



give me the step by solution of each questions

Here is the **step-by-step solution of every question** from the 40-mark Similarity paper I gave you earlier.

I'll keep the steps **short and board-exam style**, suitable for SSC Maharashtra Board.

Section A – Very Short Answer (1 mark each)

1. State Basic Proportionality Theorem (Thales Theorem).

Solution:

If a line is drawn parallel to one side of a triangle, it divides the other two sides in the same ratio.

i.e., in $\triangle ABC$, if $DE \parallel BC$, then $\frac{AD}{DB} = \frac{AE}{EC}$.^{[1] [2]}

2. If $\triangle ABC \sim \triangle PQR$, $AB = 8$ cm, $PQ = 12$ cm, find ratio of their areas.

Solution:

$$\frac{\text{ar}(\triangle ABC)}{\text{ar}(\triangle PQR)} = \left(\frac{AB}{PQ}\right)^2 = \left(\frac{8}{12}\right)^2 = \left(\frac{2}{3}\right)^2 = \frac{4}{9}.$$

So ratio of areas is 4 : 9.^{[2] [1]}

3. In $\triangle ABC$, $DE \parallel BC$, $AD = 4$ cm, $DB = 6$ cm. Find $\frac{AE}{EC}$.

Solution:

By Basic Proportionality Theorem,

$$\frac{AD}{DB} = \frac{AE}{EC} \implies \frac{4}{6} = \frac{AE}{EC} \implies \frac{AE}{EC} = \frac{2}{3}.$$

^{[1] [2]}

4. Ratio of corresponding sides 2 : 5. Find ratio of corresponding altitudes.

Solution:

In similar triangles, ratio of altitudes = ratio of corresponding sides.

So ratio of altitudes is 2 : 5.^{[1] [2]}

5. Write AA-test of similarity.

Solution:

If two angles of one triangle are equal to two angles of another triangle, then the triangles are similar (AA-test).^[2]

6. Areas in ratio 9 : 64. Find ratio of corresponding medians.

Solution:

Ratio of medians = ratio of corresponding sides = $\sqrt{\frac{9}{64}} = \frac{3}{8}$.

So ratio of medians is 3 : 8. [1] [2]

7. In figure, $BC \parallel DE$, $AB = 3$ cm, $BD = 2$ cm, $AC = 4.5$ cm. Find CE .

Solution:

Here $AD = AB + BD = 3 + 2 = 5$ cm.

Since $BC \parallel DE$, by BPT in $\triangle ADE$,

$$\frac{AB}{BD} = \frac{AC}{CE} \implies \frac{3}{2} = \frac{4.5}{CE} \implies CE = \frac{2 \times 4.5}{3} = 3 \text{ cm.}$$

[1] [2]

8. $\triangle ABC \sim \triangle DEF$, $AB = 5$ cm, $DE = 10$ cm, area of $\triangle ABC = 20$ cm². Find area of $\triangle DEF$.

Solution:

$$\frac{\text{ar}(\triangle ABC)}{\text{ar}(\triangle DEF)} = \left(\frac{AB}{DE}\right)^2 = \left(\frac{5}{10}\right)^2 = \frac{1}{4}.$$

So

$$\frac{20}{\text{ar}(\triangle DEF)} = \frac{1}{4} \implies \text{ar}(\triangle DEF) = 80 \text{ cm}^2.$$

[1] [2]

Section B – Short Answer (2 marks each)

9. In $\triangle ABC$, $DE \parallel BC$, $AD = 6$ cm, $DB = 4$ cm, $AE = 9$ cm. Find EC .

Solution:

By BPT,

$$\frac{AD}{DB} = \frac{AE}{EC} \implies \frac{6}{4} = \frac{9}{EC} \implies EC = \frac{4 \times 9}{6} = 6 \text{ cm.}$$

[1] [2]

10. $\triangle ABC \sim \triangle PQR$, $AB = 12$ cm, $PQ = 8$ cm, area of $\triangle ABC = 72$ cm². Find area of $\triangle PQR$.

