

CLASS 10 — MATHEMATICS

Chapter: Triangles

Answer Key with Step-by-Step Solutions

Maximum Marks: 40

Time Allowed: 1 hour 30 minutes

Results used: Basic Proportionality Theorem (BPT) and its converse; similarity criteria AAA (AA), SSS and SAS; in similar triangles, corresponding angles are equal and corresponding sides are in the same ratio.

SECTION A — MCQ Answer Key

Q	Option	Answer	Explanation / calculation
Q1	(B)	All equilateral triangles are similar.	All angles of every equilateral triangle are 60° , so any two are similar (AAA). Isosceles or right triangles can have different angles; rectangles can have sides in different ratios.
Q2	(A)	6 cm	By BPT, $\frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{2}{3} = \frac{4}{EC} \Rightarrow EC = 6$ cm.
Q3	(B)	12 cm	$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{2}{3} \Rightarrow QR = \frac{3}{2} \times 8 = 12$ cm.
Q4	(C)	60°	$\angle B = \angle E = 70^\circ$ and $\angle A = 50^\circ$, so $\angle C = 180^\circ - 50^\circ - 70^\circ = 60^\circ$.
Q5	(A)	parallel to BC	$\frac{AD}{DB} = \frac{3}{6} = \frac{1}{2}$ and $\frac{AE}{EC} = \frac{4}{8} = \frac{1}{2}$. Equal ratios $\Rightarrow DE \parallel BC$ (converse of BPT, Theorem 6.2).
Q6	(C)	42 m	Sun's rays make equal angles, so the triangles are similar: $\frac{h}{28} = \frac{6}{4} \Rightarrow h = 42$ m.
Q7	(D)	6 cm	$\triangle ADE \sim \triangle ABC$ (AA). $\frac{DE}{BC} = \frac{AD}{AB} = \frac{3}{5} \Rightarrow DE = 6$ cm.
Q8	(C)	6 cm	In $\triangle ADC$ and $\triangle BAC$: $\angle C$ is common and $\angle ADC = \angle BAC$, so $\triangle ADC \sim \triangle BAC$ (AA). Then $\frac{CA}{CB} = \frac{CD}{CA} \Rightarrow CA^2 = CB \times CD = 36 \Rightarrow CA = 6$ cm.
Q9	(A)	Both true; R explains A	Two equal pairs of angles force the third pair to be equal (angle sum 180°), which gives AAA similarity. This is exactly the AA criterion and R is its explanation.
Q10	(D)	A false, R true	A square and a non-square rectangle have all angles 90° but their sides are not in the same ratio, so they are not similar. A is false; R is the correct condition for similarity of polygons.

Marking: 1 mark for each correct option; no part marks in Section A.

SECTION B – Very Short Answer

Q11. Find x using BPT [2 marks]

Since $DE \parallel BC$, by BPT: $\frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{x+1}{3x-1} = \frac{x+3}{3x+4}$.

Cross-multiplying: $(x+1)(3x+4) = (x+3)(3x-1) \Rightarrow 3x^2 + 7x + 4 = 3x^2 + 8x - 3 \Rightarrow x = 7$.

Check: $AD = 8$, $DB = 20$, $AE = 10$, $EC = 25$; $8/20 = 10/25 = 2/5 \checkmark$

Answer: $x = 7$

Marking scheme:

Applying BPT correctly: 1 mark

$x = 7$: 1 mark

Q12. Is $DE \parallel BC$? [2 marks]

$$\frac{AD}{DB} = \frac{5.7}{9.5} = \frac{57}{95} = \frac{3}{5}, \quad \frac{AE}{EC} = \frac{4.8}{8} = \frac{3}{5}.$$

Since $\frac{AD}{DB} = \frac{AE}{EC}$, by the converse of BPT (Theorem 6.2), $DE \parallel BC$.

Answer: Yes, $DE \parallel BC$

Marking scheme:

Both ratios computed: 1 mark

Conclusion with the converse of BPT: 1 mark

Q13. AB from perimeters [2 marks]

Since $\triangle ABC \sim \triangle PQR$, $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP} = k$ (say). Then $AB + BC + CA = k(PQ + QR + RP)$.

