CLASS 10 · MATHEMATICS · CHAPTER 6

Triangles - Exercise 6.3

Exercise 6.3 with independently verified solutions.

CHAPTER	RESOURCE	SOURCE
Triangles	NCERT Exercises	NCERT Mathematics, Reprint 2026-27

PART 1

Verified NCERT questions and solutions

Verified NCERT questions and solutions

Solutions are checked independently and follow the supplied NCERT chapter edition.

QUESTION

Question 1

AAA similarity · SSS similarity · SAS similarity · classification

State which pairs of triangles in Figure 6.34 are similar. Give the similarity criterion and write each similar pair in symbolic form.

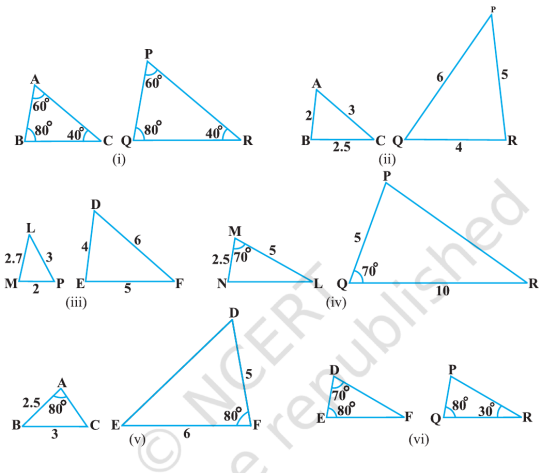


Fig. 6.34

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Figure 6-34 from the supplied NCERT chapter.

Solution

GIVEN:

Figure 6.34 supplies six pairs of triangles with marked sides or angles.

TO ANSWER:

For each pair, state whether it is similar and cite AAA, SSS or SAS when applicable.

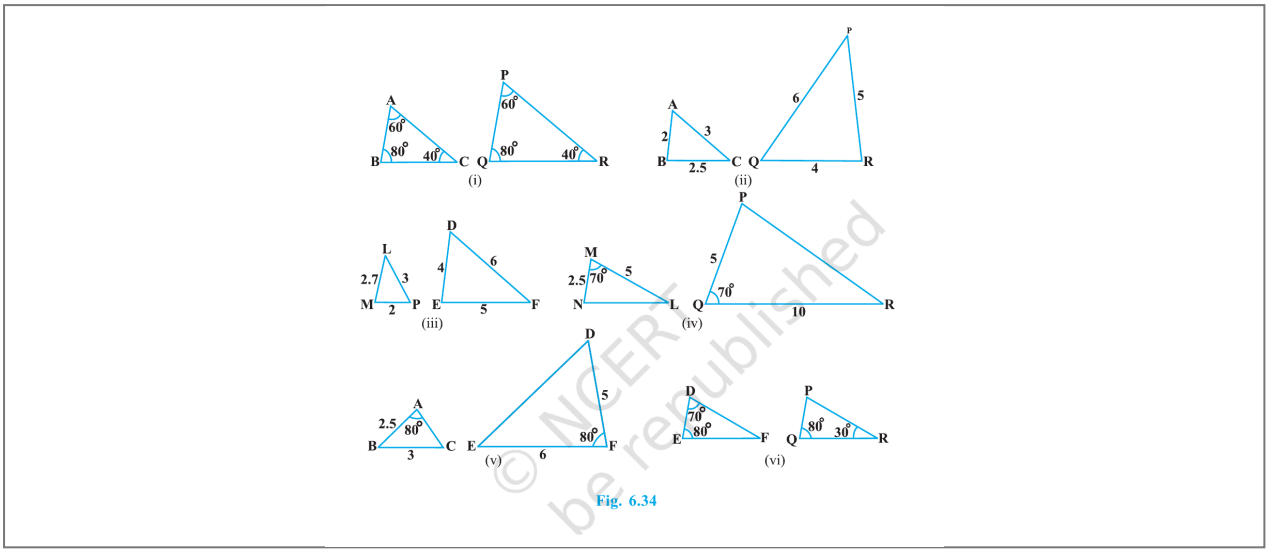


Fig. 6.34

Figure 6-34 from the supplied NCERT chapter.

SOLUTION:

(i)

$$\angle A = \angle P = 60^\circ$$

$$\angle B = \angle Q = 80^\circ$$

$$\angle C = \angle R = 40^\circ$$

Therefore, △ABC ~ △PQR by AAA similarity.

(ii)

$$\frac{AB}{QR} = \frac{2}{4} = \frac{1}{2}$$

$$\frac{BC}{RP} = \frac{2.5}{5} = \frac{1}{2}$$

$$\frac{AC}{PQ} = \frac{3}{6} = \frac{1}{2}$$

All three corresponding side ratios are equal. Therefore, △ABC ~ △QRP by SSS similarity.

(iii)

$$\frac{MP}{DE} = \frac{2}{4} = \frac{1}{2}$$

$$\frac{LP}{DF} = \frac{3}{6} = \frac{1}{2}$$

$$\frac{ML}{EF} = \frac{2.7}{5} \neq \frac{1}{2}$$

All three corresponding side ratios are not equal. Therefore, the triangles are not similar.

(iv)

$$\frac{MN}{QP} = \frac{2.5}{5} = \frac{1}{2}$$

$$\frac{ML}{QR} = \frac{5}{10} = \frac{1}{2}$$

$$\angle M = \angle Q = 70^\circ$$

The included angles are equal and the surrounding sides are proportional. Therefore, △MNL ~ △QPR by SAS similarity.

(v)

$$\frac{AB}{DF} = \frac{2.5}{5} = \frac{1}{2}$$

$$\frac{BC}{FE} = \frac{3}{6} = \frac{1}{2}$$

$$\angle B = \angle F = 80^\circ$$

The included angles are equal and the surrounding sides are proportional. Therefore, △ABC ~ △DFE by SAS similarity.

(vi)

$$\angle D = \angle P = 70^\circ$$

$$\angle E = \angle Q = 80^\circ$$

$$\angle F = \angle R = 30^\circ$$

Therefore, △DEF ~ △PQR by AAA similarity.

Final answer

Similar pairs: (i), (ii), (iv), (v) and (vi). Pair (iii) is not similar.

QUESTION

Question 2

similar triangles · angles · parallel lines

In Figure 6.35, △ODC ~ △OBA, ∠BOC = 125° and ∠CDO = 70°. Find ∠DOC, ∠DCO and ∠OAB.

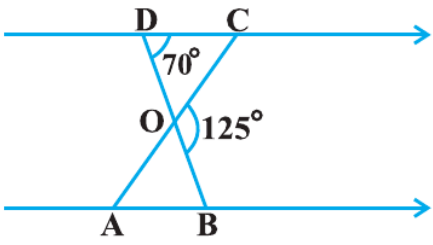


Fig. 6.35

Figure 6-35 from the supplied NCERT chapter.

Solution

GIVEN:

Triangle ODC is similar to triangle OBA; angle BOC is 125° and angle CDO is 70°.

TO FIND:

Angles DOC, DCO and OAB.

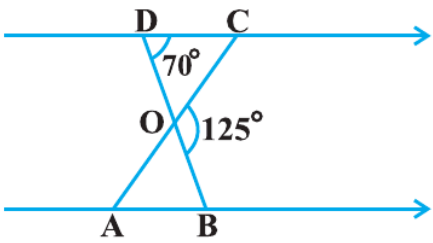


Fig. 6.35

Figure 6-35 from the supplied NCERT chapter.

SOLUTION:

∠DOC and ∠BOC form a linear pair.

$$\angle DOC = 180^\circ - 125^\circ = 55^\circ$$

In △ODC, by the angle-sum property:

$$\angle DCO = 180^\circ - \angle DOC - \angle CDO$$

$$\angle DCO = 180^\circ - 55^\circ - 70^\circ = 55^\circ$$

Given △ODC ~ △OBA, the correspondence is O ↔ O, D ↔ B and C ↔ A.

Therefore, as corresponding angles:

$$\angle OAB = \angle DCO = 55^\circ$$

Final answer

∠DOC = 55°, ∠DCO = 55°, and ∠OAB = 55°.

QUESTION

Question 3

AA similarity · trapezium · diagonals · proof

Diagonals AC and BD of trapezium ABCD, with AB ∥ DC, intersect at O. Using a similarity criterion, show that OA/OC = OB/OD.

