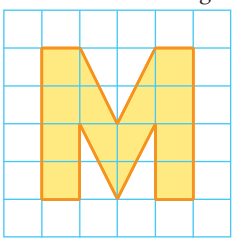
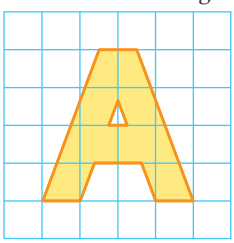
Chapter 4 Scale Factors and Similarity

4.1 Enlargements and Reductions, pages 136–138

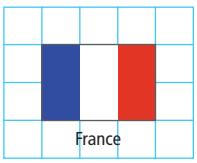
4. a) Use a 1-cm grid instead of a 0.5 cm grid.



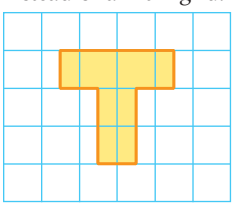
b) Use a 1-cm grid instead of a 0.5 cm grid.



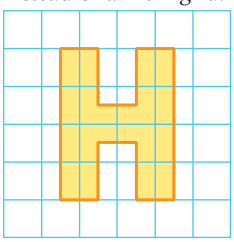
5. Use a 2-cm grid instead of a 0.5 cm grid.



6. a) Use a 0.5-cm grid instead of a 1 cm grid.

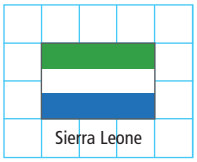


b) Use a 0.5-cm grid instead of a 1 cm grid.



7. a) greater than 1 **b)** equal to 1 **c)** less than 1

8.



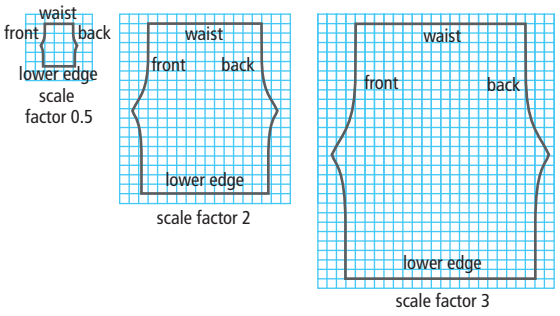
9. a) enlargement **b)** 100. The lens makes all dimensions of the original image appear to be enlarged by 100 times.

10. Examine the font used in both posters. Mia's font is 0.5 cm high, and Hassan's is 0.25 cm high. Mia's font is twice the height of Hassan's, so the scale factor is 2.

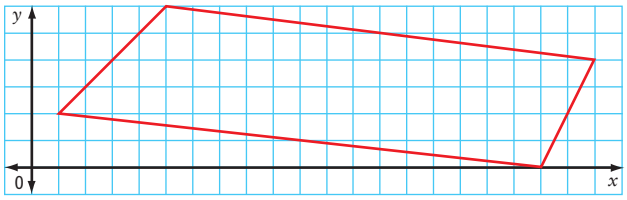
11. Example: Measure the width of the sunglasses in both images. Determine the scale factor. Then, see if the scale factor applies to another pair of corresponding parts (e.g. the width of the mouth).

12. a) width = 27 cm, length = 54 cm
b) width = 4.5 cm, length = 9 cm

13.

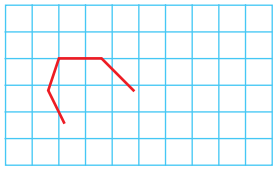


14.

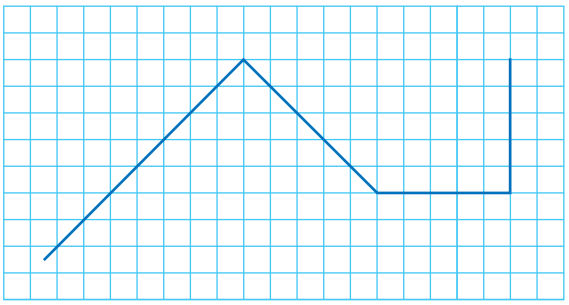


15. Example: You could reduce the image with a scale factor of $\frac{1}{4}$. Then, width = 10.5 cm, height = 7.5 cm, depth = 2.5 cm

17. a)



b)



4.2 Scale Diagrams, pages 143–145

4. a) Divide 144 by 3. **b)** Divide 117 by 5.2.
5. a) 13 **b)** 126
6. a) 1210 cm or 12.1 m **b)** 16 mm
7. a) 38.9 m **b)** 14 m
8. a) 0.15 **b)** 1.68
9. a) 0.02 **b)** 0.5
10. 0.02
11. 0.04
12. $\frac{1}{16\,000\,000}$

13. a) 6.3 cm **b)** Yes, an actual egg could have a length of approximately 6.3 cm.

