CHAPTER 4

SIMILAR TRIANGLES

KEY POINTS

1. **Similar Triangles :** Two triangles are said to be similar if their corresponding angles are equal and their corresponding sides are proportional.

2. Criteria for Similarity :

   in ΔABC and ΔDEF

   (i) ***AAA* Similarity :** $\Delta ABC \sim \Delta DEF$ when $\angle A = \angle D$, $\angle B = \angle E$ and $\angle C = \angle F$

   (ii) ***SAS* Similarity :**

   $$\Delta ABC \sim \Delta DEF \text{ when } \frac{AB}{DE} = \frac{AC}{DF} \text{ and } \angle B = \angle E$$

   (iii) **SSS Similarity :** $\Delta ABC \sim \Delta DEF$, $\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF}$.

3. The proof of the following theorems can be asked in the examination :

   (i) **Basic Proportionality Theorem :** If a line is drawn parallel to one side of a triangle to intersect the other sides in distinct points, the other two sides are divided in the same ratio.

   (ii) The ratio of the areas of two similar triangles is equal to the square of the ratio of their corresponding sides.

   (iii) **Pythagoras Theorem :** In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

(iv) **Converse of Pythagoras Theorem :** In a triangle, if the square of one side is equal to the sum of the squares of the other two sides then the angle opposite to the first side is a right angle.

MULTIPLE CHOICE QUESTIONS

1. $\Delta ABC \sim \Delta DEF$. If $DE = 2\ AB$ and BC = 3cm then EF is equal to _____.

   (a) 1.5 cm (b) 3 cm

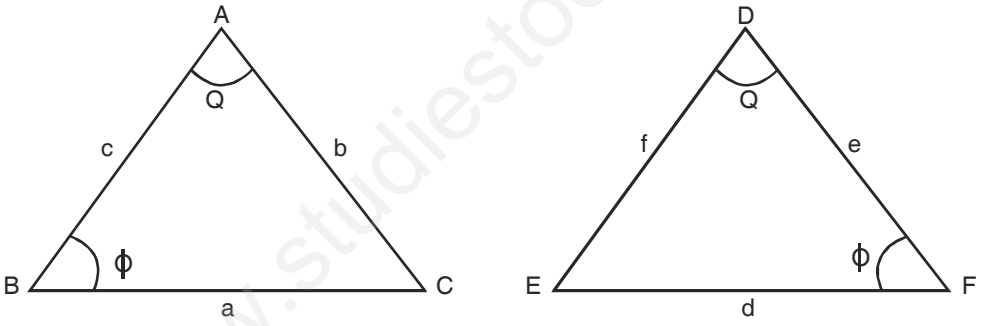
   (c) 6 cm (d) 9 cm

2. In ΔDEW, $AB \parallel EW$ if AD = 4 cm, DE = 12cm and DW = 24 cm then the value of DB = ____

   (a) 4 cm (b) 8 cm

   (c) 12 cm (d) 16 cm

3.



   In the figure the value of cd = _____

   (a) ae (b) af

   (c) bf (d) be

4. If in ΔABC, AB = 6 cm, BC = 12cm and $CA = 6\sqrt{3}\ cm$ then the measure of $\angle A$ is

   (a) 30° (b) 45°

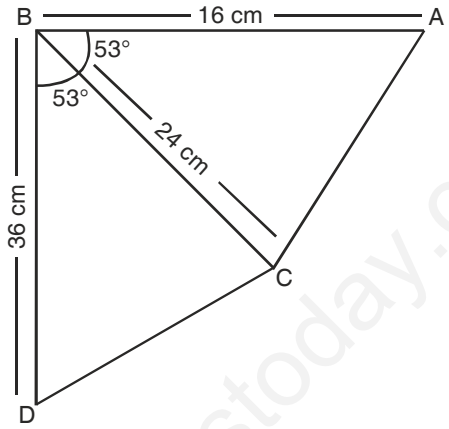
   (c) 60° (d) 90°

5. The area of two isosceles triangles are in the ratio 16 : 25. The ratio of their corresponding heights is—

(a) 5 : 4 (b) 3 : 2

(c) 4 : 5 (d) 5 : 7

6. In the figure, ΔABC is similar to _____



(a) ΔBDC (b) ΔDBC

(c) ΔCDB (d) ΔCBD

7. $\Delta AMB \sim \Delta CMD$. Also $2ar(\Delta AMB) = ar(\Delta CMD)$ the length of MD is