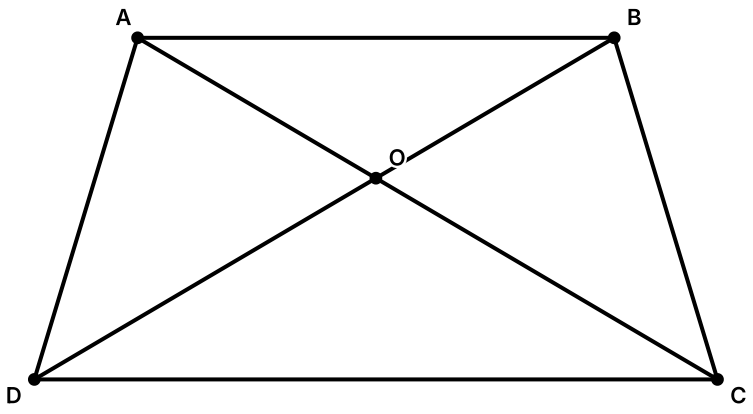
Solution

GIVEN:

ABCD is a trapezium with AB parallel to DC; diagonals AC and BD intersect at O.

TO PROVE:

OA/OC = OB/OD.



Trapezium with intersecting diagonals — solution sketch (not to scale).

PROOF:

Consider △AOB and △COD.

∠AOB = ∠COD because they are vertically opposite angles.

∠ABO = ∠CDO because AB ∥ DC and BD is a transversal.

Therefore, △AOB ~ △COD by AA similarity, with A ↔ C, O ↔ O and B ↔ D.

Hence corresponding sides are proportional:

$$\frac{OA}{OC} = \frac{OB}{OD}$$

Final answer

Therefore, OA/OC = OB/OD.

QUESTION

Question 4

SAS similarity · isosceles triangle · proof

In Figure 6.36, QR/QS = QT/PR and ∠1 = ∠2. Show that △PQS ~ △TQR.

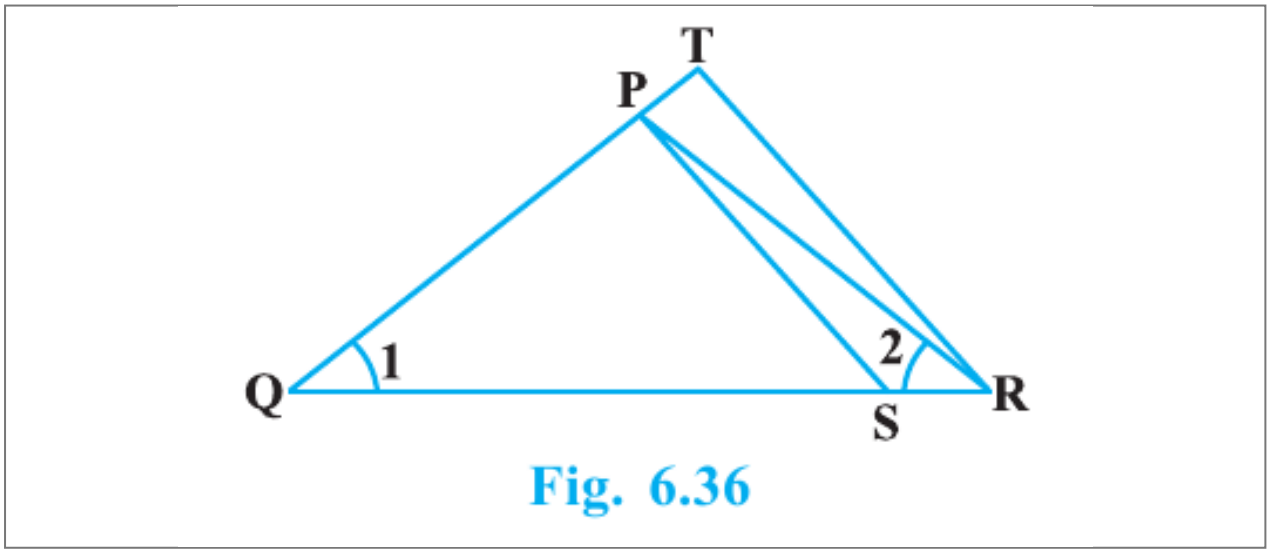


Figure 6-36 from the supplied NCERT chapter.

Solution

GIVEN:

QR/QS = QT/PR and the marked angles 1 and 2 in Figure 6.36 are equal.

TO PROVE:

Triangle PQS is similar to triangle TQR.

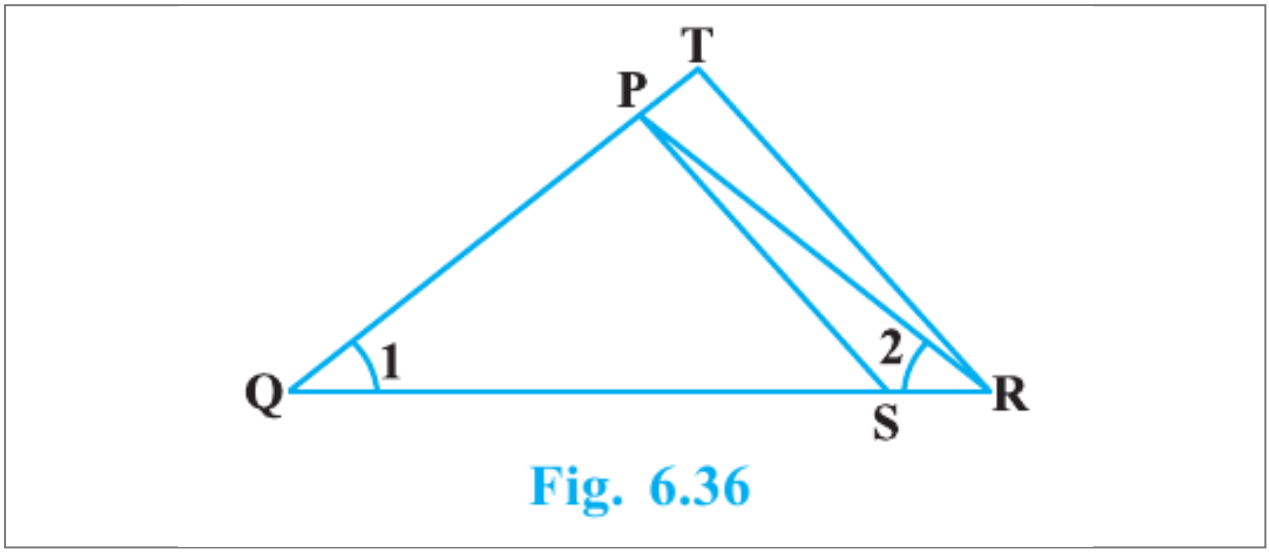


Figure 6-36 from the supplied NCERT chapter.

PROOF:

In △PQR, ∠1 = ∠2 is given. Therefore, the sides opposite these equal angles are equal: PR = PQ.

Substitute PR = PQ in the given proportion:

$$\frac{QR}{QS} = \frac{QT}{PR} = \frac{QT}{PQ}$$

Taking reciprocals:

$$\frac{QS}{QR} = \frac{PQ}{QT} \quad \ldots(1)$$

Since P lies on QT and S lies on QR, ∠PQS = ∠TQR. ...(2)

From (1) and (2), the sides including the equal angle are proportional.

Therefore, △PQS ~ △TQR by SAS similarity, with P ↔ T, Q ↔ Q and S ↔ R.

Final answer

Therefore, △PQS ~ △TQR.

QUESTION

Question 5

AA similarity · proof

S and T are points on sides PR and QR of △PQR such that ∠P = ∠RTS. Show that △RPQ ~ △RTS.

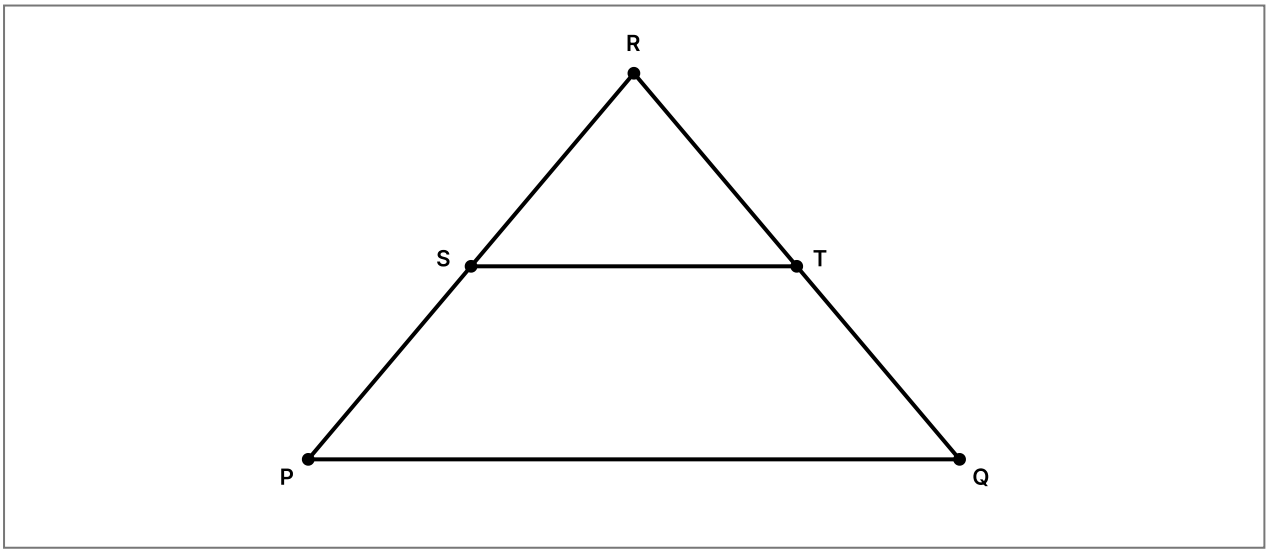
Solution

GIVEN:

S is on PR, T is on QR and angle RPQ equals angle RTS.