So $k = \frac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle PQR} = \frac{36}{24} = \frac{3}{2}$. $AB = \frac{3}{2} \times 10 = 15$ cm.

Answer: AB = 15 cm

Marking scheme:

Showing the ratio of perimeters equals the ratio of sides: 1 mark

$AB = 15$ cm: 1 mark

Q14. AC in the trapezium [2 marks]

In $\triangle AOB$ and $\triangle COD$: $\angle OAB = \angle OCD$ and $\angle OBA = \angle ODC$ (alternate angles, $AB \parallel DC$). So $\triangle AOB \sim \triangle COD$ (AA).

$$\frac{OA}{OC} = \frac{AB}{CD} = 2 \Rightarrow OA = 2 \times 3 = 6 \text{ cm. } AC = OA + OC = 6 + 3 = 9 \text{ cm.}$$

Answer: AC = 9 cm

Marking scheme:

Similarity with reason: 1 mark

$AC = 9$ cm: 1 mark

Q15. SSS check [2 marks]

$$\frac{AB}{PQ} = \frac{4}{6} = \frac{2}{3}, \quad \frac{BC}{QR} = \frac{6}{9} = \frac{2}{3}, \quad \frac{CA}{RP} = \frac{8}{12} = \frac{2}{3}.$$

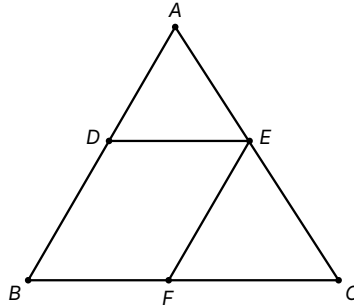
All three ratios are equal, so by the SSS similarity criterion, $\triangle ABC \sim \triangle PQR$.

Answer: Yes; SSS; $\triangle ABC \sim \triangle PQR$

Marking scheme:

All three ratios: 1 mark

Criterion and correct statement: 1 mark

SECTION C – Short Answer**Q16. Prove $AD/DB = BF/FC$ [3 marks]**

In $\triangle ABC$, $DE \parallel BC$, so by BPT: $\frac{AD}{DB} = \frac{AE}{EC}$... (1)

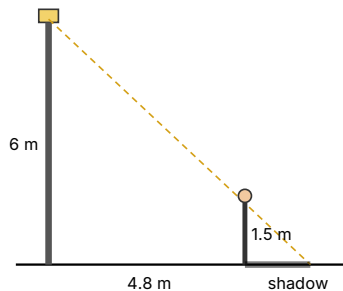
In $\triangle ABC$, $EF \parallel AB$ (E on AC, F on BC), so by BPT: $\frac{CE}{EA} = \frac{CF}{FB}$, i.e. $\frac{AE}{EC} = \frac{BF}{FC}$... (2)

From (1) and (2): $\frac{AD}{DB} = \frac{BF}{FC}$. Hence proved.

Answer: $\frac{AD}{DB} = \frac{BF}{FC}$ (proved)

Marking scheme:BPT for $DE \parallel BC$: 1 markBPT for $EF \parallel AB$ (with reciprocal form): 1 mark

Combining to conclude: 1 mark

Q17. Length of the shadow [3 marks]

Distance walked in 4 s = $1.2 \times 4 = 4.8$ m. Let the shadow length be s m.

The pole and the boy are both vertical, so the triangle formed by the boy and his shadow is similar to the triangle formed by the pole and the distance $(4.8 + s)$ to the shadow's tip (AA: right angle and common angle at the tip).

$$\frac{1.5}{6} = \frac{s}{4.8 + s} \Rightarrow 6s = 1.5s + 7.2 \Rightarrow 4.5s = 7.2 \Rightarrow s = 1.6 \text{ m.}$$

