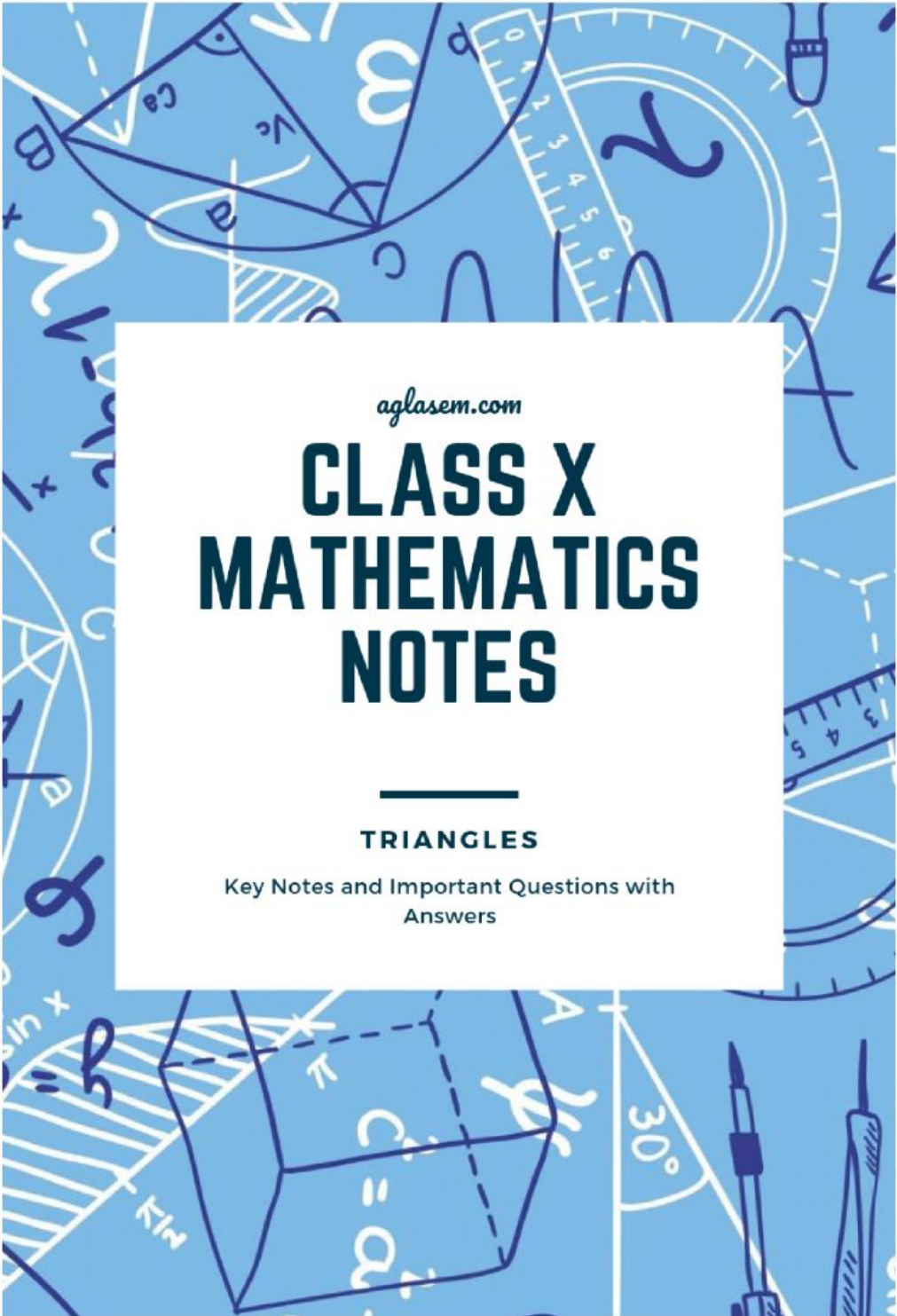




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CLASS X MATHEMATICS NOTES

TRIANGLES

Key Notes and Important Questions with
Answers

Triangles

Key Points

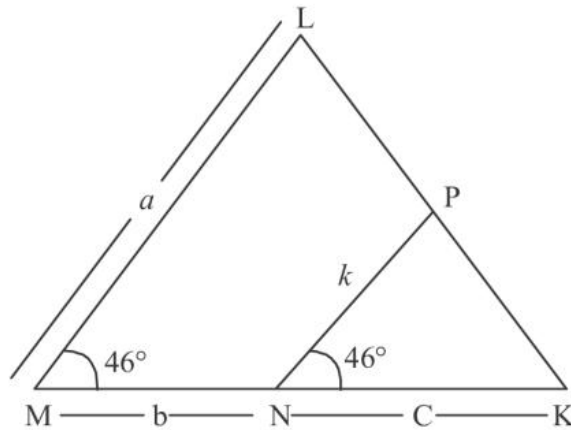
1. **Similar Triangles** : Two triangles are said to be similar if their corresponding angles are equal and their corresponding sides are proportional.
2. **Criteria for Similarity** :
in $\triangle ABC$ and $\triangle DEF$
 - (i) **AAA Similarity** : $\triangle ABC \sim \triangle DEF$ when $\angle A = \angle D$, $\angle B = \angle E$ and $\angle C = \angle F$
 - (ii) **SAS similarity** :
$$\triangle ABC \sim \triangle DEF \text{ when } \frac{AB}{DE} = \frac{BC}{EF} \text{ and } \angle B = \angle E$$
 - (iii) **SSS Similarity**: $\triangle ABC \sim \triangle DEF$, $\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF}$
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 areas of two similar triangles is equal to the square of the ratio of their corresponding sides.