TO PROVE:

Triangle RPQ is similar to triangle RTS.



Two triangles sharing angle R — solution sketch (not to scale).

PROOF:

Since S lies on PR and T lies on QR, rays RS and RP are collinear and rays RT and RQ are collinear.

$$\angle RPQ = \angle RTS$$

Given.

$$\angle PRQ = \angle TRS$$

The two angles at R use the same rays because S lies on RP and T lies on RQ.

Thus two corresponding angles are equal, with R ↔ R, P ↔ T and Q ↔ S.

Hence △RPQ ~ △RTS by AA similarity.

Final answer

Therefore, △RPQ ~ △RTS.

QUESTION

Question 6

SAS similarity · congruent triangles · proof

In Figure 6.37, if △ABE ≅ △ACD, show that △ADE ~ △ABC.

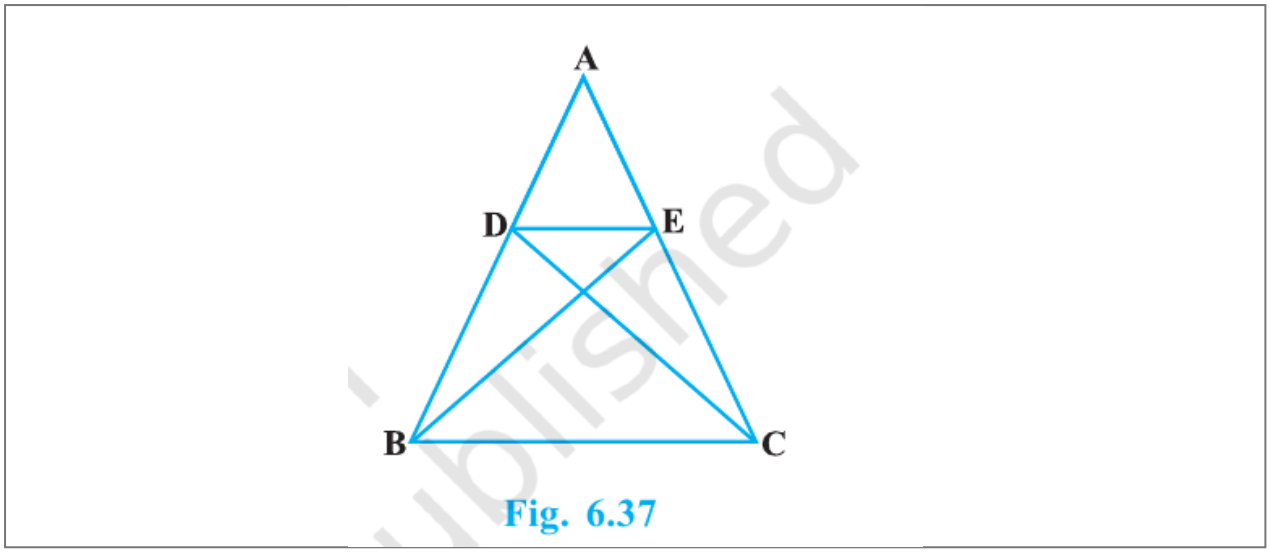


Figure 6-37 from the supplied NCERT chapter.

Solution

GIVEN:

Triangle ABE is congruent to triangle ACD in Figure 6.37.

TO PROVE:

Triangle ADE is similar to triangle ABC.

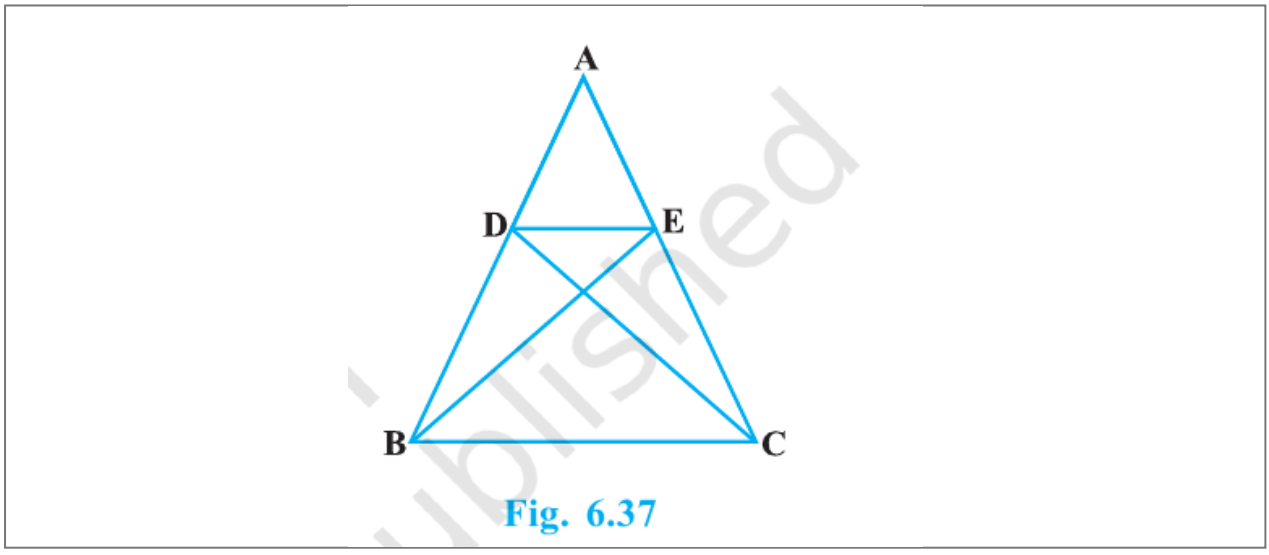


Figure 6-37 from the supplied NCERT chapter.

PROOF:

By corresponding parts of congruent triangles:

$$AB = AC, \qquad AE = AD$$

Therefore:

$$\frac{AD}{AB} = \frac{AE}{AC} \qquad \ldots(1)$$

Also, because AD lies on AB and AE lies on AC:

$$\angle DAE = \angle BAC \qquad \ldots(2)$$

The two pairs of sides including the common angle are proportional.

Hence △ADE ~ △ABC by SAS similarity, with A ↔ A, D ↔ B and E ↔ C.

Final answer

Therefore, △ADE ~ △ABC.

QUESTION

Question 7

AA similarity · altitudes · proof

In Figure 6.38, altitudes AD and CE of △ABC intersect at P. Show that:

(i) △AEP ~ △CDP

(ii) △ABD ~ △CBE

(iii) △AEP ~ △ADB

(iv) △PDC ~ △BEC

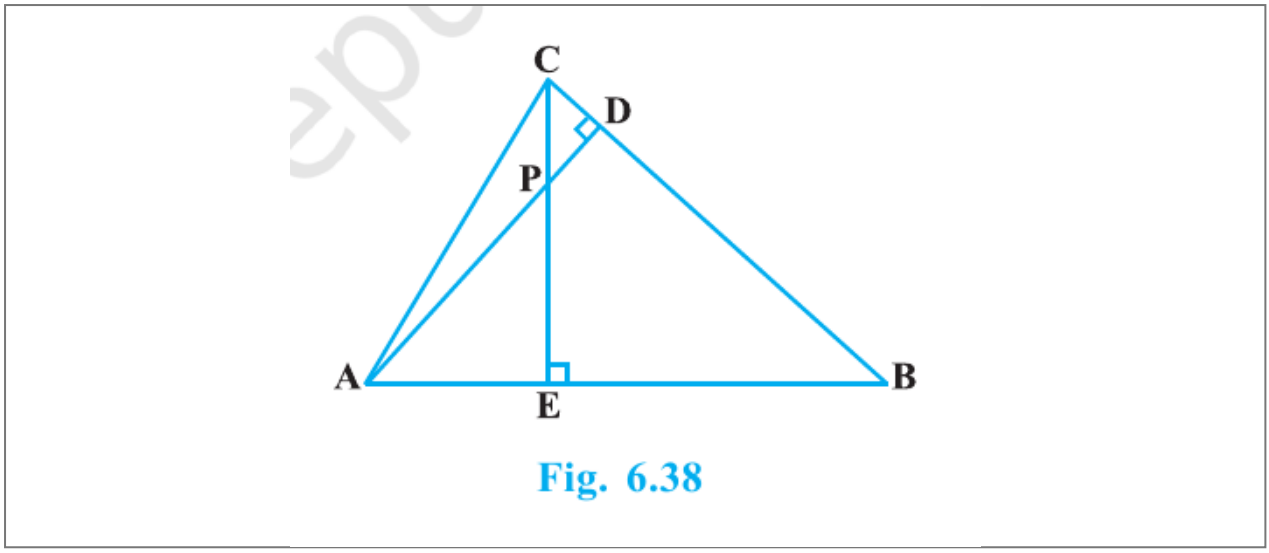


Fig. 6.38

Figure 6-38 from the supplied NCERT chapter.