Answer: 1.6 m

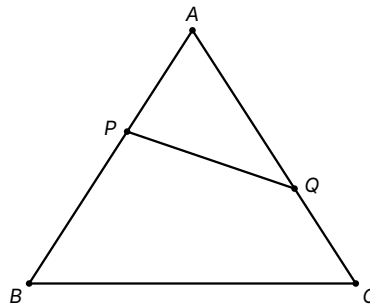
Marking scheme:

Distance 4.8 m: 1 mark

Correct similarity and proportion: 1 mark

Shadow 1.6 m: 1 mark

Q18. SAS similarity with cross correspondence [3 marks]



$$\frac{AP}{AC} = \frac{4}{8} = \frac{1}{2} \text{ and } \frac{AQ}{AB} = \frac{5}{10} = \frac{1}{2}, \text{ so } \frac{AP}{AC} = \frac{AQ}{AB}.$$

$\angle PAQ = \angle CAB$ (common angle A). So by the SAS criterion, $\triangle APQ \sim \triangle ACB$ ($P \leftrightarrow C$, $Q \leftrightarrow B$).

$$\text{Hence } \frac{PQ}{CB} = \frac{AP}{AC} = \frac{1}{2} \Rightarrow PQ = \frac{1}{2} \times 12 = 6 \text{ cm.}$$

Note: $\frac{AP}{AB} = 0.4$ and $\frac{AQ}{AC} = 0.625$ are not equal, so PQ is not parallel to BC.

Answer: $\triangle APQ \sim \triangle ACB$ (SAS); $PQ = 6$ cm

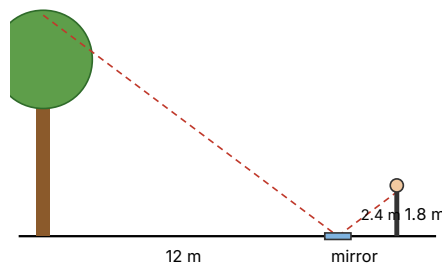
Marking scheme:

Correct ratio pairing $AP/AC = AQ/AB$: 1 mark

SAS with common angle and correct correspondence: 1 mark

$PQ = 6$ cm: 1 mark

Q19. Height of the tree using a mirror [3 marks]



Let the foot of the tree be F, its top be T, the mirror be M, the girl's feet be G and her eyes be E.

$\angle TFM = \angle EGM = 90^\circ$, and $\angle TMF = \angle EMG$ (angle of incidence = angle of reflection, so the rays make equal angles with the ground).

So $\triangle TFM \sim \triangle EGM$ (AA). Therefore $\frac{TF}{EG} = \frac{FM}{GM} = \frac{h}{1.8} = \frac{12}{2.4} = 5 \Rightarrow h = 9$ m.

Answer: 9 m

Marking scheme:

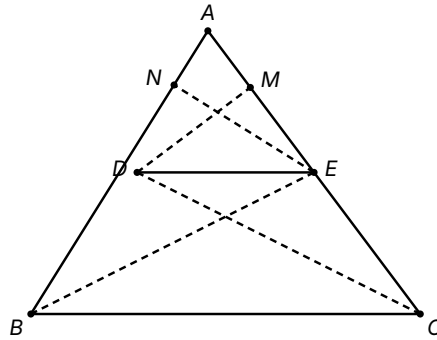
Identifying the two right triangles and equal angles: 1 mark

Correct proportion: 1 mark

Height 9 m: 1 mark

SECTION D – Long Answer

Q20. Basic Proportionality Theorem [4 marks]



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

Given: $\triangle ABC$ with $DE \parallel BC$, D on AB and E on AC . **To prove:** $\frac{AD}{DB} = \frac{AE}{EC}$.

Construction: Join BE and CD . Draw $DM \perp AC$ and $EN \perp AB$.

