Very Short Answer Type Questions

[1 mark]

Que 1. Can we construct an angle of 67.5°? Justify for your answer.

Sol. Yes, because 67.5° = $\frac{135°}{2} = \frac{1}{2}(90° + 45°)$ which can be constructed.

Que 2. An angle of 42.5° can be constructed. State true or false and give reason for your answer.

Sol. False, because 42.5° = $\frac{1}{2} \times 85°$ and 85° cannot be constructed.

Que 3. Can we construct an angle of 52.5°? Justify for your answer.

Sol. Yes, because 52.5° = $\frac{1}{4} \times 210°$ and 210° = 180° + 30° which can be constructed.

Que 4. The construction of a ΔABC, given that BC = 5 Cm, ∠B = 45° is not possible when difference of AB and AC is equal to 5.2 cm. Why?

Sol. Since one side of the triangle becomes greater than the sum of the other two sides.

Short Answer Type Questions – I

[2 marks]

Que 1. A triangle ABC can be constructed in which BC = 5 cm, $\angle C = 30°$ and AC – AB = 3.8 cm. State true or false and give reason.

Sol. True, because $AC - AB < BC$ or $AC < AB + BC$.

Que 2. A triangle ABC can be constructed in which $\angle B = 105°$, $\angle C\ 90°$ and AB + BC + AC = 10 cm. State true or false and give reason.

Sol. False, because $\angle B + \angle C = 105° + 90° = 195° > 180°$

Que 3. A triangle ABC can be constructed in which $\angle B = 60°$, $\angle C = 45°$ and AB + BC + CA = 12 cm. Write true of false and give reason for your answer.

Sol. True, because $\angle B + \angle C = 60° + 45° = 105° < 180°$.

Short Answer Type Questions – II

[3 marks]

Que 1. Draw a line segment 5.8 cm long draw its perpendicular bisector.

Sol. Steps of construction

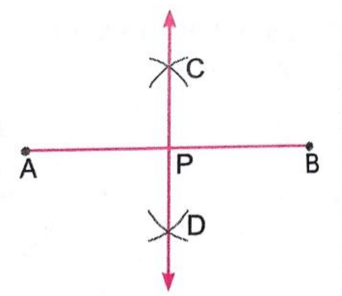

Fig. 11.1

(i) Draw a line segment AB = 5.8 cm.
(ii) Talking A as centre and radius more $\frac{1}{2}$ AB, draw two arcs, one on either side of AB.
(iii) Taking B as centre and the same radius draw two arcs, cutting the previously drawn arcs at points C and D respectively.
(iv) Join CD, intersecting AB at point P. Then, line CPD is the required perpendicular bisector of AB.

Que 2. Construct an angle of 60°

Sol. Steps of construction

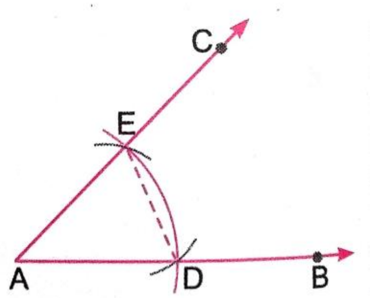

Fig. 11.2

(i) Draw a ray AB.
(ii) Taking A as centre and any convenient radius, draw an arc intersecting ray AB at point D.
(iii) Taking D as centre and same radius, draw an arc intersecting the previous arc at E.
(iv) Draw the ray AC passing through E. Then, ∠CAB is the required angle of 60°.

Justification

Join DE

In Δ ADE, we have

AD = DE = EA (Arcs of the same radii)

⇒ ΔADE is an equilateral triangle

⇒ ∠BAC = 60°

Que 3. Construct an angle of 30°.

Sol. Steps of construction

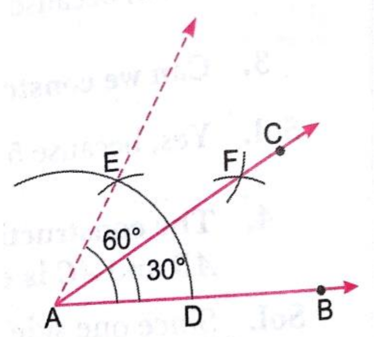

Fig. 11.3

(i) Draw a ray AB

(ii) Taking A as centre and any convenient radius, draw an arc intersecting AB at D.