Solution

GIVEN:

AD and CE are altitudes of triangle ABC and intersect at P.

TO PROVE:

Prove each of the four similar-triangle pairs in parts (i)–(iv).

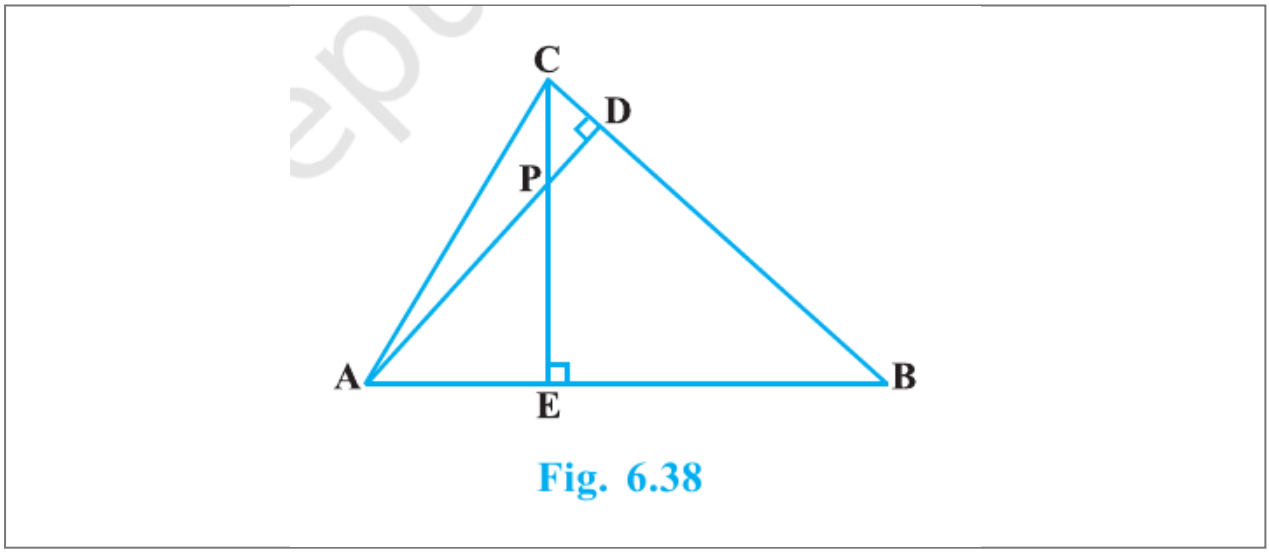


Fig. 6.38

Figure 6-38 from the supplied NCERT chapter.

PROOF:

Since AD and CE are altitudes, AD ⊥ BC and CE ⊥ AB.

(i)

$$\angle AEP = \angle CDP = 90^\circ$$

$$\angle APE = \angle CPD$$

The second pair is vertically opposite. Therefore, △AEP ~ △CDP by AA similarity.

(ii)

$$\angle ADB = \angle CEB = 90^\circ$$

$$\angle ABD = \angle CBE$$

Here BD lies on BC and BE lies on BA. Therefore, △ABD ~ △CBE by AA similarity.

(iii)

$$\angle AEP = \angle ADB = 90^\circ$$

The angle between AD and CE equals the angle between their perpendiculars BC and AB. Hence:

$$\angle APE = \angle ABD$$

Therefore, △AEP ~ △ADB by AA similarity.

(iv)

$$\angle PDC = \angle BEC = 90^\circ$$

$$\angle PCD = \angle BCE$$

Here PC and CE are the same line, while CD and CB are the same line. Therefore, △PDC ~ △BEC by AA similarity.

Final answer

All four required pairs are similar by AA similarity.

QUESTION

Question 8

AA similarity · parallelogram · proof

E is a point on side AD produced of parallelogram ABCD, and BE intersects CD at F. Show that △ABE ~ △CFB.

Solution

GIVEN:

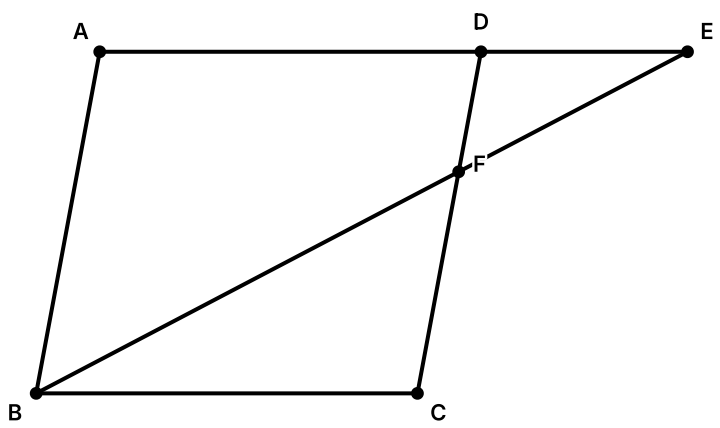
ABCD is a parallelogram; E lies on AD produced and BE intersects CD at F.

TO PROVE:

Triangle ABE is similar to triangle CFB.

CONSTRUCTION:

Produce AD to E and join BE; mark F where BE meets CD.



Parallelogram and produced side — solution sketch (not to scale).

PROOF:

In parallelogram ABCD, AB ∥ CD and AD ∥ BC.

As E lies beyond D on AD, AE ∥ BC. F lies on CD and on BE.

$$\angle BAE = \angle FCB$$

These are opposite angles of the parallelogram, formed by AB ∥ CF and AE ∥ CB.

$$\angle AEB = \angle CBF$$

These are alternate interior angles because AE ∥ BC and BE is the transversal.

Thus △ABE ~ △CFB by AA similarity: A ↔ C, B ↔ F and E ↔ B.

Final answer

Therefore, △ABE ~ △CFB.

QUESTION

Question 9

AA similarity · right triangles · proof

In Figure 6.39, ABC and AMP are right triangles, right-angled at B and M respectively. Prove that:

(i) △ABC ~ △AMP

(ii) CA/PA = BC/MP

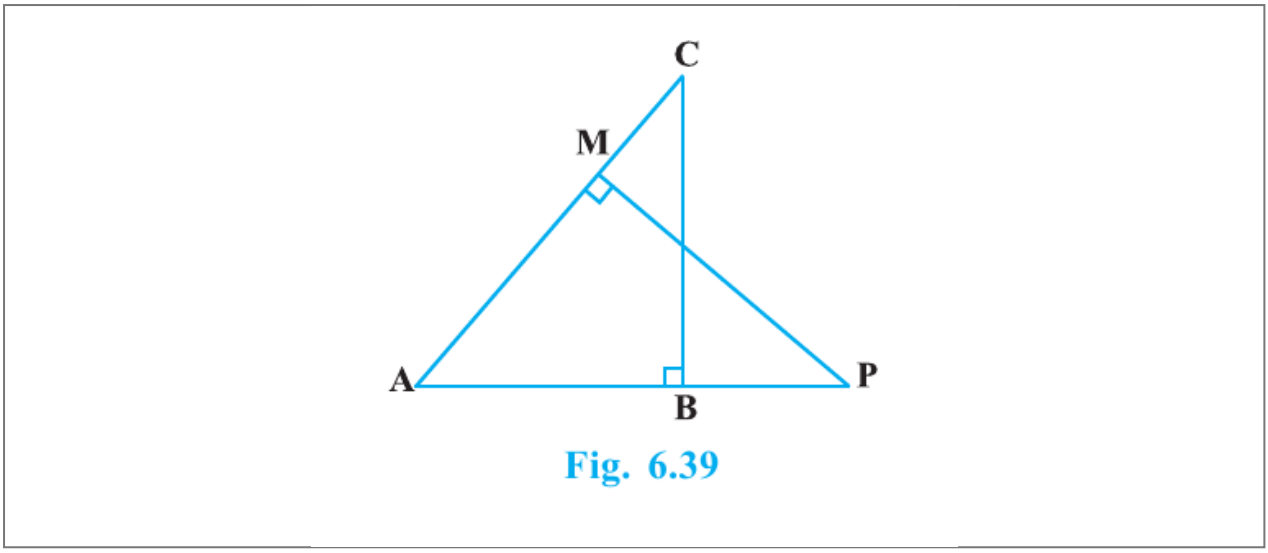


Fig. 6.39

Figure 6-39 from the supplied NCERT chapter.

