10 Practical Geometry

Learn and Remember

1. Geometrical tools like ruler, set-squares, protractor and compasses are required for geometrical construction.
2. A line parallel to a given line from a point, not lying on it, can be constructed by making its alternate angles equal.

   Construction of triangle is possible under following conditions:
3. Given three sides, with sum of the two sides is greater than the third side.
4. Given any two sides and their included angle.
5. Given any two angles and their included side.
6. In a right-angled triangle, given its hypotenuse and either one of its side or one of its acute angles.

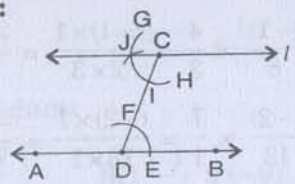
TEXTBOOK QUESTIONS SOLVED

Exercise 10.1 *(Page No. 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.

Sol. Aim: To draw a line, parallel to given line by using ruler and compasses.

Construction:



Steps of construction:

1. Draw a line-segment AB and take a point C outside AB.
2. Take any point D on AB and join C to D.
3. With D as centre and take convenient radius, draw an arc cutting AB at E and CD at F.

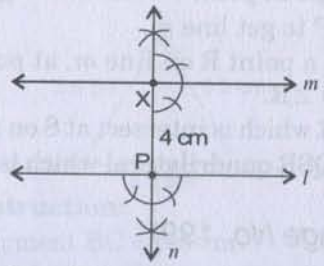
4. Now, with C as centre and same radius as in step 3, draw an arc GH cutting CD at I.
5. With the same arc EF, draw the equal arc cutting GH at J.
6. Now join JC to draw a line l.

   Thus, we draw $AB \parallel l$.

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.

Sol. Aim: To draw a line which is parallel to given line when perpendicular line is also given.

Construction:



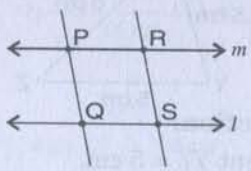
Steps of construction:

1. Draw a line l and take a point P on it.
2. At point P, draw a perpendicular line n.
3. Take PX = 4 cm on line n.
4. At point X, again draw a perpendicular line m.

   Thus, we draw $l \parallel m$.

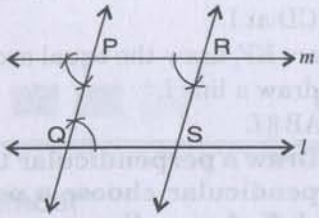
Q3. Let l be a line and P be a point not on l. Through P, draw a line m parallel to l. Now join P to any point Q on l. Choose any other point R on m. Through R, draw a line parallel to PQ. Let this meet l at S. What shape do the two sets of parallel lines enclose?

Sol. Let us draw a rough figure on the bases of given question:



Aim: To draw a pair of parallel lines intersecting other pair of parallel lines.

Construction:



Steps of construction:

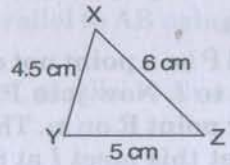
1. Draw a line l and take a point P outside of l.
2. Take point Q on line l and join PQ.
3. Make equal angle at point P such that $\angle Q = \angle P$.
4. Extend line at P to get line m.
5. Similarly, take a point R on line m, at point R, draw angles such that $\angle P = \angle R$.
6. Extend line at R which is intersect at S on line l. Draw line RS.
   Thus, we get PQSR quadrilateral which is parallelogram.

Exercise 10.2 *(Page No. 199)*

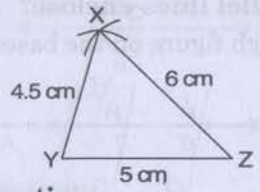
Q1. Construct ΔXYZ in which XY = 4.5 cm, YZ = 5 cm and ZX = 6 cm.

Sol. Aim: To construct ΔXYZ where XY = 4.5 cm, YZ = 5 cm and ZX = 6 cm.

Draw a rough diagram:



Construction:



Steps of construction:

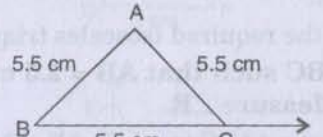
1. Draw a line-segment YZ = 5 cm.
2. From point Z as centre and radius 6 cm, draw an arc.
3. Similarly, with point Y as centre and radius 4.5 cm, draw another arc intersecting the first arc at point X.