 - (iii) **Pythagoras Theorem**: In a right triangles 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 squares of other two sides then the angle opposite to the first side is a right angle

Important Questions with Solutions

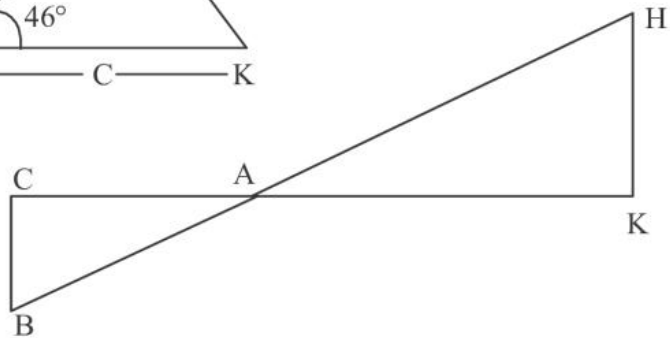
VERY SHORT ANSWER TYPE QUESTIONS

1. Is the triangle with sides 12cm, and 18 cm a right triangle?
 2. If $\triangle ABC \sim \triangle QRP$, $\frac{\text{Area}(\triangle ABC)}{\text{Area}(\triangle PQR)} = \frac{9}{4}$, $AB = 18\text{cm}$, $BC = 15\text{cm}$, then find the length of PR.
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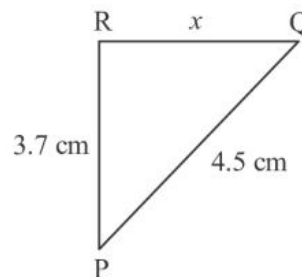
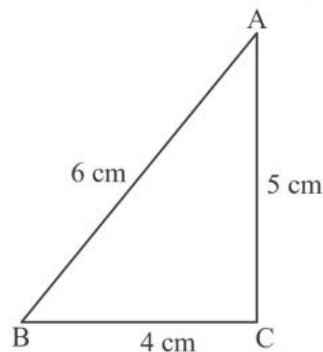
3. In the fig., $\angle M = \angle N = 46^\circ$, Express x in terms of a , b and c .



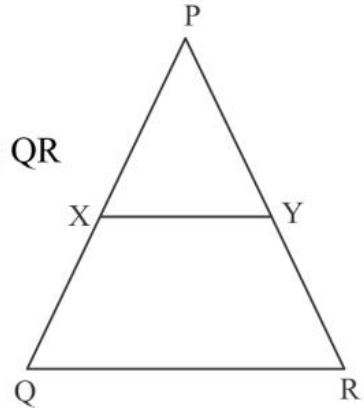
4. In fig. $\triangle AHK \sim \triangle ABC$.
If $AK = 10\text{cm}$, $BC = 3.5\text{cm}$
and $HK = 7\text{cm}$, find AC .