Solution

GIVEN:

Triangles ABC and AMP are right-angled at B and M, respectively, and share angle A.

TO PROVE:

(i) Triangle ABC is similar to triangle AMP; (ii) CA/PA = BC/MP.

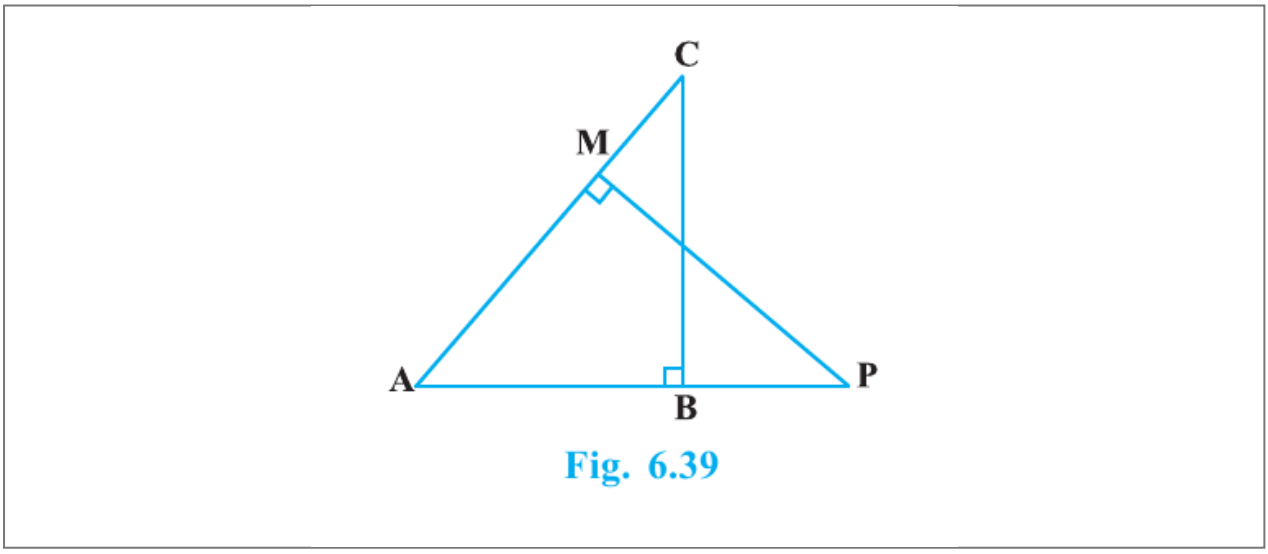


Fig. 6.39

Figure 6-39 from the supplied NCERT chapter.

PROOF:

(i)

$$\angle ABC = \angle AMP = 90^\circ$$

$$\angle BAC = \angle MAP$$

The second pair is equal because BA and AP are the same straight line, while AC and AM are the same straight line.

Therefore, △ABC ~ △AMP by AA similarity, with A ↔ A, B ↔ M and C ↔ P.

(ii) Corresponding sides of similar triangles are proportional.

Here CA corresponds to PA and BC corresponds to MP. Therefore:

$$\frac{CA}{PA} = \frac{BC}{MP}$$

Final answer

(i) △ABC ~ △AMP; (ii) CA/PA = BC/MP.

QUESTION

Question 10

AA similarity · angle bisectors · proof

CD and GH are respectively the bisectors of ∠ACB and ∠EGF, with D on AB and H on FE. If △ABC ~ △FEG, show that:

(i) CD/GH = AC/FG

(ii) △DCB ~ △HGE

(iii) △DCA ~ △HGF

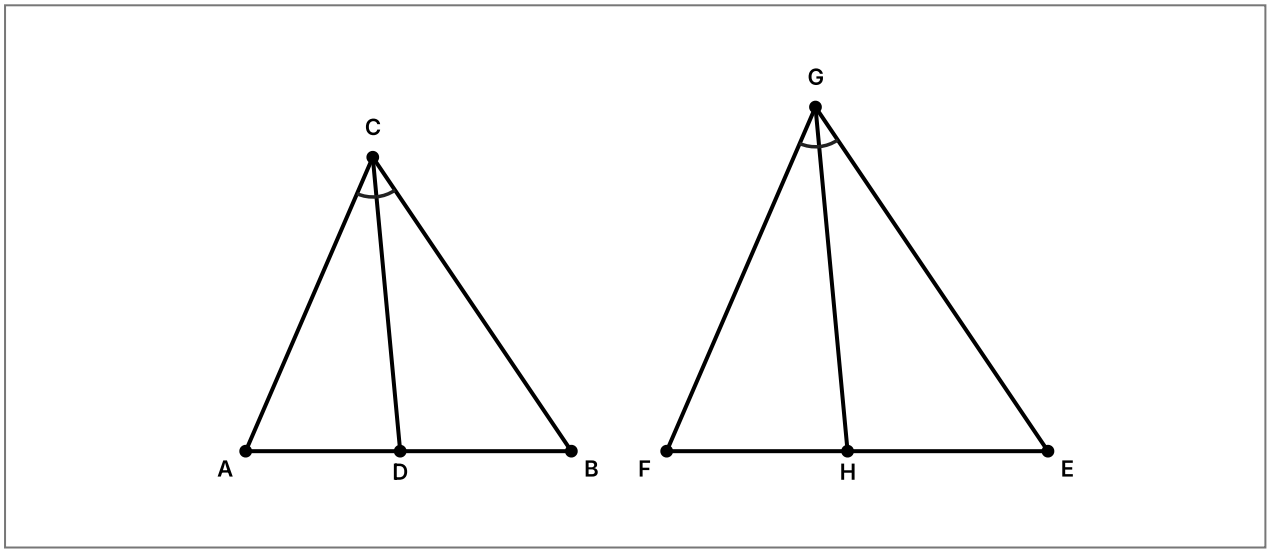
Solution

GIVEN:

Triangle ABC is similar to triangle FEG; CD and GH bisect the corresponding angles C and G.

TO PROVE:

(i) CD/GH = AC/FG; (ii) triangle DCB is similar to triangle HGE; (iii) triangle DCA is similar to triangle HGF.



Corresponding angle bisectors — solution sketch (not to scale).

PROOF:

Given △ABC ~ △FEG, the corresponding vertices are A ↔ F, B ↔ E and C ↔ G.

$$\angle BAC = \angle EFG, \quad \angle ABC = \angle FEG, \quad \angle ACB = \angle FGE$$

CD and GH bisect the corresponding angles at C and G. Each half of ∠ACB therefore equals the corresponding half of ∠FGE.

(i) Compare △ACD and △FGH.

$$\angle CAD = \angle GFH$$

Both are the corresponding angles at A and F, since D lies on AB and H lies on FE.

$$\angle ACD = \angle FGH$$

Both are halves of equal angles at C and G.

By AA similarity, △ACD ~ △FGH. Corresponding sides are proportional:

$$\frac{CD}{GH} = \frac{AC}{FG}$$

(ii) Compare △DCB and △HGE.

$$\angle DCB = \angle HGE$$

Again, these are halves of the equal angles at C and G.

$$\angle DBC = \angle HEG$$

These are the corresponding angles at B and E. Hence △DCB ~ △HGE by AA similarity.

(iii) Compare △DCA and △HGF.

$$\angle DCA = \angle HGF$$

These are the other halves of the equal angles at C and G.

$$\angle DAC = \angle HFG$$

These are the corresponding angles at A and F. Hence △DCA ~ △HGF by AA similarity.

Final answer

(i) CD/GH = AC/FG; (ii) △DCB ~ △HGE; (iii) △DCA ~ △HGF.

QUESTION

Question 11

AA similarity · isosceles triangle · perpendicular lines · proof

In Figure 6.40, E is on side CB produced of isosceles △ABC with AB = AC. If AD ⊥ BC and EF ⊥ AC, prove that △ABD ~ △ECF.