(iii) With the same radius and D as centre, draw an intersecting the previous arc at E.

(iv) Taking E and D as centre and convenient radius (more than $\frac{1}{2}$ ED), draw two arcs intersecting each other at F.

(v) Draw the ray AC passing through F. Then ∠CAB is the required angle of 30°.

Que 4. Construct an angle of 15°.

Sol. Steps of construction

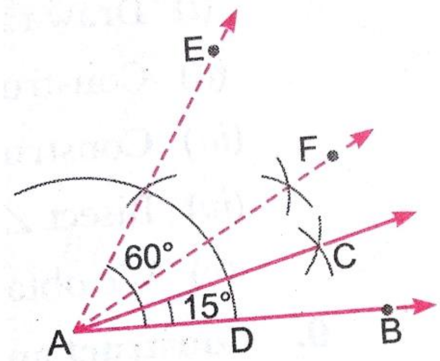

Fig. 11.4

(i) Construct an ∠EAB = 60°.

(ii) Bisect ∠EAB, so that ∠EAF = ∠FAB = 30°.

(iii) Bisect ∠FAB, so that ∠CAB = ∠FAC = 15°.

Hence ∠CAB = 15°.

Que 5. Construct an angle of 90° at the initial point of a given ray and give the justification.

Sol. Steps of Construction

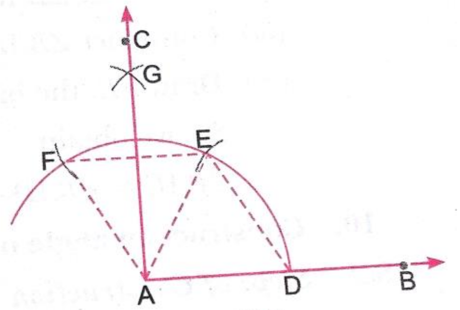

Fig. 11.5

(i) Draw a ray AB.
(ii) Taking A as centre and some convenient radius draw an arc which intersect AB, say at point D.
(iii) Taking D as centre and with the same radius as before draw an arc intersecting the previously drawn arc, say at point E.
(iv) Taking E as centre and with the same radius draw an arc intersecting the drawn arc, say at point F.
(v) With E and F as centres, and some convenient radius (more than $\frac{1}{2}$ EF), draw two arcs intersecting each other at G.
(vi) Draw ray AC passing through G. Then ∠CAB is the required angle of 90°.

Justification

By construction

AD = DE = EA
∴ ΔEAD is an equilateral triangle. So ∠EAD = 60°
Again AE = ED = FA.
∴ ΔFAE is equilateral triangle. So ∠FAE = 60°
As AG bisects ∠FAE, So ∠GAE = 30°
Now, ∠CAB = ∠GAE + ∠EAD = 30° + 60° = 90°

Que 6. Construct an angle of 45°.

Sol. Steps of Construction

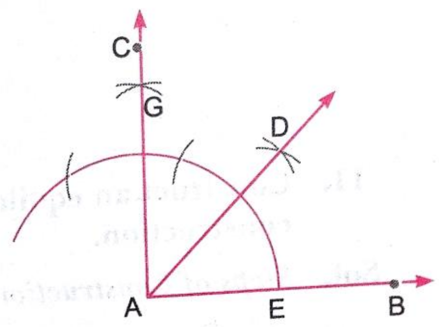

Fig. 11.6

(i) Draw a ray AB.
(ii) Construct ∠CAB = 90° as given in previous problem.
(iii) Draw DA the bisector of ∠CAB. Then ∠DAB = 45°

Que 7. Construct an angle of $22\frac{1^\circ}{2}$.

Sol. Steps of Construction

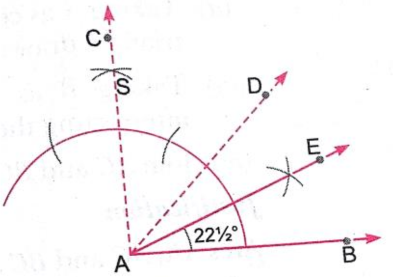

Fig. 11.7

(i) Draw ∠BAC = 90°.
(ii) Draw AD, the bisector of ∠BAC, then ∠BAD = 45°.
(iii) Draw AE, the bisector of ∠DAB, then ∠EAB = $22\frac{1^\circ}{2}$

Que 8. Construct an angle of 75°.