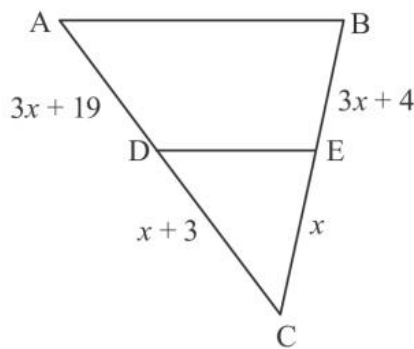
5. It is given that $\triangle DEF \sim \triangle RPQ$. Is it true to say that $\angle D = \angle R$ and $\angle F = \angle P$?
6. If the corresponding Medians of two similar triangles are in the ratio $5 : 7$, Then Find the ratio of their sides.
7. A right angled triangle has its area numerically equal to its perimeter. The length of each side is an even number and the hypotenuse is 10cm . What is the perimeter of the triangle?
8. An aeroplane leaves an airport and flies due west at a speed of 2100 km/hr . At the same time, another aeroplane leaves the same place at airport and flies due south at a speed of 2000 km/hr . How far apart will be the two planes after 1 hour?
9. The areas of two similar $\triangle ABC$ and $\triangle DEF$ are 225 cm^2 and 81 cm^2 respectively. If the longest side of the larger triangle $\triangle ABC$ be 30 cm , find the longest side of the smaller triangle DEF .
10. In the figure, if $\triangle ABC \sim \triangle PQR$, find the value of x ?



11. In the figure, $XY \parallel QR$ and $\frac{PX}{XQ} = \frac{PY}{YR} = \frac{1}{2}$, find $XY : QR$



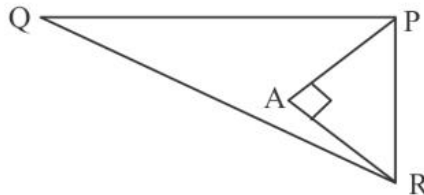
12. In figure, find the value of x which will make $DE \parallel AB$?



13. If $\triangle ABC \sim \triangle DEF$, $BC = 3EF$ and $\text{ar}(\triangle ABC) = 117 \text{ cm}^2$ find area $(\triangle DEF)$.
 14. If $\triangle ABC$ and $\triangle DEF$ are similar triangles such that $\angle A = 45^\circ$ and $\angle F = 56^\circ$, then find $\angle C$.
 15. If the ratio of the corresponding sides of two similar triangles is $2 : 3$, then find the ratio of their corresponding altitudes.

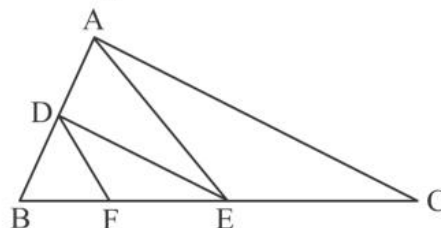
SHORT ANSWER TYPE (I) QUESTIONS

16. In the given fig. $PQ = 24 \text{ cm}$, $QR = 26 \text{ cm}$, $\angle PAR = 90^\circ$, $PA = 6 \text{ cm}$ and $AR = 8 \text{ cm}$, find $\angle QPR$.



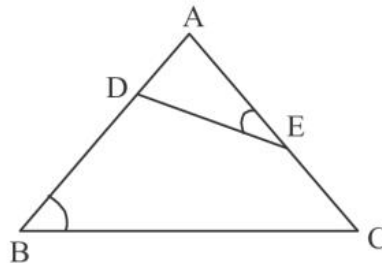
17. In the given fig., $DE \parallel AC$ and $DF \parallel AE$. Prove that

$$\frac{FE}{BF} = \frac{EC}{BE}$$

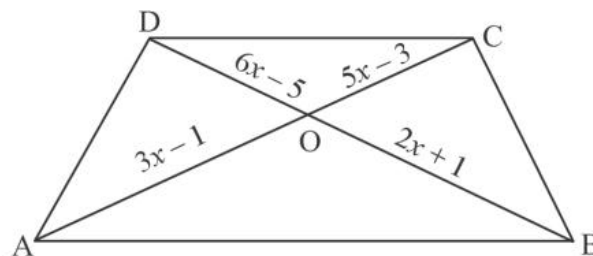


18. In $\triangle ABC$, $AD \perp BC$ Such that $AD^2 = BD \times CD$. Prove that $\triangle ABC$ is right angled at A.

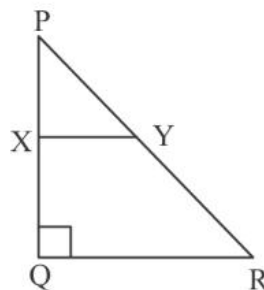
19. In the given fig, D and E are points on sides AB and CA of $\triangle ABC$ such that $\angle B = \angle AED$. Show that $\triangle ABC \sim \triangle AED$.