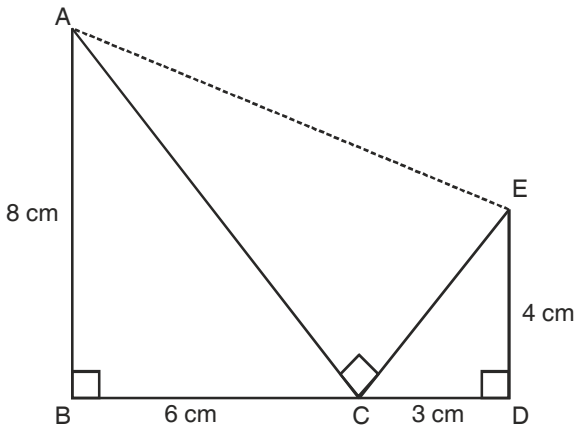
(a) $\sqrt{2}\ MB$ (b) $\sqrt{2}\ MD$

(c) $\frac{\sqrt{2}}{MB}$ (d) $\frac{\sqrt{2}}{MD}$

8. In fig. length of AE is

(a) 10 cm (b) 9 cm

(c) $5\sqrt{5}$ cm (d) $\sqrt{5}$ cm



9. In ΔABC, D and E are points on side AB and AC respectively such that $DE \parallel BC$ and $AD : DB = 3 : 1$. If $EA = 3.3$ cm then AC =

(a) 1.1 cm (b) 4.4 cm

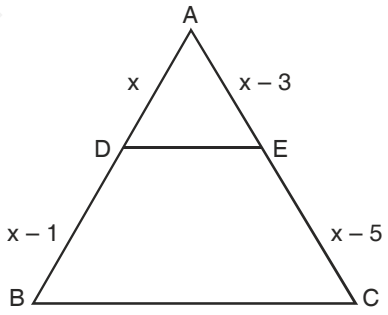
(c) 4 cm (d) 5.5 cm

10. ABC and BDE are two equilateral triangles such that D is the midpoint of BC. Ratio of the areas of triangles ABC and BDE is—

(a) 2 : 1 (b) 1 : 2

(c) 4 : 1 (d) 1 : 4

11. In ΔABC, $DE \parallel BC$. In the figure the value of x is _____



(a) 1 (b) –1

(c) 3 (d) –3

12. In ΔABC, $\angle B = 90°$, BE is the perpendicular bisector of AC then $\frac{ar(\Delta BEC)}{ar(\Delta ABC)} =$ _____

(a) $\frac{1}{2}$ (b) $\frac{2}{1}$

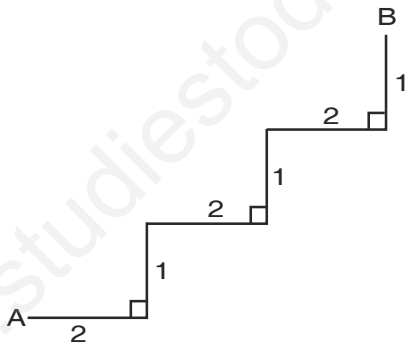
(c) $\frac{4}{1}$ (d) $\frac{1}{4}$

13. The altitude of an equilateral triangle, having the length of its side 12cmis

(a) 12 cm (b) $6\sqrt{2}$ cm

(c) 6 cm (d) $6\sqrt{3}$ cm

14. The straight line distance between A and B is



(a) $3\sqrt{5}$ (b) $5\sqrt{3}$

(c) 5 (d) $5\sqrt{2}$

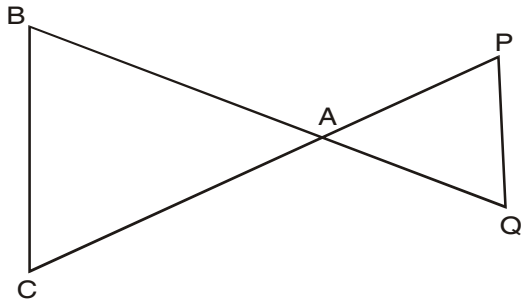
15. If in an isosceles right-angled triangle the length of the hypotenuse is 10 cm then the perimeter of the triangle is