Sol. Steps of Construction

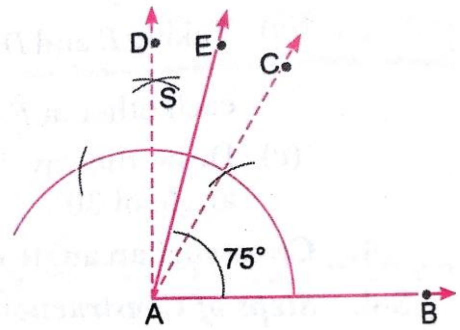

Fig. 11.8

(i) Draw ray AB.
(ii) Construct ∠BAC = 60°.
(iii) Construct ∠BAD = 90°.
(iv) Bisect ∠CAD, so that ∠CAE = ∠EAD = 15°.
(v) We obtain ∠BAE = ∠BAC + ∠CAE = 60° + 15° = 75°.

Que 9. Construct an angle of 105°.

Sol. Steps of Construction

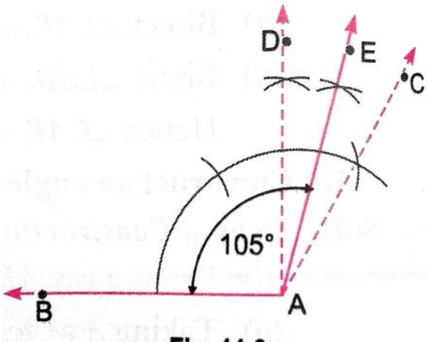

Fig. 11.9

(i) Draw ray AB.
(ii) Construct ∠BAC = 120°.
(iii) Construct ∠BAD = 90°.
(iv) Draw AE, the bisector of ∠CAD, then ∠DAE = 15°.
So, we obtain
∠BAE = ∠BAD + ∠DAE = 90° + 15° = 105°.

Que 10. Construct an angle of 123°.

Sol. Steps of Construction

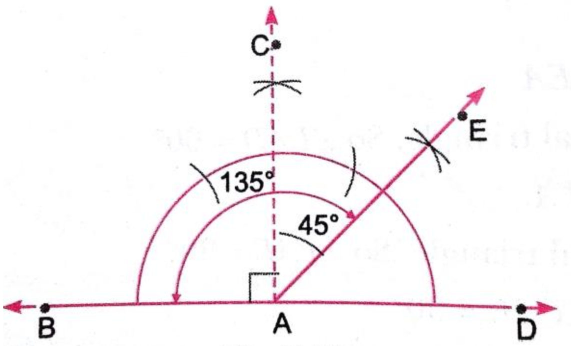

Fig. 11.10

(i) Construct ∠BAC = 90°, Then ∠CAD = 90°.
(ii) Draw AE, the bisector of ∠CAD, then ∠CAE = 45°.
So, we obtain
∠BAE = ∠BAC + ∠CAE = 90° + 45° = 135°.

Que 11. Construct an equilateral triangle, gives its side any justify the construction.

Sol. Steps of Construction

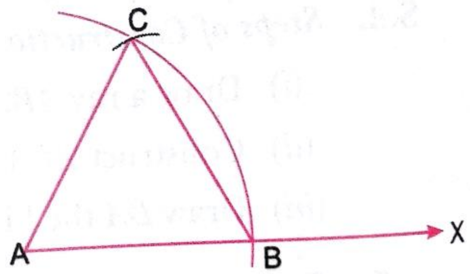

Fig. 11.11

(i) Draw a ray AX with initial point A.
(ii) Taking A as centre and radius equal to length of side of the triangle draw an arc intersecting the ray AX at B.
(iii) Taking B as centre and the same radius draw an arc intersecting the arc drawn in step (ii) at C.
(iv) Join AC and BC to obtain the required triangle.

Justification

Arcs AB, AC and BC are of the same radii

$\therefore \quad AB = BC = CA$

Long Answer Type Questions

[4 Marks]

Que 1. Construct a triangle ABC in which BC = 7 cm, ∠B = 75° and AB + AC = 13 cm.

