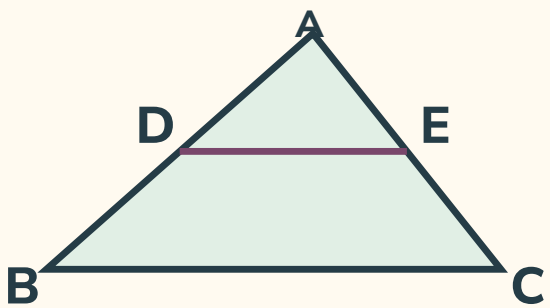
MATHS FIELD GUIDE · GRADE 10

Similarity in linked triangles

OPENING PROBLEM

Use AB = 8, AC = 6. AD = 4. Find AE.



DE ∥ BC

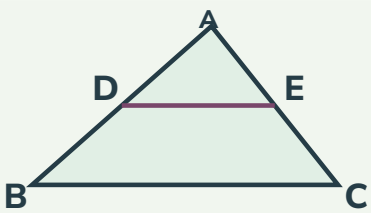
02 A parallel cut creates two similar triangles
03 Rules and worked cases
04 From the givens to the answer
05 Match the sides before scaling
06 Check your reasoning
07 Check your reasoning

ILLUSTRATED PROBLEM SHEET

A parallel cut creates two similar triangles

D lies on AB, E lies on AC and DE is parallel to BC unless the question asks you to test it.

1



DE ∥ BC

Use AB = 8, AC = 6. AD = 4. Find AE.

D is halfway to B. The smaller triangle is at half scale, so AE = 3.

2

AD = 3, DB = 6
↓
AE = 4
↓
AD/DB = AE/EC

Recover the missing segment EC.

The lower piece is twice the upper piece on AB. EC must be twice 4, which is 8.

3

Side	Upper	Lower
AB	3	5
AC	6	10

If parallelism was not given, can you deduce it?

Yes. 3/5 = 6/10. The converse applies because D and E are internal points.

4

AD/AB = 2/5
↓
Area ADE / Area ABC = 4/25

What fraction of the large area remains below DE?

1 − 4/25 = 21/25. The area factor is the square of the length factor.

AD:DB = 1:3
AD:AB = 1:4.

AD:AB = 3:4
AD:DB = 3:1.

CHAPTER PROBLEM

ΔABC∼ΔPQR in that order. AB=4,PQ=10,BC=10. Find QR.

25. Large/small factor is 10/4=2.5.

MATHS REFERENCE · GRADE 10

Similarity in linked triangles

Rules, conditions and worked cases

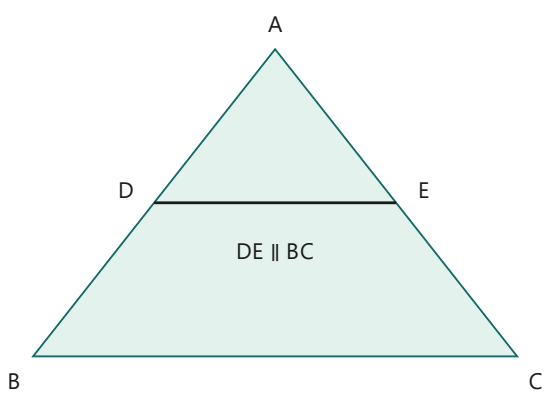
Recognise the case	Mathematical reasoning
Parallel cut	DE ∥ BC inside ΔABC yields ΔADE ~ ΔABC by AA. If AD/AB = 3/5 and BC = 20, DE = 12.
Altitude to hypotenuse	In right ΔABC, altitude from the right angle meets hypotenuse at H. The two small triangles are similar by AA.
Geometric mean	Hypotenuse segments 4 and 9 give altitude h with $h^2 = 4 \times 9$, hence h = 6.

Read the representations

Name the triangles before writing a proportion

A parallel cut gives equal corresponding angles and a shared apex angle, so ΔADE~ΔABC.

For intersecting triangles, the vertical angle supplies one equality; establish another from the givens before using AA.

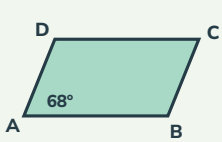


D lies on AB; E lies on AC.

Correspondence controls every side ratio

Write triangle names in matching order and keep all ratios in one direction.

A scale factor compares corresponding full sides. For internal cuts, subtract to recover a missing remainder after the proportion.



AB ∥ CD

In parallelogram ABCD, angle A is 68°. Find angle B.

Angles on the same side of a transversal between parallel lines sum to 180°. The neighbour is 112°.

WORKED EXAMPLES

From the givens to the answer

Nested triangles: find the base and the remainder

1. $D \in AB, E \in AC, DE \parallel BC$. Let $AD=6, AB=10, BC=15, AC=12$.
2. AA gives $ADE \sim ABC$. Scale factor small/large $=6/10=3/5$.
3. $DE=(3/5)15=9$ and $AE=(3/5)12=7.2$, so $EC=12-7.2=4.8$.

Transfer a length across two triangles

In triangle ABC, D lies on AB and E on AC. DE is parallel to BC. AD = 6, AB = 10 and DE = 9. Find BC.

