



Similar shapes

Mana Maths

Te reo Māori terms



āhuahanga

shape

Open in Te Aka

ōwehenga

ratio

Open in Te Aka

whakarahinga

enlargement

Open in Te Aka

tapatoru

triangle

Open in Te Aka

Similar Shapes - Notes and Steps



Key idea

Similar shapes have equal angles and the same shape — but a different size.

Every matching side is multiplied by the same **scale factor**.

Scale factor

$$\text{scale factor} = \frac{\text{big side}}{\text{small side}}$$

A side grows from 5 cm to 15 cm:

$$\text{scale factor} = \frac{15}{5} = 3.$$

Common mistake

Pair the matching sides first.

Comparing the wrong sides gives the wrong ratio.



= copy this into your book. Boxes without a pencil are just to read.

Finding a Missing Side



Key idea



To go from the small shape to the large one, **multiply** by the scale factor.
To go the other way, **divide**.

Example



Small rectangle 6×10 cm; a similar larger one has short side 15 cm.

$$\text{scale factor} = \frac{15}{6} = 2.5$$

$$\text{long side} = 10 \times 2.5 = 25 \text{ cm.}$$

Common mistake

Equal side *differences* do not prove similarity — only equal **ratios** do.

Start Tasks



1. Triangle A has sides 3, 4, 5. Triangle B has sides 6, 8, 10. Are they similar?

2. Rectangle A is $2\text{ cm} \times 5\text{ cm}$. Rectangle B is $4\text{ cm} \times 10\text{ cm}$. Are they similar?

3. Rectangle A is $3\text{ cm} \times 5\text{ cm}$. Rectangle B is $6\text{ cm} \times 8\text{ cm}$. Are they similar?

4. A side grows from 4 cm to 8 cm. Find the scale factor.

5. A side grows from 7 cm to 21 cm. Find the scale factor.

6. A side shrinks from 12 cm to 6 cm. Find the scale factor.

7. A triangle is enlarged by scale factor 2. A side was 5 cm. Find the new side length.

8. A rectangle is enlarged by scale factor 3. A side was 4 cm. Find the new side length.

9. A shape is enlarged by scale factor $\frac{1}{2}$. A side was 10 cm. Find the new side length.

Start Tasks – Answers



1. Yes

4. 2

7. 10 cm

2. Yes

5. 3

8. 12 cm

3. No

6. $\frac{1}{2}$

9. 5 cm

Start Tasks



10. A small square has side 3 cm. A similar larger square has side 9 cm. Find the scale factor.

11. A small triangle has side 8 cm. A similar larger triangle has side 12 cm. Find the scale factor.

12. A side changes from 15 cm to 5 cm. Find the scale factor.

13. Triangle A has sides 2, 3, 4. Triangle B has sides 4, 6, 8. Are they similar?

14. Triangle A has sides 4, 5, 6. Triangle B has sides 8, 10, 14. Are they similar?

15. Square A has side 6 cm. Similar square B has side 18 cm. Find the scale factor.

16. A similar shape has scale factor 4. The original side is 2.5 cm. Find the new side.

17. A similar shape has scale factor $\frac{1}{3}$. The original side is 18 cm. Find the new side.

18. A rectangle 3 by 7 is enlarged by factor 2. Write the new dimensions.

Start Tasks – Answers



10. 3

13. Yes

16. 10 cm

11. 1.5

14. No

17. 6 cm

12. $\frac{1}{3}$

15. 3

18. 6 cm $\times$ 14 cm

Start Tasks



19. A triangle side goes from 9 cm to 27 cm. Find the scale factor.

20. A side goes from 20 cm to 4 cm. Find the scale factor.

21. Two polygons have matching side lengths 5 and 15. What is the enlargement factor?

22. A larger similar triangle has side 24 cm. The scale factor from small to large is 3. Find the small side.

23. A larger similar rectangle has side 14 cm. The scale factor from small to large is 2. Find the small side.

24. A smaller similar shape has side 6 cm. The scale factor from large to small is $\frac{1}{2}$. Find the large side.