Sol. Steps of Construction

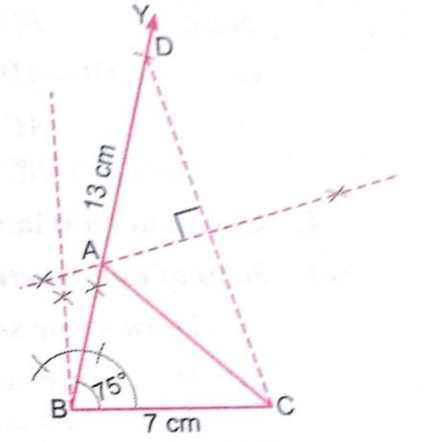

Fig. 11.12

(i) Draw BC = 7 cm.
(ii) Construct ∠YBC = 75°.
(iii) From ray BY, cut-off line segment BD = AB + AC = 13 cm.
(iv) Join CD.
(v) Draw the perpendicular bisector of CD meeting BY at A.
(vi) Join AC to obtain the required triangle ABC.

Justification

Since A lied on the perpendicular bisector of CD.
∴ AC =AD
Now BD = 13 cm
⇒ BA + AD = 13 cm
⇒ BA + AC = 13 cm
Hence, ΔABC is the required triangle.

Que 2. Construct a triangle PQR in which QR = 6 cm, ∠Q = 60° and PR – PQ = 2 cm.

Sol. Steps of Construction

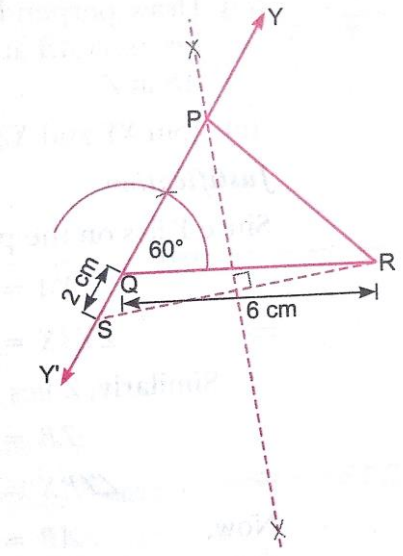

Fig. 11.13

(i) Draw QR = 6 cm.
(ii) Construct ∠YQR = 60°.
(iii) Produce YQ to Y' to form line YQY'.
(iv) From ray QY', cut-off line segment QS = 2 cm.
(v) Join SR.
(vi) Draw perpendicular bisector of RS which intersect QY at P.
(vii) Join PR to obtain required ΔPQR.

Justification

As P lies on the perpendicular bisector of RS.
Therefore, PR = PS = PQ + QS = PQ + 2 cm
⇒ PR – PQ = 2 cm
Hence, ΔPQR is the required triangle.

Que 3. Construct a triangle ABC in which BC = 8 cm, ∠B = 45° and AB – AC = 3.5 cm.

Sol. Steps of Construction

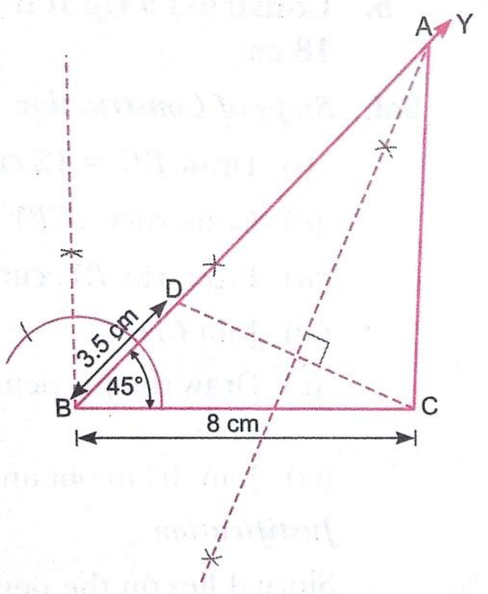

Fig. 11.14

(i) Draw BC = 8 cm.
(ii) Construct ∠YBC = 45°
(iii) From ray BY, cut-off line segment
BD = 3.5 cm.
(iv) Join CD.
(v) Draw perpendicular bisector of CD intersecting BY at A.
(vi) Join AC to obtain the required triangle ABC.

Justification

As A lies on the perpendicular bisector of CD. Therefore,

AD = AC

Now, BD = 3.5 cm

⇒ AB – AD = 3.5 cm

⇒ AB – AC = 3.5 cm

Hence, ΔABC is the required triangle.

