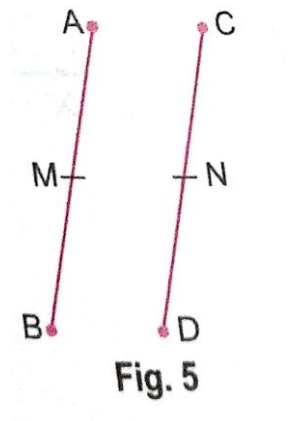


Unit - IV Geometry

Que 14. 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?



Sol. Yes

Things which are halves of the same things are equal to one another.

Curiosity, knowledge, truthfulness.

Que 15. 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 16. 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 17. 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. $x + 15 = 25$

$\Rightarrow x + 15 - 15 = 25 - 15$ (Using Euclid's third axiom)

$\Rightarrow x = 10$

Environmental care, responsible citizens, futuristic.

Que 18. Teacher asked the students to find the value of x in the following figure if $l \parallel m$. Shalini answered 35° . Is she correct? Which values are depicted here?

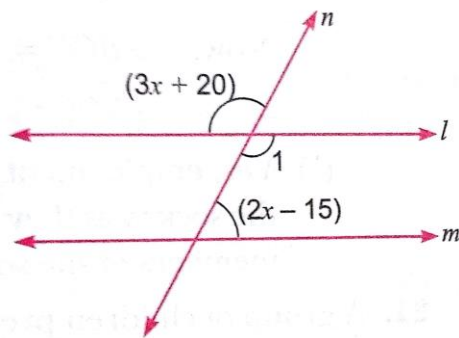


Fig. 6

Sol. $\angle 1 = 3x + 20$ (Vertically opposite angles)

$\therefore 3x + 20 + 2x - 15 = 180^\circ$ (Co-interior angles are supplementary)

$\Rightarrow 5x + 5 = 180^\circ \Rightarrow 5x = 180^\circ - 5^\circ$

$\Rightarrow 5x = 175^\circ \Rightarrow x = \frac{175}{5} = 35^\circ$

Yes, Knowledge, truthfulness.

Que 19. 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 $\angle B$ and $\angle C$) intersecting at

O in the given figure. Prove that $\angle BOC = 90^\circ + \frac{1}{2} \angle A$

Which values are depicted by these students?

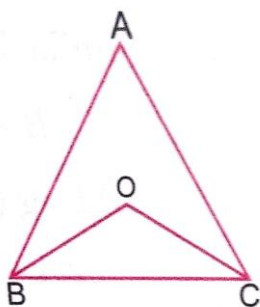


Fig. 7

Sol. In $\triangle ABC$, we have

$$\angle A + \angle B + \angle C = 180^\circ \quad (\because \text{sum of the angles of a } \triangle \text{ is } 180^\circ)$$

$$\Rightarrow \frac{1}{2}\angle A + \frac{1}{2}\angle B + \frac{1}{2}\angle C = \frac{180^\circ}{2}$$

$$\Rightarrow \frac{1}{2}\angle A + \angle 1 + \angle 2 = 90^\circ$$

$$\therefore \angle 1 + \angle 2 = 90^\circ - \frac{1}{2}\angle A \quad \dots(i)$$

Now, in $\triangle OBC$, we have:

$$\angle 1 + \angle 2 + \angle BOC = 180^\circ \quad [\because \text{sum of the angles of } \triangle \text{ is } 180^\circ]$$

$$\Rightarrow \angle BOC = 180^\circ - (\angle 1 + \angle 2)$$

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

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

$$\therefore \angle BOC = 90^\circ + \frac{1}{2}\angle A$$

Environmental care, social, futuristic.

Que 20. 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 $\angle ABC$ and OC is the bisector of $\angle ACB$.

(a) Find $\angle BOC$.

(b) Do you think employment provided to handicapped persons is important for the development of the society? Express your views with relevant points.

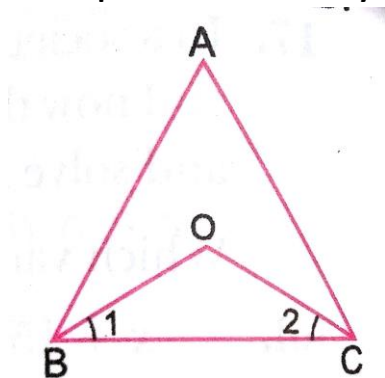


Fig. 9

Sol. (a) Since, A, B, C are equidistant from each other.

$\therefore \triangle ABC$ is an equilateral triangle.

$$\Rightarrow \angle ABC = \angle ACB = 60^\circ$$

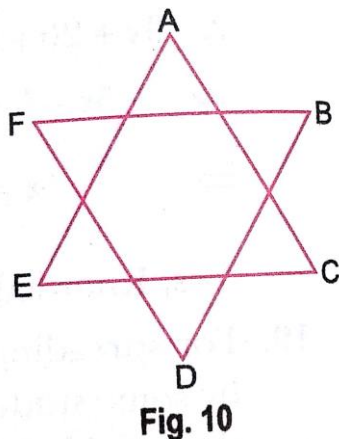
$$\Rightarrow \angle OBC = \angle OCB = \frac{1}{2} \times 60^\circ = 30^\circ \quad (\because OB \text{ and } OC \text{ are angle bisectors})$$

$$\text{Now, } \angle BOC = 180^\circ - \angle OBC - \angle OCB \quad (\text{Using angle sum property of triangle})$$

$$\Rightarrow \angle BOC = 180^\circ - 30^\circ - 30^\circ = 120^\circ$$

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



Sol. In $\triangle AEC$,

$$\angle A + \angle E + \angle C = 180^\circ \quad \dots (i) \quad (\text{Angle sum property of a triangle})$$

Similarly, in $\triangle BDF$,

$$\angle B + \angle D + \angle F = 180^\circ \quad \dots (ii)$$

Adding (i) and (ii), we get

$$\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 360^\circ$$

Social, caring, cooperative, hardworking.