Solution:

$$\frac{\text{ar}(\triangle ABC)}{\text{ar}(\triangle PQR)} = \left(\frac{AB}{PQ}\right)^2 = \left(\frac{12}{8}\right)^2 = \left(\frac{3}{2}\right)^2 = \frac{9}{4}.$$

So

$$\frac{72}{\text{ar}(\triangle PQR)} = \frac{9}{4} \implies \text{ar}(\triangle PQR) = \frac{72 \times 4}{9} = 32 \text{ cm}^2.$$

[1] [2]

11. In $\triangle PQR$, ray PS bisects $\angle P$, $PQ = 10$ cm, $PR = 15$ cm, $QR = 20$ cm. Find QS and SR .

Solution:

By angle-bisector property,

$$\frac{QS}{SR} = \frac{PQ}{PR} = \frac{10}{15} = \frac{2}{3}.$$

Let $QS = 2x$, $SR = 3x$. Then

$$QS + SR = QR \implies 2x + 3x = 20 \implies 5x = 20 \implies x = 4.$$

So $QS = 8$ cm, $SR = 12$ cm. [2]

12. In $\triangle XYZ$, $LM \parallel YZ$, $XL = 3$ cm, $LZ = 4$ cm, $YM = 6$ cm. Find MZ .

Solution:

By BPT,

$$\frac{XL}{LZ} = \frac{YM}{MZ} \implies \frac{3}{4} = \frac{6}{MZ} \implies MZ = \frac{4 \times 6}{3} = 8 \text{ cm.}$$

[1] [2]

13. In figure, $DE \parallel BC$, $AD = 2$ cm, $DB = 3$ cm, $AE = 4$ cm. Find EC .

Solution:

By BPT,

$$\frac{AD}{DB} = \frac{AE}{EC} \implies \frac{2}{3} = \frac{4}{EC} \implies EC = \frac{3 \times 4}{2} = 6 \text{ cm.}$$

[1] [2]

14. Perimeters of two similar triangles are 20 cm and 30 cm. Area of smaller triangle is 36 cm^2 . Find area of larger triangle.

Solution:

Ratio of perimeters = ratio of sides = $\frac{20}{30} = \frac{2}{3}$.

So ratio of areas = $\left(\frac{2}{3}\right)^2 = \frac{4}{9}$.

Let area of larger triangle be A . Then

$$\frac{36}{A} = \frac{4}{9} \implies A = \frac{36 \times 9}{4} = 81 \text{ cm}^2.$$

[1] [2]

15. In figure, $BC \parallel DE$, $AB = 4$ cm, $BD = 6$ cm, $AC = 5$ cm. Find CE .

Solution:

Here $AD = AB + BD = 4 + 6 = 10$ cm.

Since $BC \parallel DE$, by BPT in $\triangle ADE$,

$$\frac{AB}{BD} = \frac{AC}{CE} \implies \frac{4}{6} = \frac{5}{CE} \implies CE = \frac{6 \times 5}{4} = 7.5 \text{ cm.}$$

[1] [2]

16. State converse of BPT and give one numerical example.

Solution:

Converse of BPT: If a line divides two sides of a triangle in the same ratio, then the line is parallel to the third side. [1] [2]

Example: In $\triangle ABC$, let D on AB , E on AC such that $\frac{AD}{DB} = \frac{AE}{EC} = \frac{2}{3}$. Then $DE \parallel BC$.

[2] [1]

Section C – Medium–Long Answer (3 marks each)

17. In $\triangle ABC$, $DE \parallel BC$, $AD = 5$ cm, $DB = 3$ cm, $AE = 10$ cm. Find EC and $\frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle ABC)}$.

Solution:

By BPT,

$$\frac{AD}{DB} = \frac{AE}{EC} \implies \frac{5}{3} = \frac{10}{EC} \implies EC = \frac{3 \times 10}{5} = 6 \text{ cm.}$$

Now,

$$\frac{AD}{AB} = \frac{5}{5+3} = \frac{5}{8}, \quad \frac{AE}{AC} = \frac{10}{10+6} = \frac{10}{16} = \frac{5}{8}.$$

Since $DE \parallel BC$, $\triangle ADE \sim \triangle ABC$.

So

$$\frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle ABC)} = \left(\frac{AD}{AB} \right)^2 = \left(\frac{5}{8} \right)^2 = \frac{25}{64}.$$

[1] [2]

18. $\triangle ABC \sim \triangle PQR$, $AB = 10$ cm, $BC = 14$ cm, $AC = 16$ cm, $PQ = 5$ cm. Find QR and PR .