Que 4. Construct a triangle XYZ in which $\angle Y = 30°$, $\angle Z = 90°$ and XY + YZ + ZX = 11 cm.

Sol. Steps of Construction

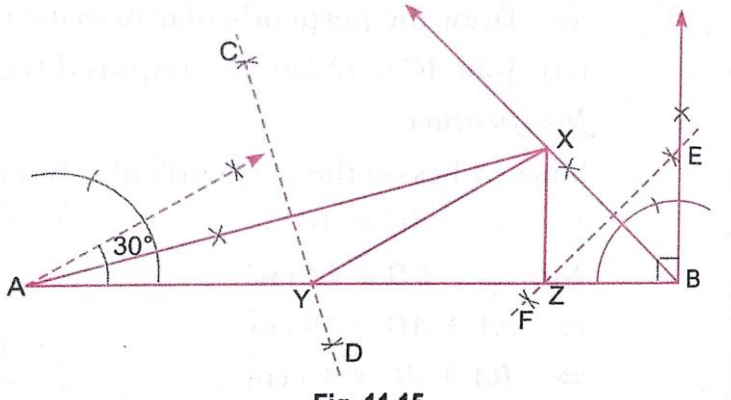

Fig. 11.15

(i) Draw a line segment AB = 11 cm.
(ii) At A, construct an angle of 30° and B construct an angle of 90°.
(iii) Bisect these angles. Let bisector of these angles intersect at point X.
(iv) Draw perpendicular bisector CD of XA to intersect AB at Y and EF of XB to intersect AB at Z.
(v) Join XY and XY to obtain requires ΔXYZ.

Justification

Since Y lies on the perpendicular bisector of XB. Therefore,

$$ZB = ZX$$

$$\Rightarrow \quad \angle ZBX = \angle ZXB$$

Now, $\quad AB = AY + YZ + ZB \quad \Rightarrow \quad AB = XY + YZ + ZX$

In ΔXAY, we have

$$\angle XYZ = \angle YXA + \angle YAX = 2\,\angle YAX = \angle A$$

In XBZ, we have

$$\angle XZY = \angle ZBX + \angle ZXB = 2\,\angle ZBX = \angle B$$

Que 5. Construct a right triangle whose base is 12 cm and sum of its hypotenuse and other side is 18 cm.

Sol. Steps of Construction

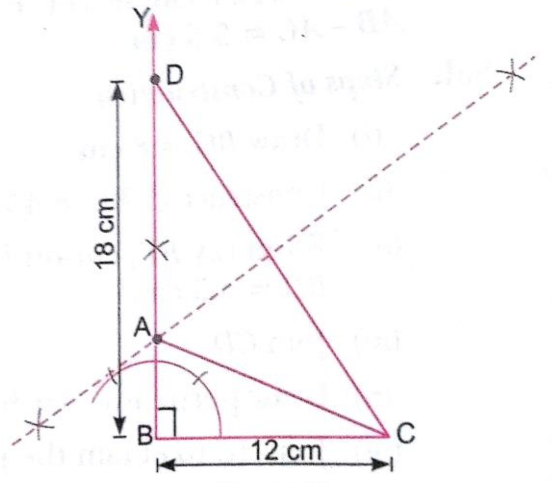

Fig. 11.16

(i) Draw BC = 12 cm.

(ii) Construct ∠CBY = 90°

(iii) From ray BY, cut-off line segment BD = 10 cm.

(iv) Join CD.

(v) Draw AC to obtain the required ΔABC.

Justification

Since A lies on the perpendicular bisector of CD.
Therefore,

AD = AC

Now, BD = BA + AD

⇒ BD = AB + AC

Hence, ΔABC is the required triangle.

HOTS (Higher Order Thinking Skills)

Que 1. Construct an equilateral triangle if it's altitude is 6 cm.

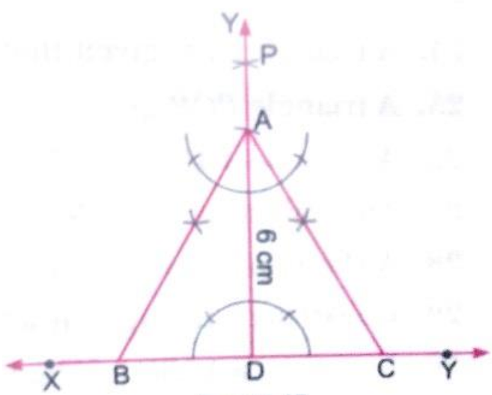

Fig. 11.17

Sol. Steps of Construction

(i) Draw a line XY.

