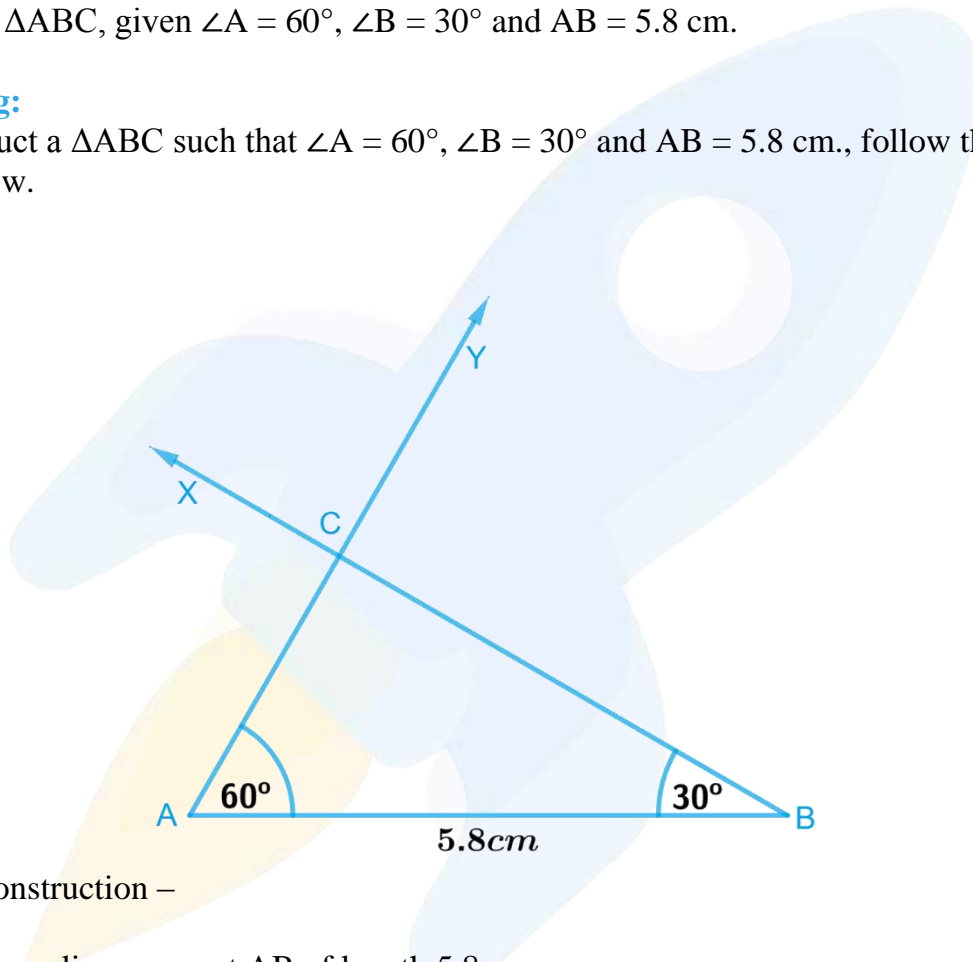
Steps of construction –

1) Draw a line segment AB of length 5.8 cm.
2) At A, draw ray AY making 60° with AB.
3) At B, draw ray BX making 30° with AB.
4) Rays BX and AY will intersect at point C.

Triangle ABC is now completed.

Q2. Construct ΔPQR if PQ = 5 cm, m∠PQR = 105° and m∠QRP = 40°.
     (Hint: Recall angle-sum property of a triangle).

Difficulty Level: Medium

What is given / known:
In triangle PQR, PQ = 5 cm, ∠PQR = 105° and ∠QRP = 40°.

To construct:
A triangle ΔPQR if PQ = 5 cm, ∠PQR = 105° and ∠QRP = 40°.

Reasoning:
We will use angle-sum property of a triangle to find the measure of ∠RPQ
By angle sum property of a triangle,
∠PQR + ∠QRP + ∠RPQ = 180°.
105° + 40° + ∠RPQ = 180°.
So, ∠RPQ = 35°
Now, let's Construct ΔPQR such that PQ = 5cm, ∠PQR = 105° and ∠RPQ = 35°, with the steps given below

Solution:
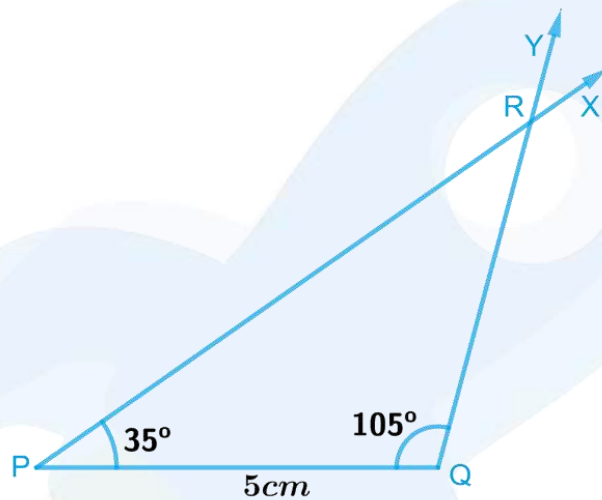
Steps of construction –

1) Draw a line segment PQ of length 5 cm.
2) At P, draw PX making 35° with PQ.
3) At Q, draw QY making an angle of 105° with PQ.
4) PX and QY will intersect at point R.