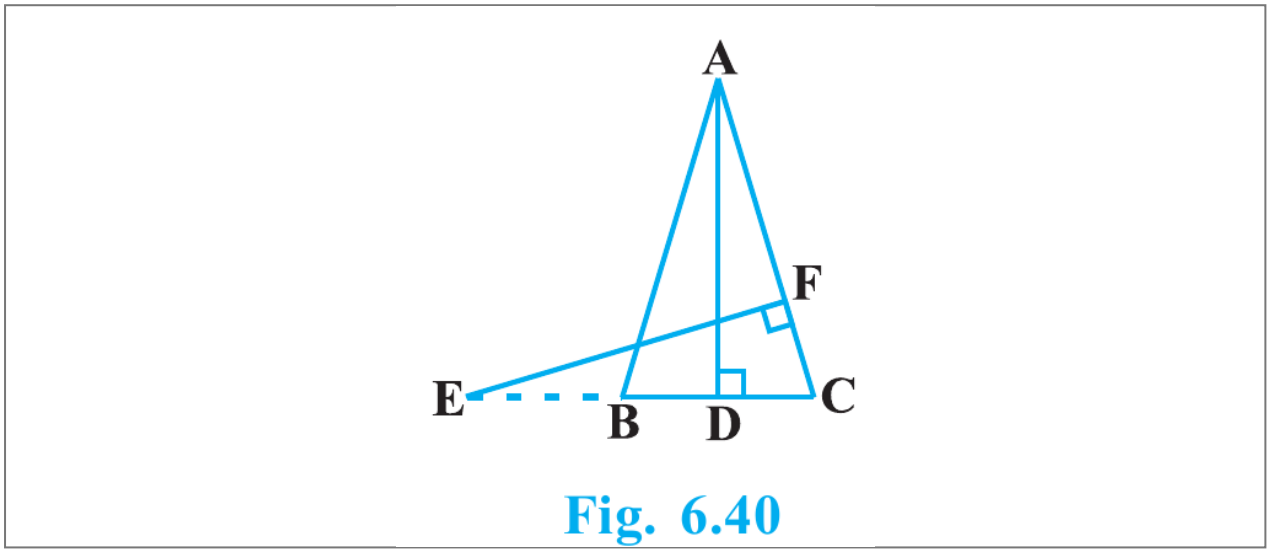


Fig. 6.40

Complete Figure 6.40 from the supplied NCERT chapter.

Solution

GIVEN:

△ABC is isosceles, so AB = AC.

E is on side CB produced beyond B.

AD ⊥ BC, with D on BC.

EF ⊥ AC, with F on AC.

TO PROVE:

$$\triangle ABD \sim \triangle ECF$$

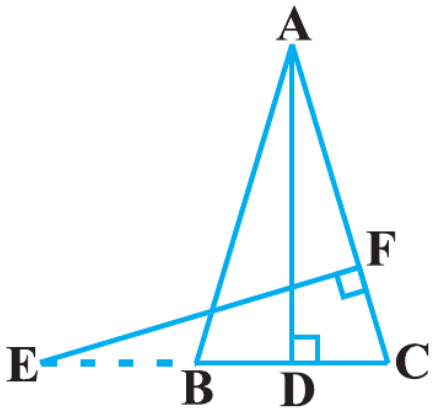


Fig. 6.40

Complete Figure 6.40 from the supplied NCERT chapter.

PROOF:

$$\angle ADB = \angle EFC = 90^\circ$$

Given perpendiculars AD ⊥ BC and EF ⊥ AC.

$$\angle ABC = \angle BCA$$

Base angles of isosceles triangle ABC, since AB = AC.

D lies on BC, so ∠ABD = ∠ABC. E, B, D and C are collinear and F lies on AC, so ∠ECF = ∠BCA.

$$\angle ABD = \angle ECF$$

Hence △ABD ~ △ECF by AA similarity, with A ↔ E, B ↔ C and D ↔ F.

Final answer

Therefore, △ABD ~ △ECF.

QUESTION

Question 12

SSS similarity · SAS similarity · medians · proof

Sides AB and BC and median AD of △ABC are respectively proportional to sides PQ and QR and median PM of △PQR. Show that △ABC ~ △PQR.

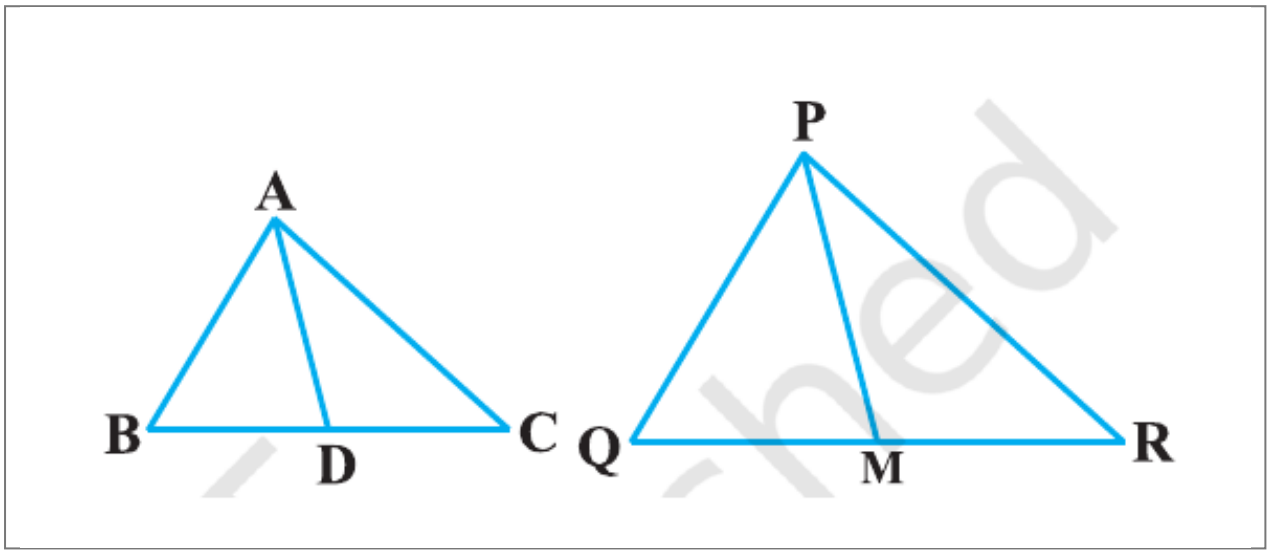


Figure 6-41 from the supplied NCERT chapter.

Solution

GIVEN:

AB/PQ = BC/QR = AD/PM; AD and PM are medians of the respective triangles.

TO PROVE:

Triangle ABC is similar to triangle PQR.

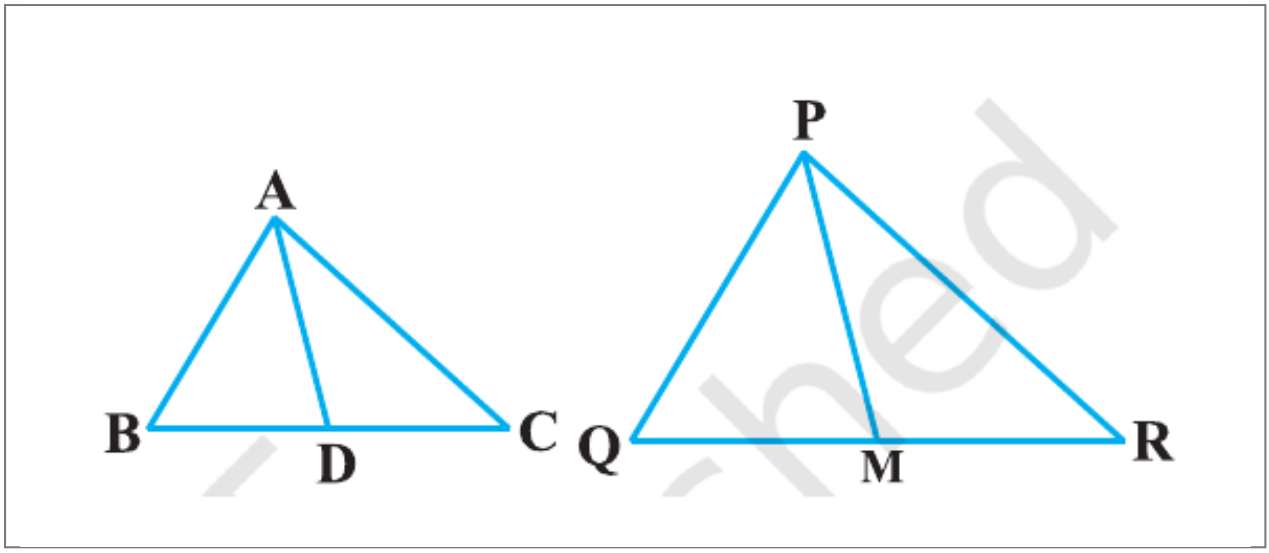


Figure 6-41 from the supplied NCERT chapter.