4. Join XY and XZ.
   Thus, XYZ is the required triangle.

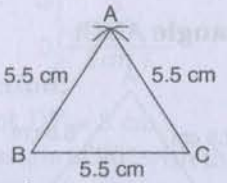
Q2. Construct an equilateral triangle of side 5.5 cm.

Sol. Aim: To draw an triangle ABC whose all sides are equal to 5.5 cm *i.e.*, AB = BC = CA = 5.5 cm.

Draw a rough diagram:



Construction:



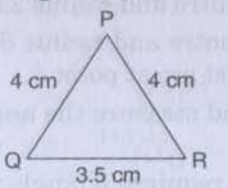
Steps of construction:

1. Draw a line-segment BC = 5.5 cm.
2. With point B and C as centres and radius 5.5 cm draw arcs, intersecting at point A.
3. Join AB and AC.
   Thus, ΔABC is the required equilateral triangles.

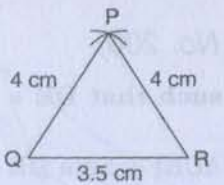
Q3. Draw ΔPQR with PQ = 4 cm, QR = 3.5 cm and PR = 4 cm. What type of triangle is this?

Sol. Aim: To construct ΔPQR in which PQ = 4 cm, QR = 3.5 cm and PR = 4 cm.

Draw a rough triangle PQR:



Construction:



Steps of construction:

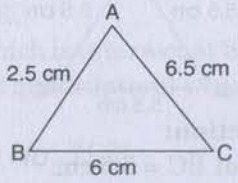
1. Draw a line-segment QR = 3.5 cm.
2. From point Q as centre and radius 4 cm, draw an arc.
3. Similarly, from point R as centre, draw another arc taking radius 4 cm which intersects at P.
4. Join PQ and PR.

Thus, ΔPQR is the required isosceles triangles.

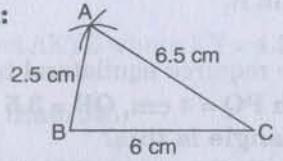
Q4. Construct ΔABC such that AB = 2.5 cm, BC = 6 cm and AC = 6.5 cm. Measure ∠B.

Sol. Aim: To construct a ΔABC in which AB = 2.5 cm, BC = 6 cm and AC = 6.5 cm.

Draw a rough triangle ABC:



Construction:



Steps of construction:

1. Draw a line segment BC = 6 cm.
2. From point B as centre and radius 2.5 cm, draw an arc.
3. From point C as centre and radius 6.5 cm, draw another arc intersecting the first arc at point A.
4. Join AB and AC and measure the angle B with the help of D-scale.

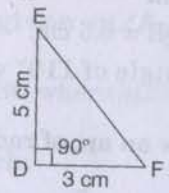
Thus, ΔABC is the required triangle where ∠B = 80°.

Exercise 10.3 *(Page No. 200)*

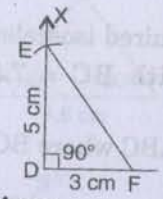
Q1. Construct ΔDEF such that DE = 5 cm, DF = 3 cm and $m\angle EDF = 90°$.

Sol. Aim: To construct ΔDEF where DE = 5 cm, DF = 3 cm and $m\angle EDF = 90°$.

Draw a rough triangle DEF:



Construction:



Steps of construction:

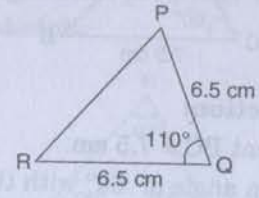
1. Draw a line-segment DF = 3 cm.
2. At point D draw an angle of 90° with the help of compass ∠XDF = 90°.
3. With D as centre, draw an arc of radius 5 cm. It cuts DX at the point E.
4. Join EF.

Thus, right-angled triangle EDF is obtained.

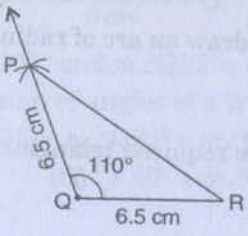
Q2. Construct an isosceles triangle in which the lengths of each of its equal sides is 6.5 cm and the angle between them is 110°.

Sol. Aim: To construct isosceles ΔPQR where PQ = RQ = 6.5 cm and ∠Q = 110°.