PQR is the required triangle.

Q3. Examine whether you can construct ΔDEF such that EF = 7.2 cm, m∠E = 110° and m∠F = 80°. Justify your answer.

Difficulty Level: Medium

What is given / known:
Length of one side of a triangle and measure of two angles.

What is unknown:
Whether a triangle be constructed with the given values of length and angles.

Reasoning

By using the angle sum property, we can find out the third angle. If the angle sum property is followed, then it is possible to construct a triangle and if not then we cannot construct a triangle.

Solution:

We will use angle-sum property of a triangle to find the measure of ∠D
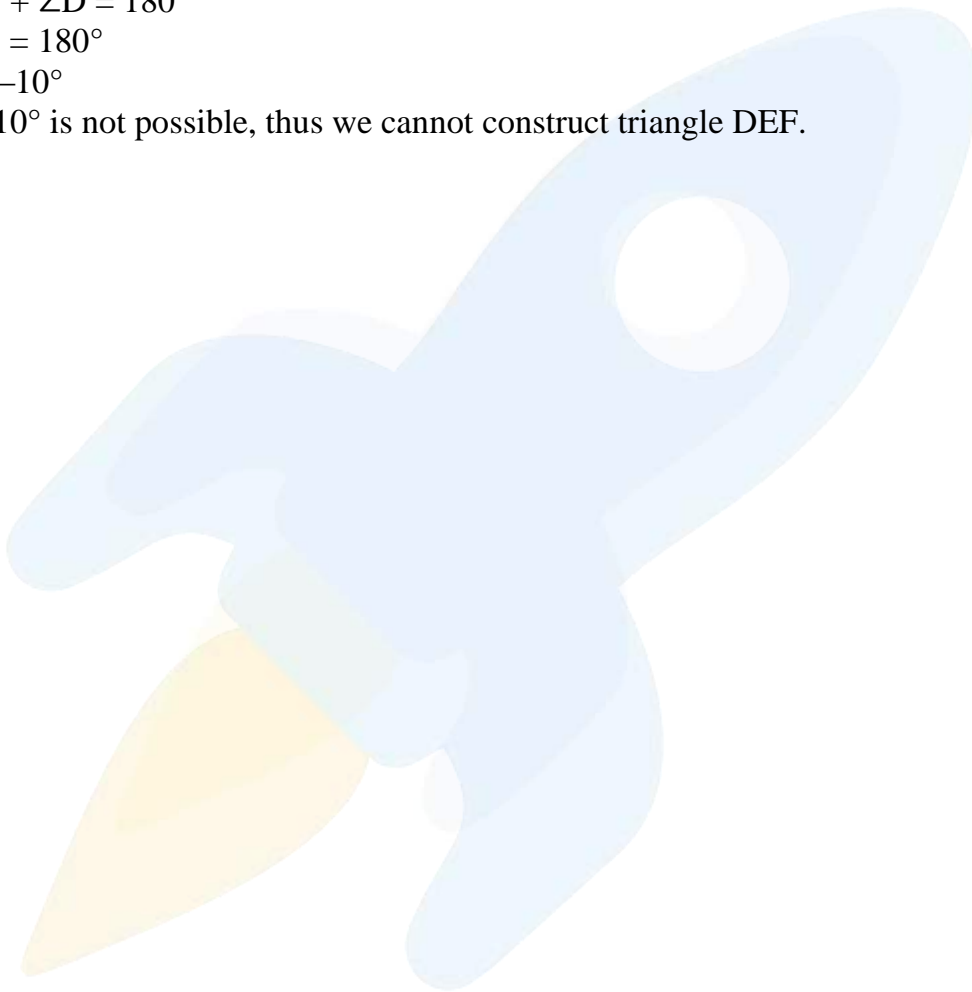
By angle sum property of a triangle,

∠E + ∠F + ∠D = 180°
110° + 80° + ∠D = 180°
190° + ∠D = 180°
So, ∠D = −10°
Angle of -10° is not possible, thus we cannot construct triangle DEF.

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Exercise 10.5 (Page 203)

Q1. Construct the right angled ΔPQR, where m∠Q = 90°, QR = 8cm and
PR = 10 cm.

Difficulty Level: Medium

What is given / known:
Length of two side of a right angled ΔPQR.