(a) $5\sqrt{2}$ cm (b) $2\sqrt{5}$ cm

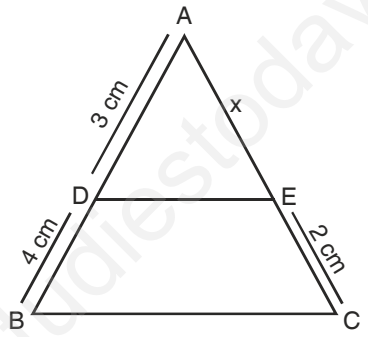
(c) $10\left(\sqrt{2}+1\right)$ cm (d) $10\left(\sqrt{2}-1\right)$ cm

SHORT ANSWER TYPE QUESTIONS

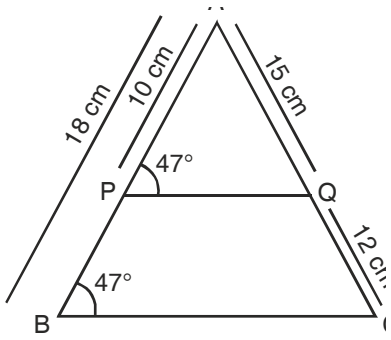
16. In figure $\Delta ABC \sim \Delta APQ$. If $BC = 8$ cm, $PQ = 4$cm $BA = 6.5$ cm, $AP = 2.8$ cm, find CA and AQ.



17. In the adjoining figure find AE if $DE \parallel BC$

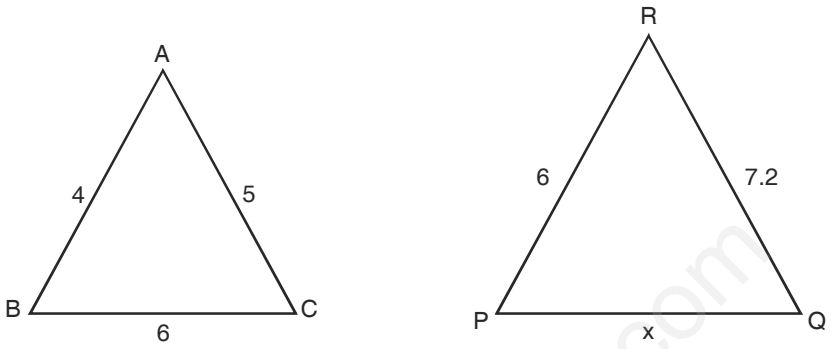


18. In the figure name the similar triangle.

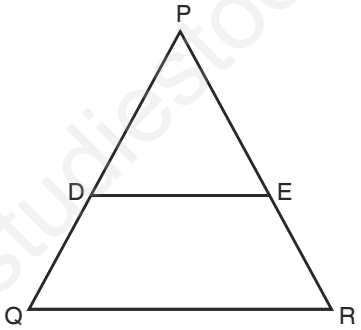


19. An isosecles triangle ABC is similar to triangle PQR. $AC = AB = 4$ cm, $RQ = 10$ cm and $BC = 6$ cm. What is the length of PR? Which type of triangle is ΔPQR?

20. In the figure $\Delta ABC \sim \Delta PQR$. What is the value of x?



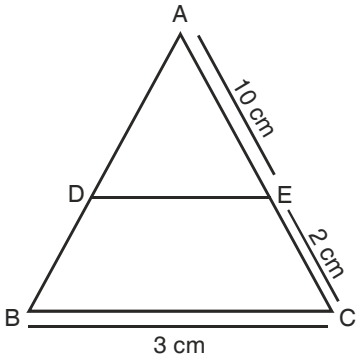
21. In ΔPQR, $DE \parallel QR$ and $DE = \frac{1}{4}QR$. Find $\frac{ar(\Delta PQR)}{ar(\Delta PDE)}$.



22. In triangles ABC and PQR if $\angle B = \angle Q$ and $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{1}{2}$ then what is the value of $\frac{PR}{QR}$?