Draw a rough ΔPQR:



Construction:



Steps of construction:

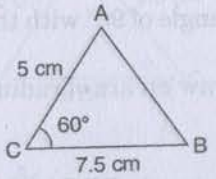
1. Draw a line segment QR = 6.5 cm.
2. At point Q draw an angle of 110° with the help of D-scale *i.e.*, ∠YQR = 110°.
3. With Q as centre, draw an arc of radius 6.5 cm. It cuts QY at the point P.
4. Join PR.

Thus, ΔPQR is the required isosceles triangle.

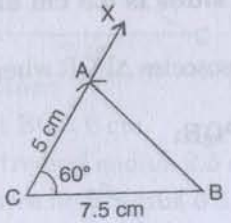
Q3. Construct ΔABC with BC = 7.5 cm, AC = 5 cm and $m\angle C = 60°$.

Sol. Aim. To construct a ΔABC where BC = 7.5 cm, AC = 5 cm and $m\angle C = 60°$.

Draw a rough diagram:



Construction:



Steps of construction:

1. Draw a line-segment BC = 7.5 cm.
2. At point C, draw an angle of 60° with the help of compass *i.e.*, ∠XCB = 60°.
3. With C as centre, draw an arc of radius 5 cm. It cuts XC at the point A.
4. Join AB.

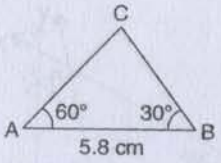
Thus, ΔABC is the required triangle.

Exercise 10.4 *(Page No. 202)*

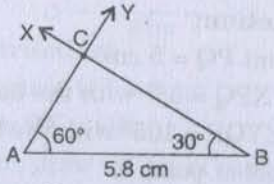
Q1. Construct ΔABC, given $m\angle A = 60°$, $m\angle B = 30°$ and AB = 5.8 cm.

Sol. Aim: To construct ΔABC where $m\angle A = 60°$, $m\angle B = 30°$ and AB = 5.8 cm.

Draw a rough sketch:



Constructions:



Steps of construction:

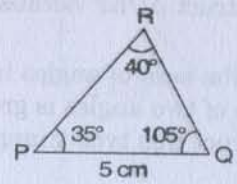
1. Draw a line segment AB = 5.8 cm.
2. At point A, draw ∠YAB = 60° with the help of compass.
3. At point B, draw ∠XBA = 30° with the help of compass.
4. AY and BX intersect at the point C.

Thus, ΔABC is the required triangle.

Q2. Construct ΔPQR if PQ = 5 cm, $m\angle PQR = 105°$ and $m\angle QRP = 40°$.

(Hint: Recall angle-sum property of a triangle.)

Sol. Draw a rough sketch:



Given: $m\angle PQR = 105°$ and $m\angle QRP = 40°$

We know that the sum of angles of a triangle is 180°.

$$m\angle PQR + m\angle QRP + m\angle QPR = 180°$$

$$\Rightarrow \quad 105° + 40° + m\angle QPR = 180°$$

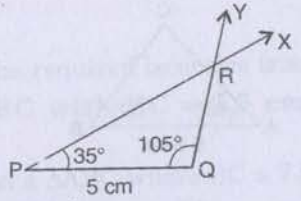
$\Rightarrow$ $145° + m\angle QPR = 180°$

$\Rightarrow$ $m\angle QPR = 180° - 145°$

or $m\angle QPR = 35°$

Aim: To construct a ΔPQR where PQ = 5 cm, $m\angle P = 35°$ and $m\angle Q = 105°$.

Construction:



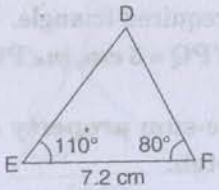
Steps of construction:

1. Draw a line segment PQ = 5 cm.
2. At point P, draw $\angle XPQ = 35°$ with the help of D-scale.
3. At point Q, draw $\angle YQP = 105°$ with the help of D-scale.
4. XP and YQ intersect at point R.

   Thus, ΔPQR is the required triangle.

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

Sol. Draw a rough sketch:



No, we cannot construct ΔDEF because $m\angle E + m\angle F = 110° + 80° = 190°$.

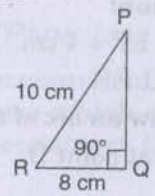
And we know that the sum of angles in a triangle is equal to 180° and given sum of two angles is greater than 180° so it is impossible to construct this type triangle.