25. Triangles with sides 3, 5, 7 and 6, 10, 14: similar or not?

26. Rectangles 4×9 and 8×18 : similar or not?

27. Explain briefly: do similar shapes always have equal angles?

Start Tasks – Answers



19. 3

22. 8 cm

25. Yes

20. 0.2

23. 7 cm

26. Yes

21. 3

24. 12 cm

27. Yes, similar shapes
keep equal matching
angles.

Build Tasks



1. Two similar triangles have corresponding sides 6 cm and 15 cm. Find the scale factor from small to large.

2. Two similar rectangles have corresponding sides 14 cm and 7 cm. Find the scale factor from large to small.

3. A shape is enlarged by factor 2.5. A side was 8 cm. Find the new side.

4. A shape is reduced by factor $\frac{3}{4}$. A side was 20 cm. Find the new side.

5. Triangles with sides 4, 6, 8 and 10, 15, 20: are they similar? Give the scale factor if they are.

6. Triangles with sides 5, 7, 9 and 15, 21, 26: are they similar?

7. A small triangle has sides 3, 4, 5. A similar larger triangle has shortest side 12 cm. Find the other two sides

8. A small rectangle is 6 cm by 10 cm. A similar larger rectangle has shorter side 15 cm. Find the longer side

9. A small pentagon side is 9 cm. A similar larger pentagon side is 13.5 cm. Find the scale factor.

Build Tasks – Answers



1. 2.5

2. $\frac{1}{2}$

3. 20 cm

4. 15 cm

5. Yes, factor 2.5

6. No

7. 16 cm and 20 cm

8. 25 cm

9. 1.5

Build Tasks



10. A similar shape has factor 3. If one side becomes 27 cm, what was the original side?

11. A similar shape has factor $\frac{2}{5}$. If the original side was 35 cm, what is the new side?

12. A triangle side goes from 18 cm to 12 cm. Find the reduction factor.

13. Two similar rectangles are 4×11 and 12×33 . Are they similar? State why.

14. Two quadrilaterals have matching side lengths 8, 12, 20 and 10, 15, 25. Are those matching sides in proportion?

15. A triangle with sides 7, 9, 11 is enlarged by factor 4. Write the new side lengths.

16. A rectangle $9 \text{ cm} \times 15 \text{ cm}$ is reduced by factor $\frac{1}{3}$. Write the new dimensions.

17. A smaller similar triangle has sides 5, 12, 13. A larger similar triangle has longest side 39 cm. Find the other

18. A model house is built at scale factor $\frac{1}{20}$. A wall on the real house is 8 m. How long is the

Build Tasks – Answers



10. 9 cm

13. Yes

16. 3 cm $\times$ 5 cm

11. 14 cm

14. Yes, all ratios are $\frac{5}{4}$

17. 15 cm and 36 cm

12. $\frac{2}{3}$

15. 28 cm, 36 cm, 44 cm

18. 0.4 m

Build Tasks



19. A map uses scale factor $\frac{1}{50000}$. A road is 3 cm on the map. What is the real distance in cm?

20. A photocopier enlarges by factor 1.2. A line segment was 14 cm. Find the copy length.

21. A drawing is reduced from 18 cm to 10.8 cm. Find the scale factor.

22. Triangles with sides 2.5, 4, 6 and 5, 8, 12: similar or not?

23. Rectangles 5×8 and 15×24 : similar or not?

24. A shape has perimeter 30 cm. It is enlarged by factor 4. What is the new perimeter?

25. A shape has perimeter 48 cm after enlargement by factor 3. What was the original perimeter?

26. Explain briefly how you check whether two shapes are similar using side lengths.

27. A smaller triangle has side x . A similar larger triangle has matching side $5x$. What is the scale factor?

Build Tasks – Answers



19. 150000 cm

22. Yes

25. 16 cm

20. 16.8 cm

23. Yes

26. Check that all matching side ratios are equal.

21. 0.6

24. 120 cm

27. 5

Push Tasks



1. Triangle A has sides 4, 6, 10. Triangle B has sides 6, 9, 15. Prove they are similar using a ratio check.