PROOF:

Let the common proportionality ratio be k:

$$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM} = k$$

Since AD and PM are medians:

$$BD = \frac{BC}{2}, \qquad QM = \frac{QR}{2}$$

Therefore:

$$\frac{BD}{QM} = \frac{BC}{QR} = k$$

Thus, in △ABD and △PQM:

$$\frac{AB}{PQ} = \frac{AD}{PM} = \frac{BD}{QM}$$

Therefore, △ABD ~ △PQM by SSS similarity, so ∠ABD = ∠PQM.

Because D lies on BC and M lies on QR, ∠ABD = ∠ABC and ∠PQM = ∠PQR. Hence ∠ABC = ∠PQR.

Also:

$$\frac{AB}{PQ} = \frac{BC}{QR}$$

The included angles are equal. Therefore, △ABC ~ △PQR by SAS similarity.

Final answer

Therefore, △ABC ~ △PQR.

QUESTION

Question 13

AA similarity · geometric mean · proof

D is a point on side BC of △ABC such that ∠ADC = ∠BAC. Show that $CA^2 = CB \times CD$.

Solution

GIVEN:

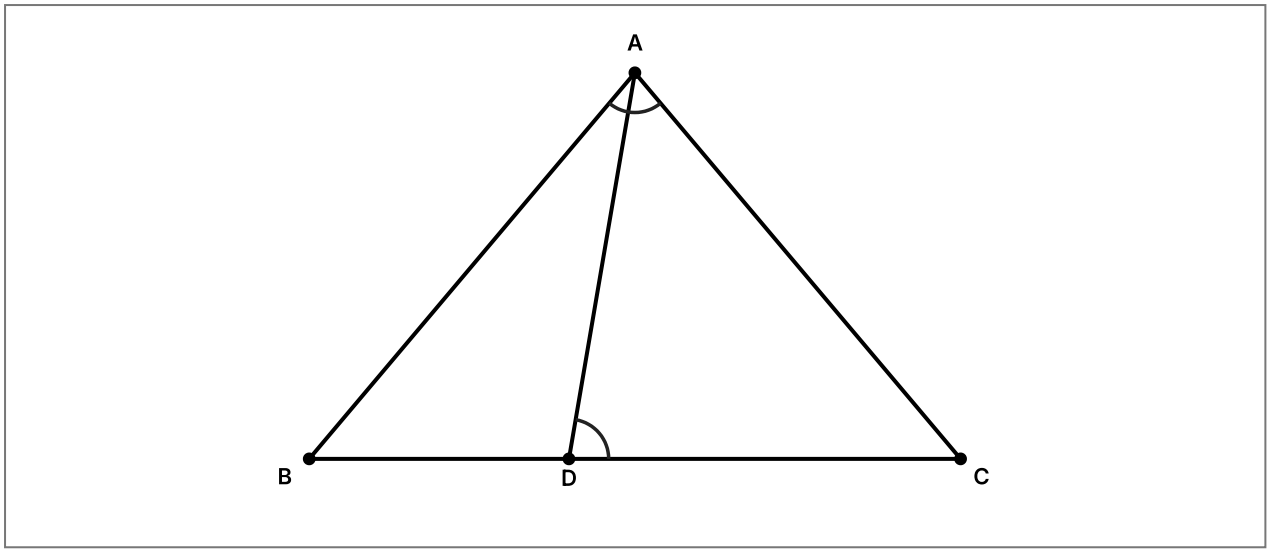
D lies on BC in triangle ABC and angle ADC equals angle BAC.

TO PROVE:

$CA^2 = CB \times CD$.

CONSTRUCTION:

Join A to D.



Triangle with D on its base — solution sketch (not to scale).

PROOF:

Consider △BAC and △ADC.

$$\angle BAC = \angle ADC$$

Given.

$$\angle BCA = \angle ACD$$

The angles at C are equal because B, D and C lie on one line.

Therefore, △ADC ~ △BAC by AA similarity, with A ↔ B, D ↔ A and C ↔ C.

Corresponding sides give:

$$\frac{DC}{AC} = \frac{AC}{BC}$$

Cross multiplying:

$$AC^2 = BC \times DC$$

Final answer

Therefore, $CA^2 = CB \times CD$.

QUESTION

Question 14

SSS similarity · medians · Apollonius theorem · proof

Sides AB and AC and median AD of △ABC are respectively proportional to sides PQ and PR and median PM of △PQR. Show that △ABC ~ △PQR.

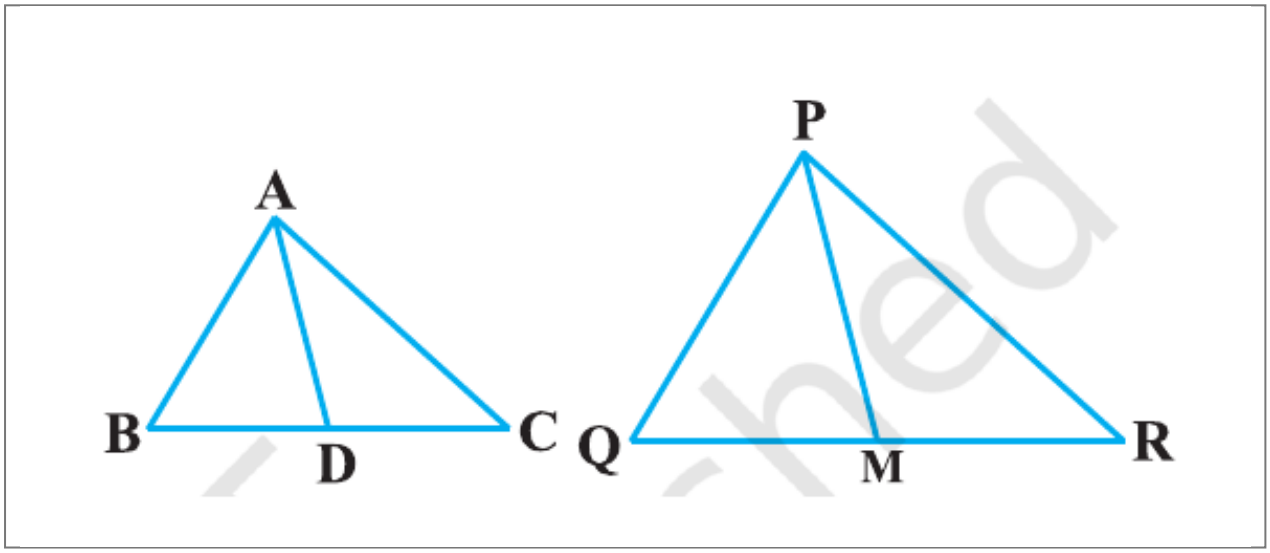


Figure 6-41 from the supplied NCERT chapter.

Solution

GIVEN:

AB/PQ = AC/PR = AD/PM; AD and PM are medians of the respective triangles.

TO PROVE:

Triangle ABC is similar to triangle PQR.

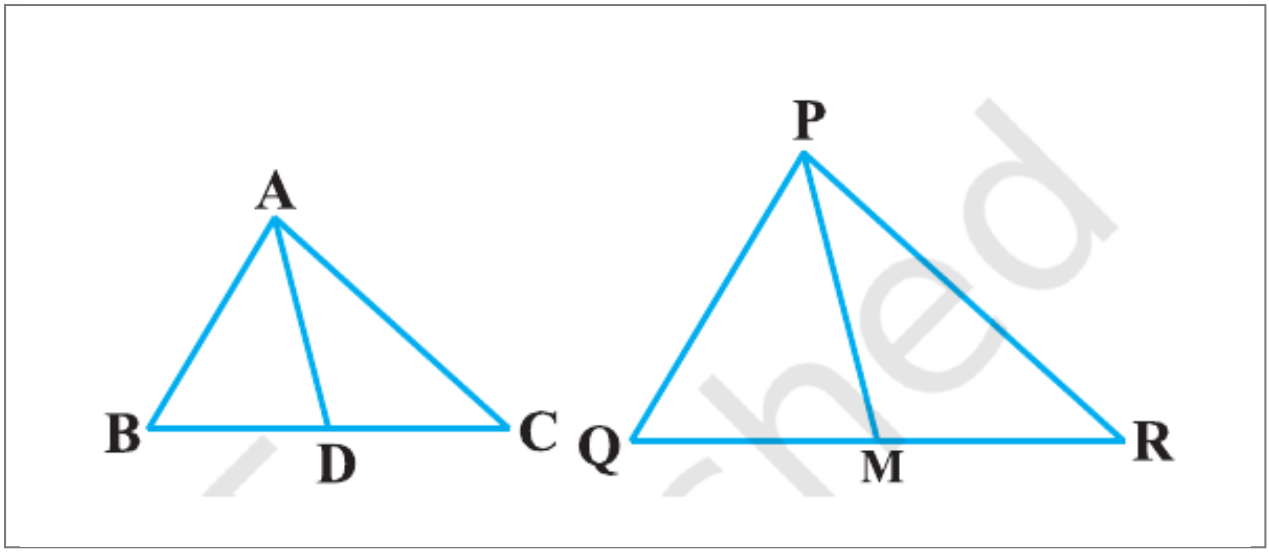


Figure 6-41 from the supplied NCERT chapter.