To construct:
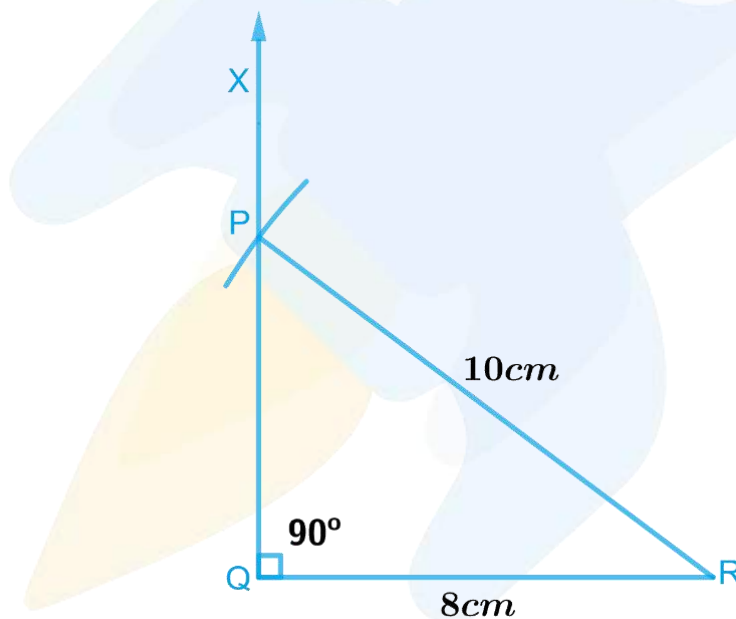A right angled ΔPQR, where ∠Q = 90°, QR = 8cm and PR = 10 cm.

Reasoning:
To construct a right-angled ΔPQR, where ∠Q = 90°, QR = 8cm and PR = 10 cm, draw
a rough sketch and mark the measures. Remember to mark the right angle and follow the
steps given below.

Solution:

Steps of construction –

1) Draw QR of length 8 cm.
2) At Q, draw QX perpendicular QR.
3) With R as centre, draw an arc of radius 10 cm which should intersect QX at
   point P.
4) Join P and R.

ΔPQR is the required triangle.

Q2. Construct a right-angled triangle whose hypotenuse is 6 cm long and one of the legs is 4 cm long.

Difficulty Level: Medium

What is given / known:
Hypotenuse of a right-angled triangle and one of the legs.

To construct:
A right-angled triangle whose hypotenuse is 6 cm long and one of the legs is 4 cm long.

Reasoning:
To construct a right-angled triangle whose hypotenuse is 6 cm long and one of the legs is 4 cm long, draw a rough sketch and mark the measures. Remember to mark the right angle and follow the steps given below.

Solution:
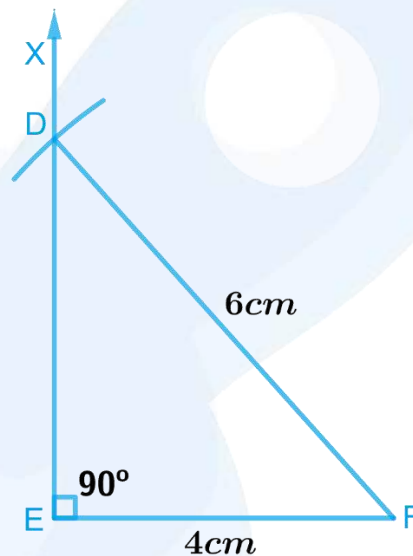
Steps of construction –

1) Draw a line segment EF of length 4 cm.
2) At E, draw EX perpendicular EF.
3) With F as centre, draw an arc of radius 6cm which should intersect EX at point D.
4) Join D with F.

ΔDEF is the required triangle.

Q3. Construct an isosceles right-angled triangle ABC, where m∠ACB = 90° and AC = 6 cm.

Difficulty Level: Medium

What is given / known:
Length of side of an isosceles right-angled triangle ABC, AC = 6cm and ∠ACB = 90°.

To construct:

An isosceles right-angled triangle ABC, where ∠ACB = 90° and AC = 6 cm.

Reasoning:

Since ΔABC is an isosceles right-angled triangle, where ∠ACB = 90° and AC = 6 cm. Therefore, length of the other equal side, we can take is BC = 6cm. To construct this triangle, follow the steps given below.

Solution:
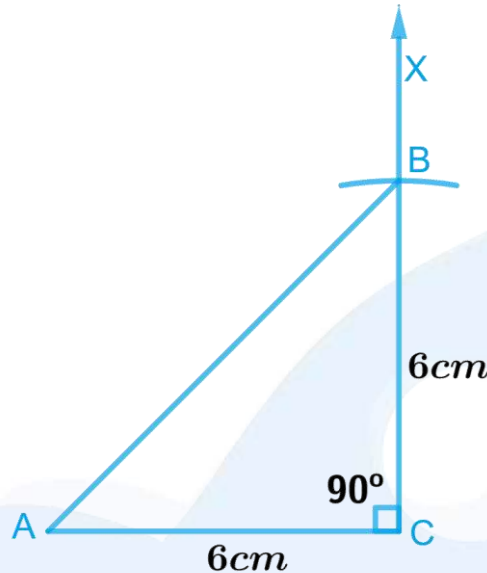
Steps of construction –

1) Draw a line segment CA of length 6 cm.
2) At point C, draw CX perpendicular CA.
3) With C as centre, draw an arc of radius 6 cm which should intersect CX at point B.
4) Join A and B.

Triangle ABC is the required isosceles right-angled triangle.

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