(ii) Construct perpendicular PD at any point D on the line XY.

(iii) From point D, cut-off line segment AD = 6 cm.

(iv) Construct $\angle BAD = \angle CAD = 30^0$. Then ABC is the required triangle.

Justification

As $\angle A = \angle BAD + \angle CAD = 30^0 + 30^0 = 60^0$ and $AD \perp BC$ therefore, Δ ABC is an equilateral triangle with altitude AD = 6 cm.

Value Based Questions

Que 1. Teacher held two sticks AB and CD of equal length in her hands and marked their mid points M and N respectively. She then asked the students whether AM is equal to ND or not. Aprajita answered yes. Is Aprajita correct? State the axiom of Euclid that supports her answer. Which values of Aprajita are depicted here?

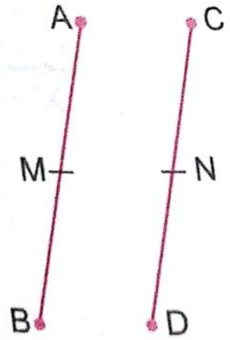

Fig. 5

Sol. Yes, Things which are halves of the same things are equal to one another. Curiosity, knowledge, truthfulness.

Que 2. For her records, a teacher asked the students about their heights. Manav said his height is same as that of Arnav. Raghav also answered the same, way that his height is same as that of Arnav. She then asked the students to relate the height of Manav and Raghav. Arnav answered they both have same height. Is Arnav correct? If yes, state Euclid's axiom which supports his answer.
Which values of Arnav are depicted here?

Sol. Yes, Things which are equal to the same thing are equal to one another. Knowledge, curiosity, truthfulness.

Que 3. The number of members of society A who participated in 'Say No to Crackers' campaign is double the number of members from society B. Also, the number of members from society C is double the number of members from society B. Can you relate the number of participants from society A and C? Justify your answer using Euclid's axiom. Which values are depicted here?

Sol. The number of participants from society A and C is equal. Things which are double of the same thing are equal to one another. Social service, helpfulness, cooperation, environmental concern.

Que 4. In a society, the number of persons using CNG instead of petrol for their vehicles has increased by 15 and now the number is 25. Form a linear equation to find the original number of persons using CNG and solve it using Euclid's axiom.
Which values are depicted in the question?

Sol. X + 15 = 25
⇒ $x + 15 - 15 = 25 - 15$ (Using Euclid's third axiom)
⇒ x = 10
Environmental care, responsible citizens, futuristic.

Que 5. Teacher asked the students to find the value of x in the following figure if l|| m.
Shalini answered 35°. Is she correct? Which values are depicted here?

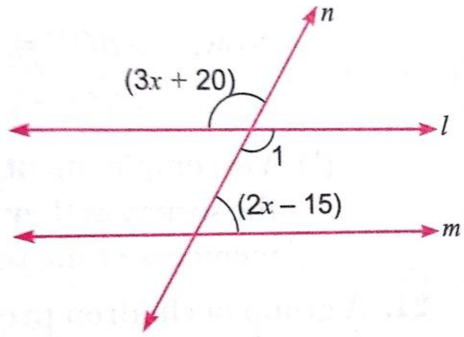

Fig. 6

Sol. ∠1 = 3x + 20 (Vertically opposite angles)
∴ 3x + 20 2x – 15 = 180 ° (Co-interior angles are supplementary)
⇒ $5x + 5 = 180°$ ⇒ $5x = 180° - 5°$
⇒ 5x = 175 ° ⇒ $x = \frac{175}{5} = 35°$

Yes, Knowledge, truthfulness.

Que 6. For spreading the message 'Save Environment Save Future' a rally was organised by some students of a school. They were given triangular cardboard pieces which they divided into two parts by drawing bisectors of base angles (say ∠B and ∠C) intersecting at O in the given figure. Prove that ∠BOC = $90 + \frac{1}{2}\angle A$
Which values are depicted by these students?