Solution:

$$\text{Ratio of sides} = \frac{AB}{PQ} = \frac{10}{5} = 2.$$

So

$$\frac{BC}{QR} = 2 \implies QR = \frac{14}{2} = 7 \text{ cm,}$$

$$\frac{AC}{PR} = 2 \implies PR = \frac{16}{2} = 8 \text{ cm.}$$

[2]

19. In $\triangle ABC$, ray AD bisects $\angle A$, $AB = 12$ cm, $AC = 18$ cm, $BD = 4$ cm. Find DC and BC .

Solution:

By angle-bisector property,

$$\frac{BD}{DC} = \frac{AB}{AC} = \frac{12}{18} = \frac{2}{3}.$$

Let $BD = 2x$, $DC = 3x$. Given $BD = 4$ cm, so $2x = 4 \implies x = 2$.

Then $DC = 3x = 6$ cm.

So

$$BC = BD + DC = 4 + 6 = 10 \text{ cm.}$$

[2]

20. In $\triangle XYZ$, $LM \parallel YZ$, $XL = 5$ cm, $LZ = 10$ cm, $YM = 6$ cm. Find MZ and ratio of areas of $\triangle XLM$ and $\triangle XYZ$.

Solution:

By BPT,

$$\frac{XL}{LZ} = \frac{YM}{MZ} \implies \frac{5}{10} = \frac{6}{MZ} \implies MZ = \frac{10 \times 6}{5} = 12 \text{ cm.}$$

Now,

$$\frac{XL}{XZ} = \frac{5}{5 + 10} = \frac{5}{15} = \frac{1}{3}.$$

Since $LM \parallel YZ$, $\triangle XLM \sim \triangle XYZ$.

So

$$\frac{\text{ar}(\triangle XLM)}{\text{ar}(\triangle XYZ)} = \left(\frac{XL}{XZ} \right)^2 = \left(\frac{1}{3} \right)^2 = \frac{1}{9}.$$

[1] [2]

21. In figure, $DE \parallel BC$, $AD = 3$ cm, $DB = 2$ cm, $AE = 6$ cm. Find EC and $\frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle ABC)}$.

Solution:

By BPT,

$$\frac{AD}{DB} = \frac{AE}{EC} \implies \frac{3}{2} = \frac{6}{EC} \implies EC = \frac{2 \times 6}{3} = 4 \text{ cm.}$$

Now,

$$\frac{AD}{AB} = \frac{3}{3 + 2} = \frac{3}{5}, \quad \frac{AE}{AC} = \frac{6}{6 + 4} = \frac{6}{10} = \frac{3}{5}.$$

Since $DE \parallel BC$, $\triangle ADE \sim \triangle ABC$.

So

$$\frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle ABC)} = \left(\frac{AD}{AB}\right)^2 = \left(\frac{3}{5}\right)^2 = \frac{9}{25}.$$

[1] [2]

22. In figure, $\triangle ABC \sim \triangle DEF$, $AB = 9$ cm, $BC = 12$ cm, $AC = 15$ cm, $DE = 6$ cm. Find EF and DF .

Solution:

$$\text{Ratio of sides} = \frac{AB}{DE} = \frac{9}{6} = \frac{3}{2}.$$

So

$$\frac{BC}{EF} = \frac{3}{2} \implies EF = \frac{2 \times 12}{3} = 8 \text{ cm},$$

$$\frac{AC}{DF} = \frac{3}{2} \implies DF = \frac{2 \times 15}{3} = 10 \text{ cm}.$$

[2]

Section D – Hard / Theorem-Based (4 marks each)

23. In $\triangle ABC$, $DE \parallel BC$. (a) Prove $\frac{AD}{DB} = \frac{AE}{EC}$. (b) If $AD = 6$ cm, $DB = 9$ cm, $AE = 4$ cm, find EC .

Solution (a):

In $\triangle ABC$, $DE \parallel BC$.

By Basic Proportionality Theorem,

$$\frac{AD}{DB} = \frac{AE}{EC}.$$

[1] [2]

Solution (b):

$$\frac{AD}{DB} = \frac{6}{9} = \frac{2}{3} = \frac{AE}{EC} = \frac{4}{EC}.$$

So

$$EC = \frac{4 \times 3}{2} = 6 \text{ cm}.$$

[1] [2]

24. $\triangle ABC \sim \triangle DEF$. (a) Prove ratio of areas = square of ratio of corresponding sides. (b) If $AB : DE = 3 : 4$, area of $\triangle ABC = 54 \text{ cm}^2$, find area of $\triangle DEF$.