PROOF:

Let the common proportionality ratio be k:

$$\frac{AB}{PQ} = \frac{AC}{PR} = \frac{AD}{PM} = k$$

Therefore:

$$AB = kPQ, \qquad AC = kPR, \qquad AD = kPM$$

By Apollonius' theorem in △ABC:

$$BC^2 = 2AB^2 + 2AC^2 - 4AD^2$$

Substituting the proportional lengths:

$$BC^2 = k^2(2PQ^2 + 2PR^2 - 4PM^2) \qquad ...(1)$$

By Apollonius' theorem in △PQR:

$$QR^2 = 2PQ^2 + 2PR^2 - 4PM^2 \qquad ...(2)$$

From (1) and (2):

$$BC^2 = k^2QR^2$$

Since side lengths are positive:

$$\frac{BC}{QR} = k$$

Therefore:

$$\frac{AB}{PQ} = \frac{AC}{PR} = \frac{BC}{QR}$$

Hence △ABC ~ △PQR by SSS similarity, with A ↔ P, B ↔ Q and C ↔ R.

Final answer

Therefore, △ABC ~ △PQR.

QUESTION

Question 15

AA similarity · shadows · application

A vertical pole 6 m long casts a 4 m shadow. At the same time, a tower casts a 28 m shadow. Find the height of the tower.

Solution

GIVEN:

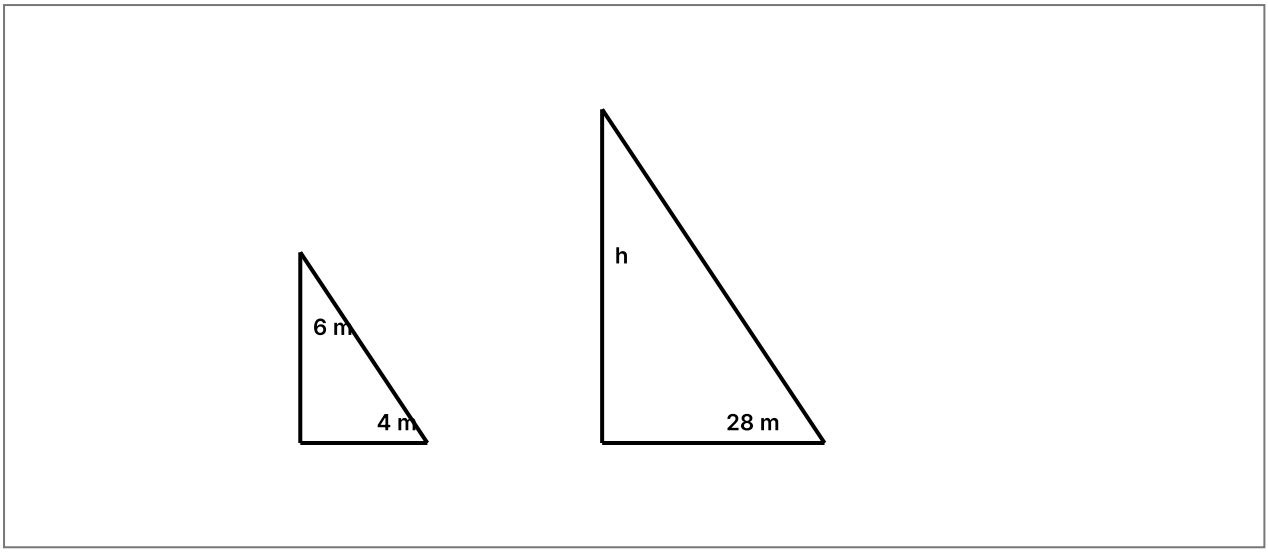
A 6 m pole casts a 4 m shadow; at the same time, the tower casts a 28 m shadow.

TO FIND:

The tower's height.

CONSTRUCTION:

Join each top to the end of its shadow along the sunlight direction.



Pole and tower shadows — solution sketch (not to scale).

SOLUTION:

Let the height of the tower be h metres.

The pole and tower are vertical, so each forms a right triangle with the ground.

Because the observations are at the same time, the sun's rays make the same angle with the ground. Therefore, the two triangles are similar by AA.

Corresponding height-to-shadow ratios are equal:

$$\frac{h}{28} = \frac{6}{4}$$

Cross multiplying:

$$4h = 28 \times 6$$

$$h = \frac{28 \times 6}{4}$$

$$h = 7 \times 6 = 42 \text{ m}$$

Final answer

The tower is 42 m high.

QUESTION

Question 16

SAS similarity · medians · proof

AD and PM are medians of △ABC and △PQR respectively, where △ABC ~ △PQR. Prove that AB/PQ = AD/PM.

Solution

GIVEN:

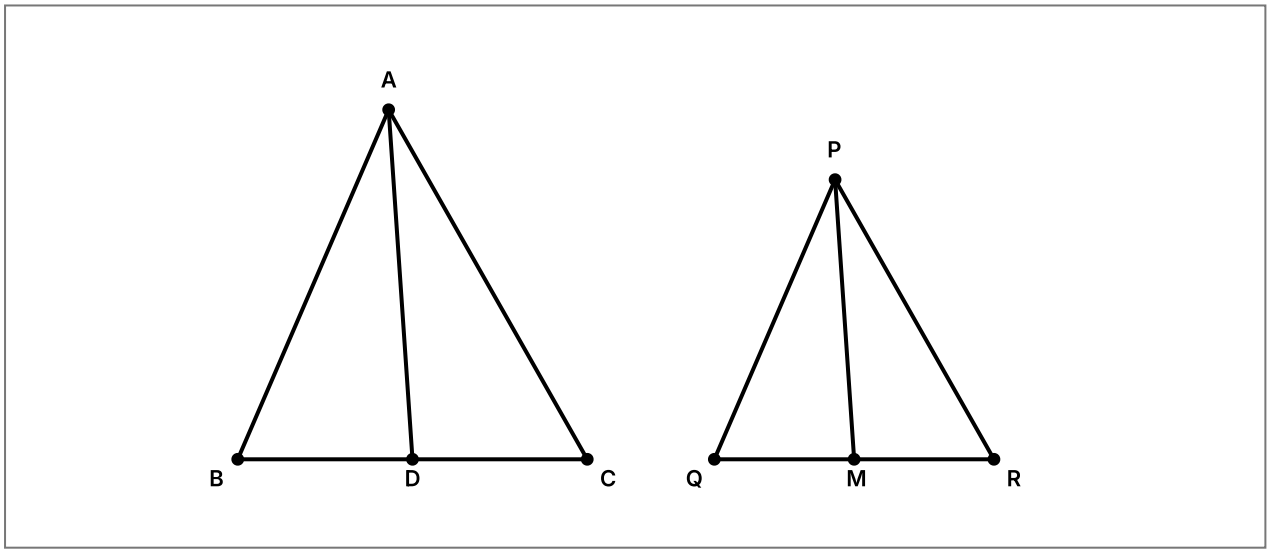
△ABC and △PQR, with △ABC ~ △PQR.

AD is the median of △ABC, so D is the midpoint of BC.

PM is the median of △PQR, so M is the midpoint of QR.

TO PROVE:

$$\frac{AB}{PQ} = \frac{AD}{PM}$$



Corresponding medians in similar triangles — solution sketch (not to scale).

PROOF:

The similarity correspondence is A ↔ P, B ↔ Q and C ↔ R. Therefore:

$$\frac{AB}{PQ} = \frac{BC}{QR} \qquad ...(1)$$

$$\angle ABC = \angle PQR$$

Since AD and PM are medians:

$$BD = \frac{BC}{2}, \qquad QM = \frac{QR}{2}$$

Hence:

$$\frac{BD}{QM} = \frac{BC/2}{QR/2}$$

$$\frac{BD}{QM} = \frac{BC}{QR} = \frac{AB}{PQ} \qquad ...(2)$$

Also, ∠ABD = ∠PQM because D lies on BC, M lies on QR, and ∠ABC = ∠PQR.

From (2) and the included equal angle, △ABD ~ △PQM by SAS similarity.

Therefore, corresponding sides give:

$$\frac{AD}{PM} = \frac{AB}{PQ}$$

Final answer

Therefore, AB/PQ = AD/PM.