Exercise 10.5 *(Page No. 203)*

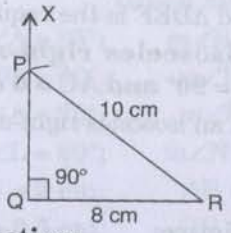
Q1. Construct the right-angled ΔPQR, where $m\angle Q = 90°$, QR = 8 cm and PR = 10 cm.

Sol. Aim: To construct a right-angled triangle PQR where PR = 10 cm, QR = 8 cm and $m\angle Q = 90°$.

Draw a rough figure:



Construction:



Steps of construction:

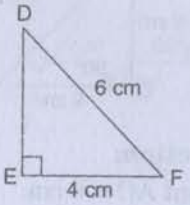
1. Draw a line segment QR = 8 cm.
2. At point Q, draw $QX \perp QR$.
3. With R as centre, draw an arc of radius 10 cm.
4. This arc cut the QX at point P.
5. Join PR.

   Thus, right-angled ΔPQR is the required triangle.

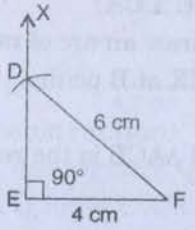
Q2. Construct a right-angled triangle whose hypotenuse is 6 cm long and one of the legs is 4 cm long.

Sol. Aim: To construct a right-angled ΔDEF where DF = 6 cm and EF = 4 cm.

Draw a rough figure:



Construction:



Steps of construction:

1. Draw a line segment EF = 4 cm.
2. At point E, draw EX ⊥ EF.
3. With F as centre, draw an arc of radius 6 cm. (hypotenuse)
4. This arc cuts the EX at point D.
5. Join DF.

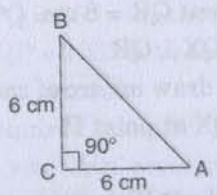
Thus, right-angled ΔDEF is the required triangle.

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

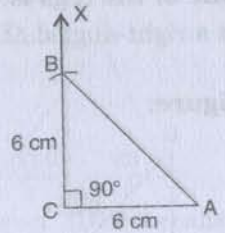
Sol. Aim: To construct an isosceles right-angled triangle ABC where $m\angle C = 90°$.

AC = BC = 6 cm.

Draw a rough figure:



Construction:



Steps of construction:

1. Draw a line segment AC = 6 cm.
2. At point C, draw XC ⊥ CA.
3. With C as centre draw an arc of radius 6 cm.
4. This arc cuts the CX at B point.
5. Join BA.

Thus, right-angled ΔACB is the required isosceles triangle.

MISCELLANEOUS QUESTIONS

(Page No.: 204)

Below are given the measures of certain sides and angles of triangles. Identify those which cannot be constructed and, say why you cannot construct them. Construct rest of the triangles.

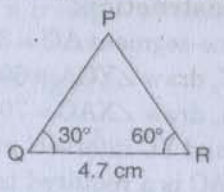
Triangle	Given measurement		
1. ΔABC	$m\angle A = 85°$;	$m\angle B = 115°$;	AB = 5 cm
2. ΔPQR	$m\angle Q = 30°$;	$m\angle R = 60°$;	QR = 4.7 cm
3. ΔABC	$m\angle A = 70°$;	$m\angle B = 50°$;	AC = 3 cm
4. ΔLMN	$m\angle L = 60°$;	$m\angle N = 120°$;	LM = 5 cm
5. ΔABC	BC = 2 cm;	AB = 4 cm;	AC = 2 cm
6. ΔPQR	PQ = 3.5 cm;	QR = 4 cm;	PR = 3.5 cm
7. ΔXYZ	XY = 3 cm;	YZ = 4 cm;	XZ = 5 cm
8. ΔDEF	DE = 4.5 cm;	EF = 5.5 cm;	DF = 4 cm

Sol. (1) ΔABC, $m\angle A = 85°$, $m\angle B = 115°$, AB = 5 cm

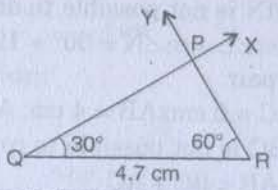
ΔABC is not possible because $m\angle A + m\angle B = 85° + 115° = 200°$ and we know the sum of angles of a triangle is $180° < 200°$.

(2) **Aim:** To construct a ΔPQR where $m\angle Q = 30°$, $m\angle R = 60°$ and QR = 4.7 cm.