1. The parallel lines give matching angles, so ADE and ABC are similar. The enlargement factor is AB/AD = 5/3. Multiply 9 by 5/3 to get BC = 15.

Check another case

Example 1

$\Delta ABC \sim \Delta PQR$ in that order. $AB=4, PQ=10, BC=16$. Find QR.

40

Large/small factor is $10/4=2.5$.

Example 2

point arrangement

Point	D	E
Location	Between A and B	Between A and C

In triangle ABC, D is an internal point of AB and E is an internal point of AC. Use only the parallelism or ratios explicitly given in the question.

$DE \parallel BC, AD=4, DB=6, AC=45$. Find EC.

27

AE/AC=4/10=2/5, leaving 3/5.

DE ∥ BC in triangle ABC
↓
AD/AB = AE/AC
↓
3/9 = AE/15

D is on AB and E on AC. Find AE.

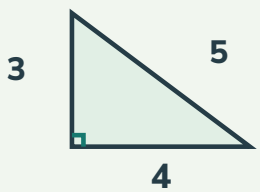
AE = 5. The small triangle has one third the full side lengths.

ILLUSTRATED PROBLEM SHEET

Match the sides before scaling

For similar figures one length scale k governs every corresponding side. Areas scale by k^2.

1



Scale every side by two. Which lengths result?

6, 8 and 10. The angles stay fixed, and the perimeter doubles.

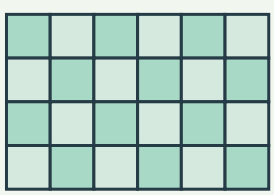
2

Length	Small	Large
AB ↔ PQ	4	10
BC ↔ QR	6	?

If ABC and PQR are similar in that order, find QR.

The length scale is 10/4 = 2.5, so QR = 15.

3



This rectangle is a twofold enlargement of a 3 by 2 rectangle. How do the areas compare?

Twenty-four squares versus six. Doubling both directions multiplies area by four.

4

Area ratio = 25:9

↓

Length ratio = 5:3

Why take a square root?

A two-dimensional area uses the length scale twice. Lengths are positive.

Length scale 3
area scale 9.

Area scale 9
positive length scale 3.

CHAPTER PROBLEM

Two similar triangles have corresponding lengths 6 and 9. If the smaller perimeter is 18, find the larger perimeter.

27. Perimeters scale by the side factor 3/2.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

Data A

point arrangement

Point	D	E
Location	Between A and B	Between A and C

In triangle ABC, D is an internal point of AB and E is an internal point of AC. Use only the parallelism or ratios explicitly given in the question.

Try the problem	Solution and reasoning
01 · Data A DE∥BC inside ΔABC, AD/AB=2/3, BC=12. Find DE.	8 AA similarity gives the same side factor 2/3.
02 May you set AD/DB equal to AE/AC for a parallel cut?	Those fractions compare different parts. Match part to remainder on both sides, or part to whole on both.
03 · Data A DE∥BC, AD=4,DB=6,AC=35. Find EC.	21 AE/AC=4/10=2/5, leaving 3/5.
04 For ΔABC~ΔPQR, which is a correct ratio? A) AB/PQ=BC/QR B) AB/QR=AC/PQ C) AB/BC=PR/PQ D) AC/QR=BC/PR	AB/PQ=BC/QR Match vertices A↔P,B↔Q,C↔R.
05 Can rectangles 2 by 6 and 3 by 4 be similar just because both have area 12?	No. Their long-to-short ratios are 3 and 4/3.
06 AB∥CD and lines AC,BD meet at O between A,C and B,D. OA=6,OC=9,OB=6. Find OD.	9 AOB~COD by vertical and alternate angles; OC/OA=3/2.

Segment	First part	Second part
AB	4	6
AC	6	9

Do these division ratios support a parallel cut?

4/6 = 6/9. For internal D and E on the two sides, the converse gives DE ∥ BC.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

Data A

point arrangement

Point	D	E
Location	Between A and B	Between A and C

In triangle ABC, D is an internal point of AB and E is an internal point of AC. Use only the parallelism or ratios explicitly given in the question.

Try the problem	Solution and reasoning
07 In AB∥CD with diagonals AC and BD meeting at O, prove ΔAOB~ΔCOD.	∠AOB=∠COD as vertical angles. A second angle pair is equal by alternate angles on parallel AB and CD. Conclude AA with A↔C and B↔D.
08 Why is one common angle alone insufficient for triangle similarity?	Many triangles can share one angle with different remaining angles and side ratios. Supply a second matching angle or a valid SAS/SSS similarity condition.
09 · Data A DE∥BC inside ΔABC, AD/AB=2/3, BC=15. Find DE.	10 AA similarity gives the same side factor 2/3.
10 ΔABC~ΔPQR in that order. AB=4,PQ=10,BC=12. Find QR.	30 Large/small factor is 10/4=2.5.
11 · Data A DE∥BC inside ΔABC, AD/AB=2/3, BC=21. Find DE.	14 AA similarity gives the same side factor 2/3.

DE joins side midpoints
↓
Scale = ½
↓
DE = ½ BC

If the opposite side is 18 cm, how long is the midsegment?

9 cm. It is parallel to the opposite side.

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