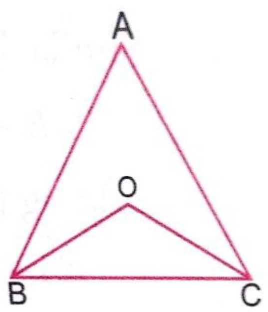

Fig. 7

Sol. In ΔABC, we have
∠A + ∠B + ∠C = 180 ° (∵ sum of the angles of a Δ is 180 °)

⇒ $\frac{1}{2}\angle A + \frac{1}{2}\angle B + \frac{1}{2}\angle C = \frac{180°}{2}$

$\Rightarrow \quad \frac{1}{2}\angle A + \angle 1 + \angle 2 = 90°$

$\therefore \quad \angle 1 + \angle 2 = 90° - \frac{1}{2}\angle A$ ....(i)

Now, in ΔOBC, we have:

$\angle 1 + \angle 2 + \angle BOC = 180°$ [∵ sum of the angles of Δ is 180 °]

$\Rightarrow \quad \angle BOC = 180° - (\angle 1 + \angle 2)$

$\Rightarrow \quad \angle BOC = 180° - (90° - \frac{1}{2}\angle A)$ [using (i)]

$\Rightarrow \quad \angle BOC = 180° - 90° + \frac{1}{2}\angle A$

$\therefore \quad \angle BOC = 90° + \frac{1}{2}\angle A$

Environmental care, social, futuristic.

Que 7. Three bus stops situated at A, B and C in the figure are operated by handicapped persons. These 3 bus stops are equidistant from each other. OB is the bisector of ∠ABC and OC is the bisector of ∠ACB.
(a) Find ∠BOC.
(b) Do you think employment provided to handicapped persons is important for the development of the society? Express your views with relevant points.

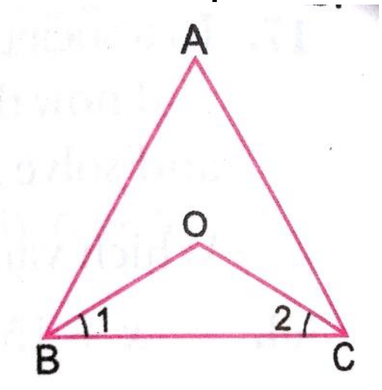

Fig. 9

Sol. (a) Since, A, B, C are equidistant from each other.
∴ ∠ABC is an equilateral triangle.
⇒ ∠ABC = ∠ABC = 60°

$\Rightarrow \quad \angle OBC = \angle OCB = \frac{1}{2} \times 60° = 30°$ (∵ OB and OC are angle bisectors)

Now, ∠BOC = 180° - ∠OBC - ∠OCB (Using angle sum property of triangle)

⇒ ∠BOC = 180°- 30°-30° = 120°

(b) Yes, employment provided to the handicapped persons is important for the development of the society as they would become independent, self-reliant, confident, social, helpful and useful members of the society.

Que 8. A group of children prepared some decorative pieces in the shape of a star for the orphans in an orphanage. Show that $\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 360°$
Which values of the children are depicted here?

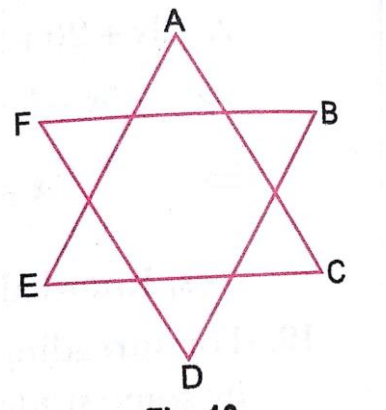

Fig. 10

Sol. In ΔAEC,
$\angle A + \angle E + \angle C = 180°$ … (i) (Angle sum property of a triangle)

Similarly, in ΔBDF,
$\angle B + \angle D \angle F = 180°$ …. (ii)

Adding (i) and (ii), we get
$\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 360°$
Social, caring, cooperative, hardworking.

Que 9. For annual day, Sakshi and Nidhi were asked to make one rangoli each on two different places. They started it with triangles (say ABC and ΔPQR) and their medians (AM and PN). If two sides (AB and BC) and a median (AM) of one triangle are respectively equal to two sides (PQ and QR) and a median (PN) of other triangle, prove that the two triangles (ΔABC and ΔPQR) are congruent. Which values of the girls are depicted here?