Draw a rough figure of ΔPQR:



Construction:

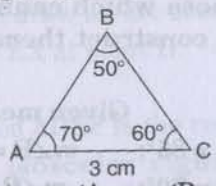


Steps of construction:

1. Draw a line-segment QR = 4.7 cm.
2. At point Q, draw $\angle XQR = 30°$ with the help of compass.

3. At point R, draw $\angle YRQ = 60°$ with the help of compass.
4. QX and RY rays intersect at point P.
   Thus, ΔPQR is the required triangle.

(3) **Draw a rough figure:**



We know that $m\angle A + m\angle B + m\angle C = 180°$

$\Rightarrow \quad 70° + 50° + m\angle C = 180°$

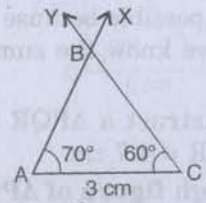
$\Rightarrow \quad 120° + m\angle C = 180°$

$\Rightarrow \quad m\angle C = 180° - 120° = 60°$

or $\quad m\angle C = 60°$

Aim: To construct a ΔABC, where AC = 3 cm, $m\angle A = 70°$ and $m\angle C = 60°$.

Construction:



Steps of construction:

1. Draw a line-segment AC = 3 cm.
2. At point C, draw $\angle YCA = 60°$.
3. At point A, draw $\angle XAC = 70°$.
4. Rays XA and YC intersect at point B.
   Thus, ΔBAC is a required triangle.

(4) ΔLMN, $m\angle L = 60°$, $m\angle N = 120°$, LM = 5 cm
This ΔLMN is not possible to draw.
Because $m\angle L + m\angle N = 60° + 120° = 180°$ which is form of linear pair.

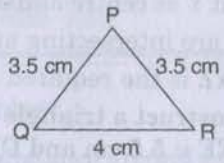
(5) ΔABC, BC = 2 cm, AB = 4 cm, AC = 2 cm
This ΔABC is not possible to construct.
Because AB < BC + AC

$4 < 2 + 2 \quad \Rightarrow \quad 4 \nless 4$ not possible.

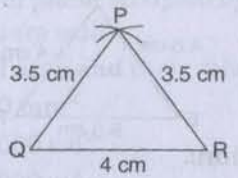
$\because$ Sum of the length of two sides of a triangle is greater than the third side.

(6) **Aim:** To construct a ΔPQR, PQ = 3.5 cm, QR = 4 cm and PR = 3.5 cm.

Draw a rough figure:



Construction:

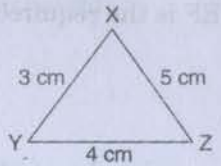


Steps of construction:

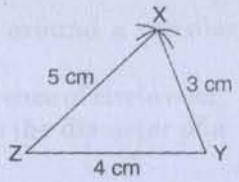
1. Draw a line segment QR = 4 cm.
2. From point Q as centre and draw an arc of radius 3.5 cm.
3. Similarly, from point R as centre and draw another arc of radius 3.5 cm, both arcs are intersecting at the point P.
   Thus, ΔPQR is the required triangle.

(7) **Aim:** To draw a triangle whose sides are XY = 3 cm, YZ = 4 cm and XZ = 5 cm.

Draw a rough figure:



Construction:



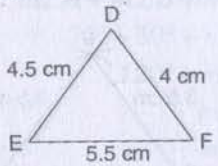
Steps of construction:

1. Draw a line segment ZY = 4 cm.
2. From point Z as centre and draw an arc of radius 5 cm.
3. From point Y as centre and draw an arc of radius 3 cm.
4. Both arcs are intersecting at point X.

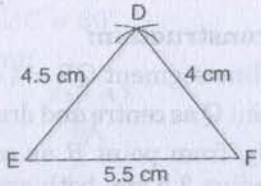
   Thus, ΔXYZ is the required triangle.

(8) **Aim:** To construct a triangle DEF whose sides are DE = 4.5 cm, EF = 5.5 cm and DF = 4 cm.

Draw a rough figure:



Construction:



Steps of construction:

1. Draw a line-segment EF = 5.5 cm.
2. From point E as centre and draw an arc of radius 4.5 cm and from point F as centre and draw an arc of radius 4 cm.
3. Both arcs are intersecting at point D.

   Thus, ΔDEF is the required triangle.

❑❑