2. Triangle A has sides 5, 7, 9. Triangle B has sides 10, 14, 19. Are they similar? Justify.

3. A triangle with sides 3, 4, 5 is enlarged so the longest side becomes 17.5 cm. Find the other two sides.

4. A rectangle is 8 cm by 14 cm. A similar rectangle has longer side 35 cm. Find the shorter side.

5. A similar triangle has scale factor $\frac{5}{4}$. One original side is 16 cm. Find the new matching side.

6. A similar triangle has scale factor $\frac{3}{4}$. One new side is 18 cm. Find the original matching side.

7. Two similar polygons have perimeters 27 cm and 45 cm. Find the scale factor from small to large.

8. A shape has area 12 cm^2 . It is enlarged by scale factor 3. What happens to each side length?

9. A small triangle has perimeter 18 cm. A similar larger triangle has factor 2.5. Find the new perimeter.

Push Tasks – Answers



1. Yes, factor 1.5

4. 20 cm

7. $\frac{5}{3}$

2. No

5. 20 cm

8. Each side length is multiplied by 3.

3. 10.5 cm and 14 cm

6. 24 cm

9. 45 cm

Push Tasks



10. A map is drawn at scale $\frac{1}{25000}$. A river is 7.2 cm on the map. Find the real length in cm.

11. A model car is built at scale $\frac{1}{18}$. The real car length is 4.5 m. Find the model length in m.

12. A photocopy is reduced to 80% size. What scale factor is this? If the width was 25 cm, find the new width.

13. Shapes P and Q are similar. A side goes from 9 cm on P to 15 cm on Q. Another side on P is 12 cm. Find its matching side on Q.

14. Shapes R and S are similar. A side on R is 18 cm and the matching side on S is 12 cm. Another side on R is 27 cm. Find the matching

15. A triangle has sides $x, x + 2, x + 4$. A similar triangle has matching sides $2x, 2x + 4, 2x + 8$. What is the scale factor?

16. Two triangles have side sets 6, 9, 12 and 10, 15, 20. Explain why one scale factor works for all three sides

17. Two shapes have equal angles but side ratios $2 : 3, 4 : 6$, and $5 : 8$. Are they similar? Why or why not?

18. A square is enlarged from side a to side $3a$. What is the scale factor? What happens to the perimeter?

Push Tasks – Answers



10. 180000 cm

13. 20 cm

16. All three matching side ratios equal $\frac{5}{3}$.

11. 0.25 m

14. 18 cm

17. No, because not all matching side ratios are equal.

12. 0.8 and 20 cm

15. 2

18. Scale factor 3; perimeter triples.

Push Tasks



19. A triangle with perimeter 24 cm is reduced by factor $\frac{2}{3}$. Find the new perimeter.

20. A similar rectangle has dimensions $3x$ by $5x$. A larger one has dimensions $12x$ by $20x$. Find the scale factor.

21. A shape is enlarged by factor k . One side changes from 7 cm to 28 cm. Find k .

22. A shape is reduced by factor k . One side changes from 30 cm to 18 cm. Find k .

23. Two similar triangles have matching sides a and $1.5a$. Another side on the smaller triangle is 14 cm. Find the larger matching side

24. A polygon side is 11 cm after enlargement by factor 2.2. Find the original matching side.

25. State one similarity test using side lengths only.

26. Why can two shapes with one matching side ratio still fail to be similar?

27. A large triangle is similar to a small one with factor 4. If the small sides are 2, 3, 4, write the large side lengths

Push Tasks – Answers



19. 16 cm

22. 0.6

25. If all matching side ratios are equal, the shapes are similar.

20. 4

23. 21 cm

26. Because one ratio alone does not guarantee all other matching sides are in the same proportion.

21. 4

24. 5 cm

27. 8 cm, 12 cm, 16 cm