Sol. In ΔABC and ΔPQR

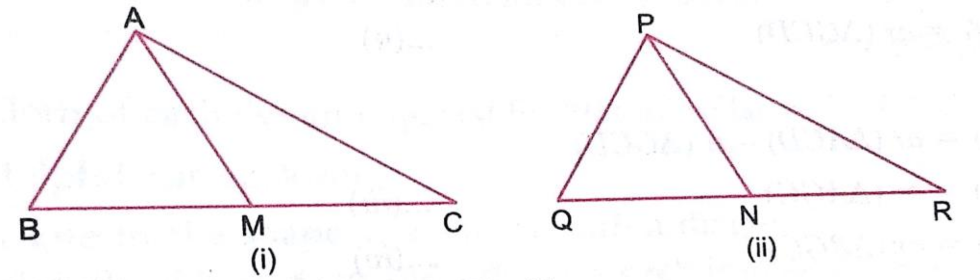

Fig. 11

BC = QR

⇒ $\frac{1}{2}BC = \frac{1}{2}QR$

⇒ BM = QN

In triangle ABM and PQN, we have

	AB = PQ	(Given)
	BM = QN	(Proved above)
	AM = PN	(Given)
∴	$\Delta ABM \cong \Delta PQN$	(SSS congruence criterion)
⇒	$\angle B = \angle Q$	(CPCT)

Now, in triangles ABC and PQR, we have

	AB = PQ	(Given)
	$\angle B = \angle Q$	(Proved above)
	BC = QR	(Given)
∴	$\Delta ABC \cong \Delta PQR$	(SSS congruence criterion)

Participation, beauty, hardworking.

Que 10. Triangular pieces of cardboards were cut out by some people who were organising 'No Pollution' campaign in their area. If the three angles of one cutout are respectively equal to the three angles of the other cutout, can we say the two cutouts are congruent? Justify your answer.
Which values of these people are depicted here?

Sol. The two cutouts may not be congruent. For example all equilateral triangles have equal angles but may have different sides.
Environmental concern, cooperative, caring, social.

Que 11. Anya wants to prepare a poster on education of girlchild for a campaign. She takes a triangular sheet and divides it into three equal parts by drawing its medians which intersect at the point G (see Fig. 12).

Show that ar (ΔAGC) = ar (ΔAGC) = ar (ΔAGB) = (ΔBGC) = $\frac{1}{3} ar\ (\Delta ABC)$

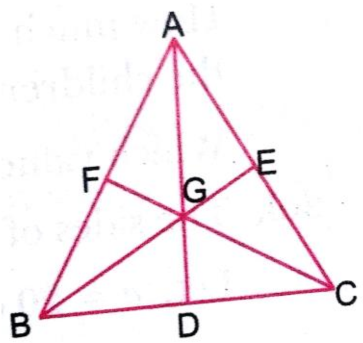

Fig. 12

Do you think education of a girl child is important for the development of a society? Justify your answer.

Sol. Given: A ΔABC in which medians AD, BE and CF intersects at G.

Proof: (ΔAGB) = ar (ΔBGC) = ar (ΔCGA) = $\frac{1}{3}$ ar (ΔABC)

Proof: In ΔABC, AD is the median. As a median of a triangle divides it into two triangles of equal area.

∴ ar (ΔABD) = ar (ΔACD) … (i)

In ΔGBC, GD is the median

∴ aq (ΔGBD) = ar (ΔGCD) …. (ii)

Subtracting (ii) from (i), we get

ar (ΔABD) – ar (ΔGBD) = ar (ACD) – ar (ΔGCD)

ar (ΔAGB) = ar (ΔAGC) … (iii)

Similarly, ar (ΔAGB) = ar (ΔBGC) … (iv)

From (iii) and (iv), we get

ar (ΔAGB) = ar (ΔBGC) = ar (ΔAGC) …. (v)

But, ar (ΔAGB) + ar (ΔBGC) + ar (ΔAGC) = ar (ΔABC) …. (vi)

From (v) and (vi), we get

3 ar (ΔAGB) = ar (ΔABC)

⇒ ar (ΔAGB) = $\frac{1}{3} ar(\Delta ABC)$

Hence, ar (ΔAGB) = ar (ΔAGC) = ar (ΔBGC) = $\frac{1}{3}$ ar (ΔABC)

Yes, for the development of a society, education of each girl child is essential. An educated society always progresses.