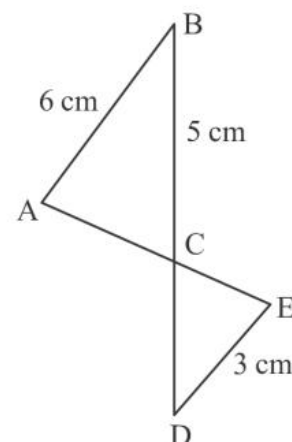
20. In the given fig., $AB \parallel DC$ and diagonals AC and BD intersect at O. If $OA = 3x - 1$ and $OB = 2x + 1$, $OC = 5x - 3$ and $OD = 6x - 5$, find x .



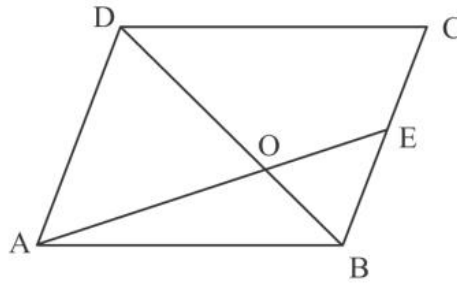
21. In the fig, PQR is a triangle, right angled at Q. If $XY \parallel QR$, $PQ = 6\text{cm}$, $PY = 4\text{cm}$ & $PX : XQ = 1 : 2$ Calculate the lengths of PR and QR.



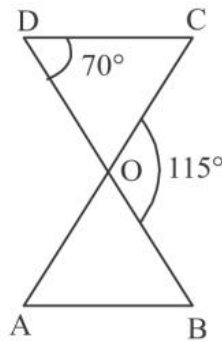
22. In the figure, $AB \parallel DE$. Find the length of CD.



23. In the figure, ABCD is a parallelogram. AE divides the line segment BD in the ratio 1 : 2. If BE = 1.5cm find BC.



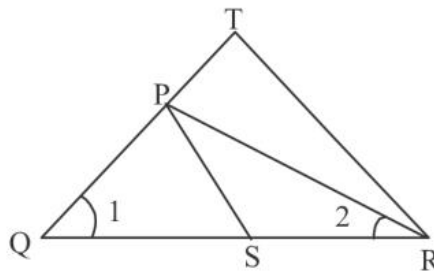
24. In the given figure, $\triangle ODC \sim \triangle OBA$, $\angle BOC = 115^\circ$ and $\angle CDO = 70^\circ$ find, (i) $\angle DOC$, (ii) $\angle DCO$, (iii) $\angle OAB$, (iv) $\angle OBA$.



25. Perimeter of two equilateral triangles ABC and PQR are 144m and 96m, find ar ($\triangle ABC$) : ar ($\triangle PQR$)

SHORT ANSWER TYPE (II) QUESTION

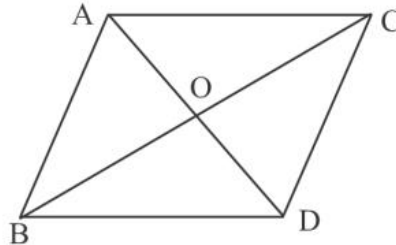
26. In the figure, $\frac{QR}{QS} = \frac{QT}{PR}$ and $\angle 1 = \angle 2$ them prove that $\triangle PQS \sim \triangle TQR$



27. In equilateral $\triangle ABC$, $AD \perp BC$. Prove that $3 BC^2 = 4AD^2$.
28. In $\triangle ABC$, $\angle ACB = 90^\circ$, also $CD \perp AB$, Prove that $\frac{BC^2}{AC^2} = \frac{BD}{AD}$.