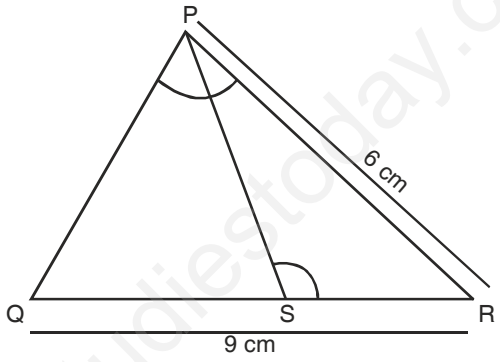
23. The measurement of three sides of a triangle are a, $\sqrt{10}a$, $3a$. What is the measurement of the angle opposite to the longest side?

24. In the adjoining figure $DE \parallel BC$. What is the value of DE.



LONG ANSWER TYPE QUESTIONS

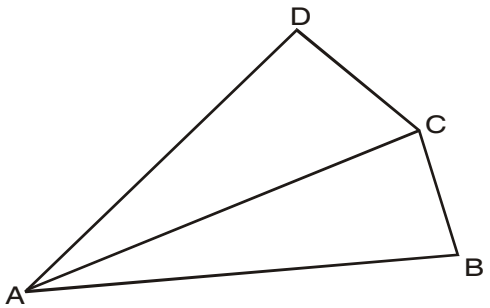
25. In the figure find *SR* if $\angle QPR = \angle PSR$. *PR* = 6 cm and *QR* = 9 cm



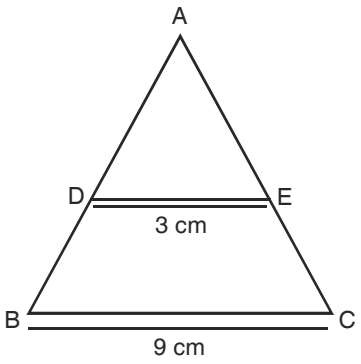
26. In ΔPQR, $RS \perp PQ$, $\angle QRS = \angle P$, *PS* = 5 cm, *SR* = 8 cm. Find *PQ*.

27. Two similar triangles *ABC* and *PBC* are made on opposite sides of the same base *BC*. Prove that *AB* = *BP*.

28. In a quadrilateral *ABCD*, $\angle B = 90°$, $AD^2 = AB^2 + BC^2 + CD^2$. Prove that $\angle ACD = 90°$.



29. In figure $DE \parallel BC$, $DE = 3$ cm, $BC = 9$ cm and $ar(\Delta ADE) = 30$ cm^2. Find ar (trap. $BCED$).

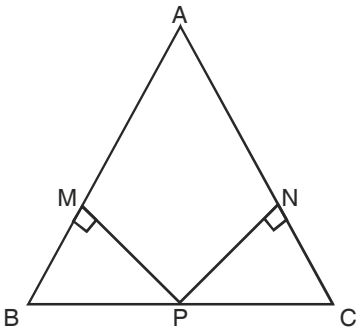


30. Amit is standing at a point on the ground 8m away from a house. A mobile network tower is fixed on the roof of the house. If the top and bottom of the tower are 17m and 10m away from the point. Find the heights of the tower and house.

31. In a right angled triangle ABC, right angle at B, $\frac{BC}{AB} = \sqrt{3}$. Find $\frac{AB}{AC}$.

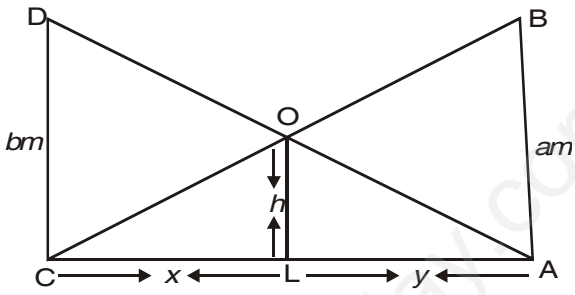
32. In a right angled triangle PRO, PR is the hypotenuse and the other two sides are of length 6cm and 8cm. Q is a point outside the triangle such that $PQ = 24$cm $RQ = 26$cm. What is the measure of $\angle QPR$?

33. In the figure ΔABC is isosceles with $AB = AC$, P is the mid point of BC. If $PM \perp AB$ and $PN \perp AC$. Prove that $MP = NP$.



34. *PQRS* is a trapezium. *SQ* is a diagonal. *E* and *F* are two points on parallel sides *PQ* and *RS* respectively intersecting *SQ* at *G*. Prove that $SG \times QE = QG \times SF$.