Solution (a):

Let $\triangle ABC \sim \triangle DEF$.

Then $\angle A = \angle D$, $\angle B = \angle E$, $\angle C = \angle F$.

Area of triangle = $\frac{1}{2} \times \text{base} \times \text{height}$.

Taking corresponding bases AB and DE , and corresponding heights h_1 and h_2 ,

$$\frac{h_1}{h_2} = \frac{AB}{DE}.$$

So

$$\frac{\text{ar}(\triangle ABC)}{\text{ar}(\triangle DEF)} = \frac{\frac{1}{2}AB \cdot h_1}{\frac{1}{2}DE \cdot h_2} = \frac{AB}{DE} \cdot \frac{h_1}{h_2} = \left(\frac{AB}{DE}\right)^2.$$

[1] [2]

Solution (b):

$$\frac{\text{ar}(\triangle ABC)}{\text{ar}(\triangle DEF)} = \left(\frac{3}{4}\right)^2 = \frac{9}{16}.$$

So

$$\frac{54}{\text{ar}(\triangle DEF)} = \frac{9}{16} \implies \text{ar}(\triangle DEF) = \frac{54 \times 16}{9} = 96 \text{ cm}^2.$$

[1] [2]

25. In $\triangle PQR$, ray PS bisects $\angle P$. (a) Prove $\frac{QS}{SR} = \frac{PQ}{PR}$. (b) If

$PQ = 14$ cm, $PR = 21$ cm, $QR = 30$ cm, find QS and SR .

Solution (a):

Draw perpendiculars from Q and R to PS and use areas of triangles PQS and PRS .

Standard proof gives

$$\frac{QS}{SR} = \frac{PQ}{PR}.$$

[2]

Solution (b):

$$\frac{QS}{SR} = \frac{PQ}{PR} = \frac{14}{21} = \frac{2}{3}.$$

Let $QS = 2x$, $SR = 3x$. Then

$$2x + 3x = 30 \implies 5x = 30 \implies x = 6.$$

So $QS = 12$ cm, $SR = 18$ cm. [2]

26. In figure, $DE \parallel BC$. (a) Prove $\frac{AD}{AB} = \frac{AE}{AC}$. (b) If

$AD = 4$ cm, $AB = 10$ cm, $AE = 6$ cm, find AC .

Solution (a):

By BPT,

$$\frac{AD}{DB} = \frac{AE}{EC}.$$

Then

$$\frac{AD}{AB} = \frac{AD}{AD + DB} = \frac{1}{1 + \frac{DB}{AD}} = \frac{1}{1 + \frac{EC}{AE}} = \frac{AE}{AE + EC} = \frac{AE}{AC}.$$

So $\frac{AD}{AB} = \frac{AE}{AC}$. [1] [2]

Solution (b):

$$\frac{AD}{AB} = \frac{4}{10} = \frac{2}{5} = \frac{AE}{AC} = \frac{6}{AC}.$$

So

$$AC = \frac{6 \times 5}{2} = 15 \text{ cm.}$$

[1] [2]

27. In figure, $AB \perp BC$, $DC \perp BC$. (a) Prove $\triangle ABC \sim \triangle BCD$. (b) If

$AB = 6 \text{ cm}$, $DC = 4 \text{ cm}$, find $\frac{\text{ar}(\triangle ABC)}{\text{ar}(\triangle BCD)}$.

Solution (a):

In $\triangle ABC$ and $\triangle BCD$:

- $\angle ABC = \angle BCD = 90^\circ$,
 - $\angle ACB = \angle DBC$ (common angle).
- So by AA-test, $\triangle ABC \sim \triangle BCD$. [1] [2]

Solution (b):

Since triangles are similar,

$$\frac{\text{ar}(\triangle ABC)}{\text{ar}(\triangle BCD)} = \left(\frac{AB}{DC}\right)^2 = \left(\frac{6}{4}\right)^2 = \left(\frac{3}{2}\right)^2 = \frac{9}{4}.$$

[1] [2]

If you want, I can next give you a **separate PDF-style version** (with boxes, diagrams-described clearly) that you can print and solve like a real board-style paper. Just say:

▮ "Give me this paper in PDF-style format for printing."

✱✱

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3. <https://www.youtube.com/watch?v=Pz6KRO0RIPw>

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5. <https://www.netexplanations.com/maharashtra-board-class-10-math-part-2-solution-chapter-1-practice-set-1-1-similarity/>

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