29. In the adjoining figure $\triangle ABC$ & $\triangle DBC$ are on the same base BC. AD & BC intersect

at O. Prove that $\frac{\text{area}(\triangle ABC)}{\text{area}(\triangle DBC)} = \frac{AO}{DO}$

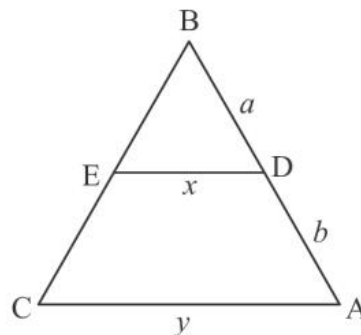


30. In $\triangle ABC$, If AD is the median, Show that $AB^2 + AC^2 = 2(AD^2 + BD^2)$
 31. In $\triangle ABC$, $\angle C$ is a right angle. Points P & Q lies on the sides CA & CB respectively Prove that $AQ^2 + BP^2 = AB^2 + PQ^2$
 32. If AD and PS are medians of $\triangle ABC$ and $\triangle PQR$ respectively where $\triangle ABC \sim \triangle PQR$, Prove that $\frac{AB}{PQ} = \frac{AD}{PS}$.

33. In an equilateral $\triangle ABC$, $AD \perp BC$, Prove that $3AB^2 = 4AD^2$

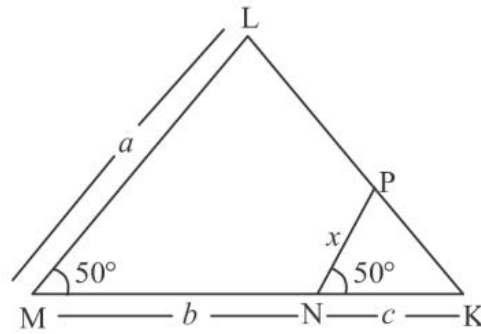
34. In the given fig, $DE \parallel AC$. which of the following is correct?

$$x = \frac{a+b}{ay} \quad \text{or} \quad x = \frac{ay}{a+b}$$



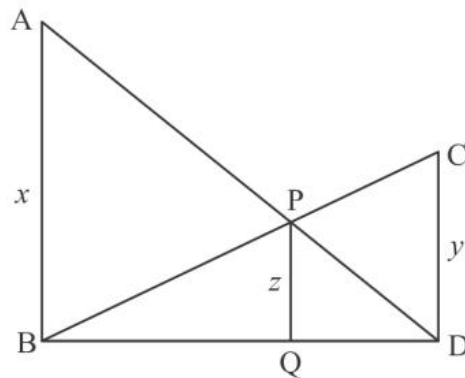
35. Prove that the sum of the square of the sides of a rhombus is equal to the sum of the squares of its diagonals;
 36. A street light bulb is fixed on a pole 6m above the level of the street. If a woman of height 1.5m casts a shadow of 3m, find how far she is away from the base of the pole.
 37. Two poles of height a metres and b metres are p metres 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 $\frac{ab}{a+b}$ metres.

38. In the given fig., find the value of x in terms of a , b and c

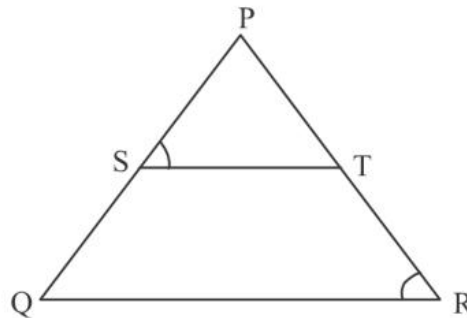


39. In fig., $AB \parallel PQ \parallel CD$, $AB = x$ units. $CD = y$ units and $PQ = z$ units. Prove that

$$\frac{1}{x} + \frac{1}{y} = \frac{1}{z}$$

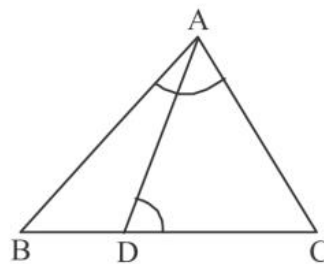


40. In the given fig., $\frac{PS}{SQ} = \frac{PT}{TR}$ and $\angle PST = \angle PRQ$. Prove that PQR is an isosceles Δ .

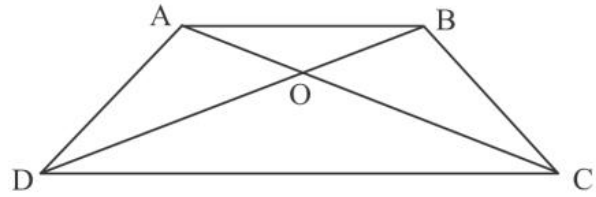


41. In the figure, D is a point on the side BC of ΔABC such that $\angle ADC = \angle BAC$

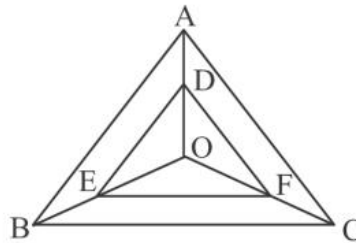
Prove that $\frac{CA}{CD} = \frac{CB}{CA}$