35. Two poles of height *a* metres and *b* metres are apart. Prove that the height of the point of intersection of the lines joining the top of each pole to the foot of the opposite pole is given by $\frac{ab}{a+b}$ mts.



36. Show that the areas of two similar triangles are in the ratio of the squares (of the corresponding angle bisector segments).

37. In a rhombus, prove that four times the square of any sides is equal to the sum of squares of its diagonals.

38. *ABCD* is a trapezium with *AE* || *DC*. If *ABD* is similar to ΔBEC. Prove that $AD = BC$.

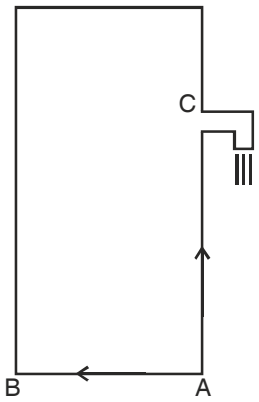
39. In a triangle, if the square of one side is equal to the sum of the squares on the other two sides, then prove that the angle opposite to the first side is a right triangle.

40. Prove that in a right triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.

41. *ABCD* is a rectangle in which length is double of its breadth. Two equilateral triangles are drawn one each on length and breadth of rectangle. Find the ratio of their areas.

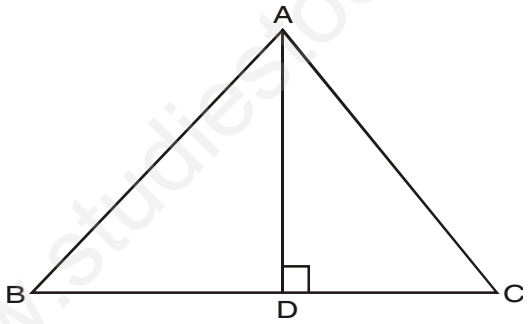
42. Amar and Ashok are two friends standing at a corner of a rectangular garden. They wanted to drink water. Amar goes due north at a speed of 50m/min and Ashok due west at a speed of 60m/min. They travel for 5

minutes. Amar reaches the tap and drink water. How far (minimum distance) is Ashok from the tap now.

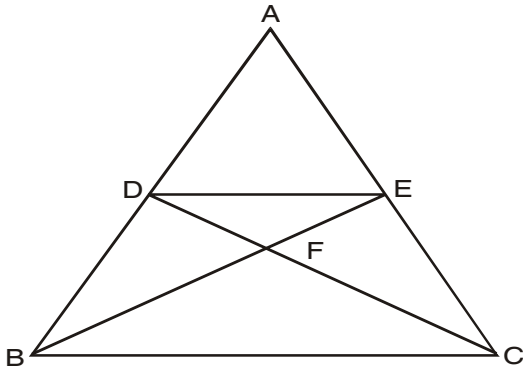


43. If two triangles are equiangular, prove that the ratio of the corresponding sides is same as the ratio of the corresponding altitudes.

44. In figure, if $AD \perp BC$ and $\frac{BD}{DA} = \frac{DA}{DC}$, prove that ΔABC is a right triangle.



45. In figure $DE \parallel BC$ and $AD : DB = 5 : 4$. Find $\frac{ar\ \Delta DEF}{ar\ \Delta\ CFB}$



ANSWERS

1. *c*
2. *b*
3. *a*
4. *d*
5. *c*
6. *d*
7. *a*
8. *c*
9. *b*
10. *c*
11. *d*
12. *d*
13. *d*
14. *a*
15. *c*
16. $AC = 5.6$ cm, $AQ = 3.25$ cm
17. 1.5 cm
18. $\Delta APQ \sim \Delta ABC$
19. $\frac{20}{3}$ cm
20. 4.8 cm
21. 16 : 1
22. $\frac{1}{2}$
23. 90°
24. 2.5 cm
25. 4 cm
26. 17.8 cm
29. 240 cm^2
30. 9m, 6m
31. $\frac{1}{2}$
32. 90°
41. 4 : 1
42. $50\sqrt{61}$ m
43. $5\sqrt{10}$ cm
45. $\frac{ar\ \Delta DEF}{ar\ \Delta CFB} = \frac{25}{81}$