Que 22. For annual day, Sakshi and Nidhi were asked to make one rangoli each on two different places. They started it with triangles (say $\triangle ABC$ and $\triangle PQR$) 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 ($\triangle ABC$ and $\triangle PQR$) are congruent.

Which values of the girls are depicted here?

Sol. In $\triangle ABC$ and $\triangle PQR$

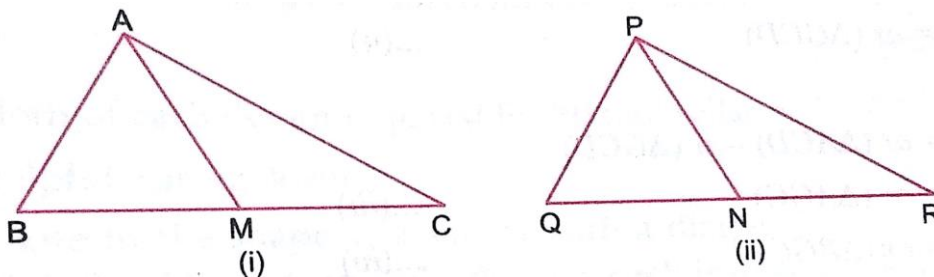


Fig. 11

$$BC = QR$$

$$\Rightarrow \frac{1}{2}BC = \frac{1}{2}QR$$

$$\Rightarrow BM = QN$$

In triangle ABM and PQN, we have

$$AB = PQ \quad (\text{Given})$$

$$BM = QN \quad (\text{Proved above})$$

$$AM = PN \quad (\text{Given})$$

$$\therefore \triangle ABM \cong \triangle PQN \quad (\text{SSS congruence criterion})$$

$$\Rightarrow \angle B = \angle Q \quad (\text{CPCT})$$

Now, in triangles ABC and PQR, we have

$$AB = PQ \quad (\text{Given})$$

$$\angle B = \angle Q \quad (\text{Proved above})$$

$$BC = QR \quad (\text{Given})$$

$$\therefore \triangle ABC \cong \triangle PQR \quad (\text{SSS congruence criterion})$$

Participation, beauty, hardworking.

Que 23. 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 24. 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 $\text{ar}(\triangle AGC) = \text{ar}(\triangle AGC) = \text{ar}(\triangle AGB) = \text{ar}(\triangle BGC) = \frac{1}{3} \text{ar}(\triangle ABC)$

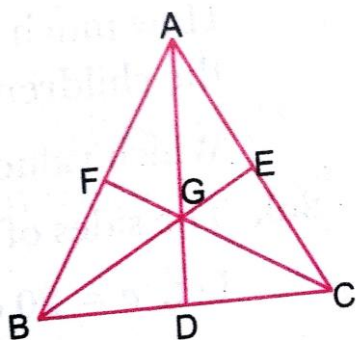


Fig. 12

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

Sol. Given: A $\triangle ABC$ in which medians AD, BE and CF intersect at G.

Proof: $(\triangle AGB) = \text{ar}(\triangle BGC) = \text{ar}(\triangle CGA) = \frac{1}{3} \text{ar}(\triangle ABC)$

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

$$\therefore \text{ar}(\triangle ABD) = \text{ar}(\triangle ACD) \quad \dots (i)$$

In $\triangle GBC$, GD is the median

$$\therefore \text{ar}(\triangle GBD) = \text{ar}(\triangle GCD) \quad \dots (ii)$$

Subtracting (ii) from (i), we get

$$\begin{aligned} \text{ar}(\triangle ABD) - \text{ar}(\triangle GBD) &= \text{ar}(\triangle ACD) - \text{ar}(\triangle GCD) \\ \text{ar}(\triangle AGB) &= \text{ar}(\triangle AGC) \quad \dots (iii) \end{aligned}$$

$$\text{Similarly, } \text{ar}(\triangle AGB) = \text{ar}(\triangle BGC) \quad \dots (iv)$$

From (iii) and (iv), we get

$$\text{ar}(\triangle AGB) = \text{ar}(\triangle BGC) = \text{ar}(\triangle AGC) \quad \dots (v)$$

$$\text{But, } \text{ar}(\triangle AGB) + \text{ar}(\triangle BGC) + \text{ar}(\triangle AGC) = \text{ar}(\triangle ABC) \quad \dots (vi)$$

From (v) and (vi), we get

$$\begin{aligned} 3 \text{ar}(\triangle AGB) &= \text{ar}(\triangle ABC) \\ \Rightarrow \text{ar}(\triangle AGB) &= \frac{1}{3} \text{ar}(\triangle ABC) \end{aligned}$$

$$\text{Hence, } \text{ar}(\triangle AGB) = \text{ar}(\triangle AGC) = \text{ar}(\triangle BGC) = \frac{1}{3} \text{ar}(\triangle ABC)$$

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