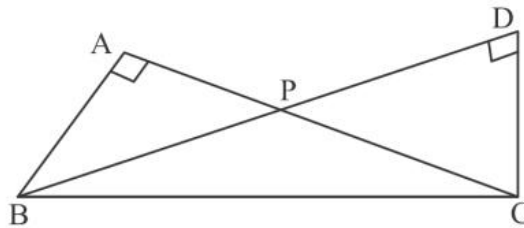
42. In the figure, ABCD is a trapezium in which $AB \parallel DC$, the diagonals AC & BD intersect at O. Prove that $\frac{AO}{OC} = \frac{BO}{DO}$



43. In the figure, a point O inside $\triangle ABC$ is joined to its vertices. From a point D on AO, DE is drawn parallel to AB & from E, EF is drawn parallel to BC. Prove that $DF \parallel AC$.



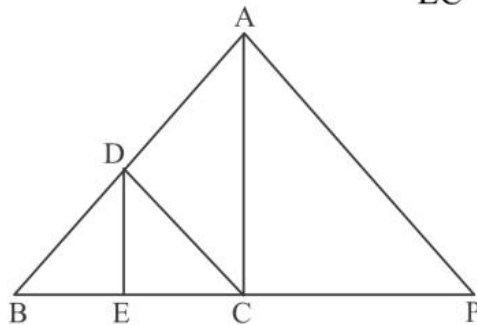
44. Two triangles BAC and BDC, right angled at A and D respectively, are drawn on the same base BC and on the same side of BC. If AC and DB intersect at P, Prove that $AP \times PC = DP \times PB$



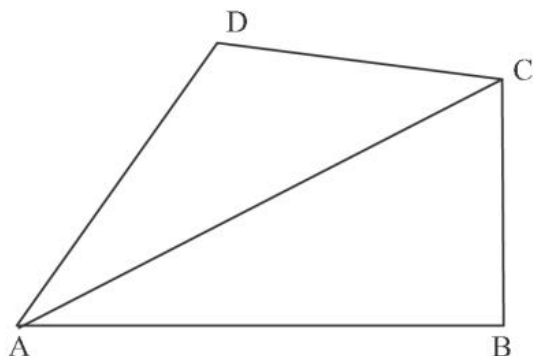
45. Hypotenuse of a right triangle is 25 cm and out of the remaining two sides, one is larger than the other by 5 cm, find the lengths of the other two sides.

LONG ANSWER TYPE QUESTIONS

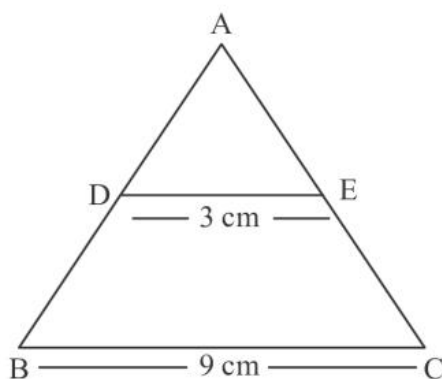
46. In the following figure, $DE \parallel AC$ and $\frac{BE}{EC} = \frac{BC}{CP}$. Prove that $DC \parallel AP$.



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

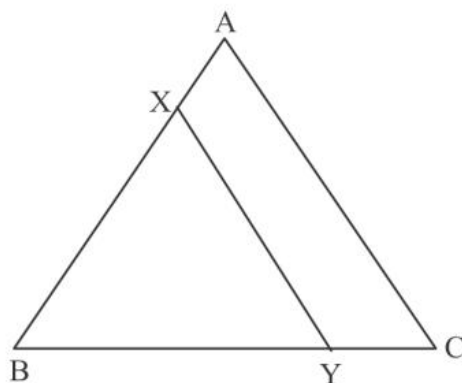


48. In figure, $DE \parallel BC$, $DE = 3\text{cm}$, $BC = 9\text{cm}$ and $\text{ar}(\triangle ADE) = 30\text{cm}^2$. Find $\text{ar}(\text{trap. BCED})$.