Proof: $\text{ar}(\triangle ADE) = \frac{1}{2} \times AD \times EN$ and $\text{ar}(\triangle BDE) = \frac{1}{2} \times DB \times EN$, so $\frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle BDE)} = \frac{AD}{DB}$... (1)

Similarly, $\text{ar}(\triangle ADE) = \frac{1}{2} \times AE \times DM$ and $\text{ar}(\triangle DEC) = \frac{1}{2} \times EC \times DM$, so $\frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle DEC)} = \frac{AE}{EC}$... (2)

$\triangle BDE$ and $\triangle DEC$ are on the same base DE and between the same parallels DE and BC , so $\text{ar}(\triangle BDE) = \text{ar}(\triangle DEC)$... (3)

From (1), (2) and (3): $\frac{AD}{DB} = \frac{AE}{EC}$. Hence proved.

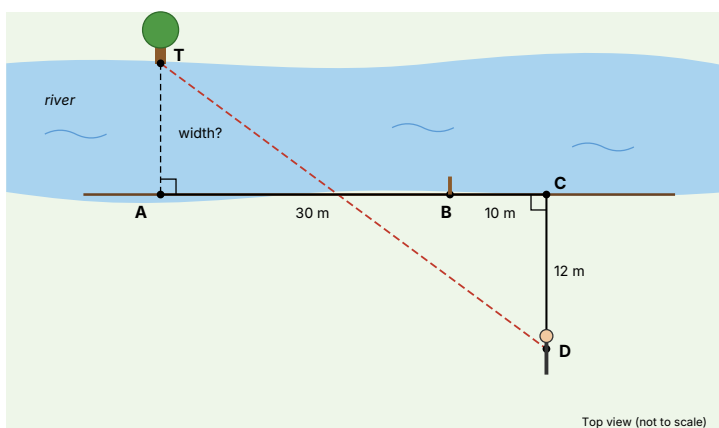
(b) By BPT, $\frac{AE}{EC} = \frac{AD}{DB} = \frac{3}{4}$. So $AE = \frac{3}{7} \times AC = \frac{3}{7} \times 14 = 6$ cm.

Answer: (a) Proof as above; (b) AE = 6 cm

Marking scheme:

- (a) Statement, given, to prove and construction: 1 mark
- (a) Area ratios (1) and (2): 1 mark
- (a) Equal areas (3) and conclusion: 1 mark
- (b) AE = 6 cm: 1 mark

SECTION E – Case Study



Q21. Width of the river [4 marks]

(i) In $\triangle TAB$ and $\triangle DCB$: $\angle TAB = \angle DCB = 90^\circ$, and $\angle TBA = \angle DBC$ (vertically opposite angles, since T, B, D are in a line). So $\triangle TAB \sim \triangle DCB$ by the **AA (AAA) criterion**.

(ii) $\frac{TA}{DC} = \frac{AB}{CB} (= \frac{TB}{DB})$.

(iii) $TA = DC \times \frac{AB}{CB} = 12 \times \frac{30}{10} = \mathbf{36 \text{ m}}$. If $CD = 15 \text{ m}$: $TA = 15 \times 3 = \mathbf{45 \text{ m}}$.

Answer: (i) AA (ii) $TA/DC = AB/CB$ (iii) 36 m; 45 m

Marking scheme:

(i) AA with both reasons: 1 mark

(ii) Correct proportion: 1 mark

(iii) Width 36 m: 1 mark; 45 m: 1 mark

Final Answer Summary

Q	Final answer	Q	Final answer
Q1	(B)	Q12	Yes, $DE \parallel BC$ (ratios $3/5$)
Q2	(A) 6 cm	Q13	$AB = 15$ cm
Q3	(B) 12 cm	Q14	$AC = 9$ cm
Q4	(C) 60°	Q15	Yes; SSS; $\triangle ABC \sim \triangle PQR$
Q5	(A) parallel to BC	Q16	Proof
Q6	(C) 42 m	Q17	1.6 m
Q7	(D) 6 cm	Q18	$\triangle APQ \sim \triangle ACB$; $PQ = 6$ cm
Q8	(C) 6 cm	Q19	9 m
Q9	(A)	Q20	(a) Proof (b) $AE = 6$ cm
Q10	(D)	Q21	(i) AA (iii) 36 m; 45 m
Q11	$x = 7$		

Marks: Section A 10 + Section B 10 + Section C 12 + Section D 4 + Section E 4 = **40**

— End of Solutions —