49. State and prove Pythagoras theorem.
50. In an equilateral $\triangle ABC$, D is a point on side BC such that $BD = \frac{1}{3} BC$. Prove that $9AD^2 = 7AB^2$.
51. In $\triangle PQR$, $PD \perp QR$ such that D lies on QR. If $PQ = a$, $PR = b$, $QD = c$ and $DR = d$ and a, b, c, d are positive units. Prove that $(a + b)(a - b) = (c + d)(c - d)$.
52. In a trapezium ABCD, $AB \parallel DC$ and $DC = 2AB$. If EF is drawn parallel to AB cuts AD in F and BC in E such that $\frac{BE}{BC} = \frac{3}{4}$. Diagonals DB intersects EF at G. Prove that $7 EF = 10AB$.
53. Prove that the ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding sides.

54. In the given figure, the line segment XY is Parallel to AC of $\triangle ABC$ and it divides the triangle into two parts of equal areas. Prove that $\frac{AX}{AB} = \frac{\sqrt{2}-1}{\sqrt{2}}$



55. Through the vertex D of a parallelogram ABCD, a line is drawn to intersect the sides BA and BC produced at E and F respectively. Prove that

$$\frac{DA}{AE} = \frac{FB}{BE} = \frac{FC}{CD}$$

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

ANSWERS

- | | |
|--|--|
| 1. No | 2. 16cm |
| 3. $x = \frac{ac}{b+c}$ | 4. 5cm |
| 5. $\angle D = \angle R$ true, $\angle F = \angle P$ false | 6. 5 : 7 |
| 7. 24cm | 8. 2900km |
| 9. 18cm | 10. $x = 3$ |
| 11. 1 : 3 | 12. $x = 2$ |
| 13. 13cm^2 | 14. 56° |
| 15. 2 : 3 | 16. 90° |
| 20. $x = 2$ | 21. $PR = 12\text{cm}$, $QR = 6\sqrt{3}\text{cm}$ |
| 22. 2.5 cm | 23. 3cm |
| 24. $65^\circ, 45^\circ, 45^\circ, 70^\circ$ | 25. 9 : 4 |
| 34. $x = \frac{ay}{a+b}$ | 36. 9m |
| 38. $x = \frac{ac}{b+c}$ | 45. 15cm, 20cm |
| 48. 240 cm^2 | |

Practice-Test

Triangles

Time : 50 Minutes

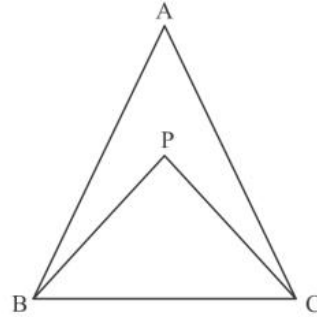
M.M. : 20

SECTION-A

- The lengths of the diagonals of rhombus are 16cm and 12cm. find the side of the rhombus. 1
- In an equilateral $\triangle ABC$, $AD \perp BC$ and $\frac{AD^2}{BC^2} = x$ find the value of x . 1

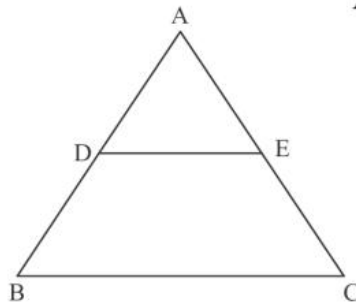
SECTION-B

- In $\triangle ABC$, if $DE \parallel BC$, $AD = x + 1$, $DB = x - 1$, $AE = x + 3$ and $EC = x$, then find the value of x . 2
- In the given figure, can triangle ABC be similar to $\triangle PBC$? If yes, give reasons. 2



SECTION-C

- PQR is a right angled triangle, having $\angle Q = 90^\circ$, If $QS = SR$, Show that $PR^2 = 4PS^2 - 3PQ^2$. 3
- In figure, $DE \parallel BC$ and $AD : DB = 5 : 4$, find $\frac{\text{Area}(\triangle DFE)}{\text{Area}(\triangle CFB)}$ 3



SECTION-D

- State and prove pythagoras theorem. 4
- In an equilateral $\triangle LMN$, the side MN is trisected at O. prove that $\frac{LO^2}{LM^2} = \frac{7}{9}$. 4

□□□