14. a) $\frac{1}{15}$ **b)** The length of the footprint image is approximately 3.4 cm. With the scale factor of $\frac{1}{15}$, the actual length of the footprint is approximately 51 cm. **c)** Example: The span of a human hand to the footprint could be approximately 1:2.1. The footprint is approximately 2 times as large as a human hand span.

15. 50 000

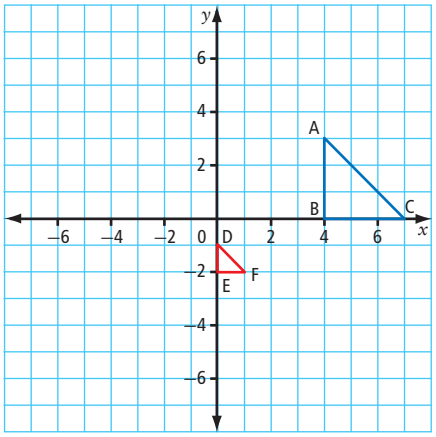
16. Yes, it will fit. The model will measure 2.5 m in height, giving it a 0.5 m clearance.

17. length = 17.4 m, height = 4.35 m

18. a) 2 **b)** 3 **c)** 1.5 **d)** $\frac{1}{3}$ **e)** $\frac{2}{3}$

19. a) $\frac{1}{1800}$ **b)** 2700 cm or 27 m

20. a)



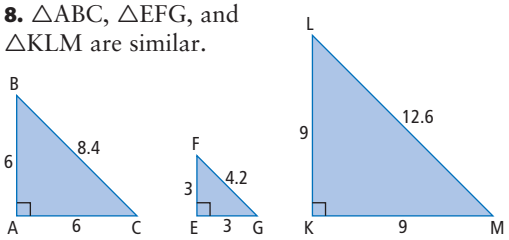
b) Yes, the sides of the larger triangle are 3 times the length of the sides of the smaller triangle. **c)** $\frac{1}{3}$ **d)** 3 **e)** Area of △ABC is 4.5 square units; area of △DEF is 0.5 square units. **f)** 1:0.1; 1:9 **g)** The scale factor of the area is 3 times larger than the scale factor of the sides (when comparing △DEF:△ABC)

21. a) 2.6 m **b)** 5.2 m

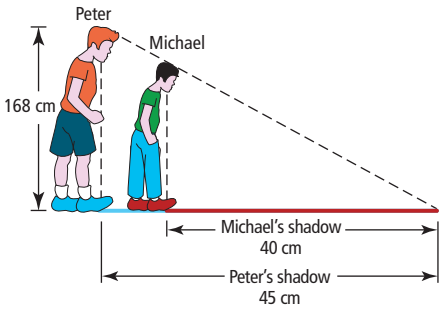
22. a) 2.5, $\frac{2}{5}$ **b)** Example: Scale factors between a smaller object and a larger one are often easier to use.

4.3 Similar Triangles, pages 150–153

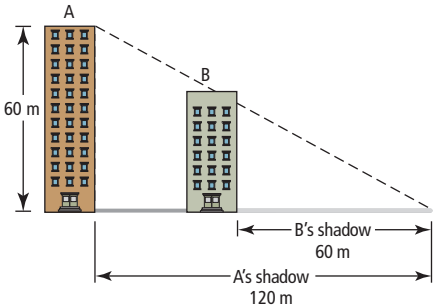
4. Corresponding angles: ∠P and ∠T, ∠Q and ∠U, ∠R and ∠V.
Corresponding sides: PQ and TU, PR and TV, QR and UV.
5. Corresponding angles: ∠A and ∠Y, ∠B and ∠W, ∠C and ∠X.
Corresponding sides: AB and YW, BC and WX, AC and YX.
6. Yes, the triangles are similar because the sides are the proportional; the sides are related by a scale factor of 5.
7. No, the triangles are not similar because the sides are not proportional.
8. △ABC, △EFG, and △KLM are similar.



9. $x = 56$
10. $x = 10$
12. 2.0 m
13. 4.0 m
14. 7.68 m
15. $x = 76.25$ cm
16. Peter is taller. Michael is 149.3 cm tall.



17. Example: Two buildings, A and B, stand side by side. Building A casts a shadow of 120 m and is 60 m tall. Building B has a shadow of 60 m. Using the diagram, find the height of Building B.

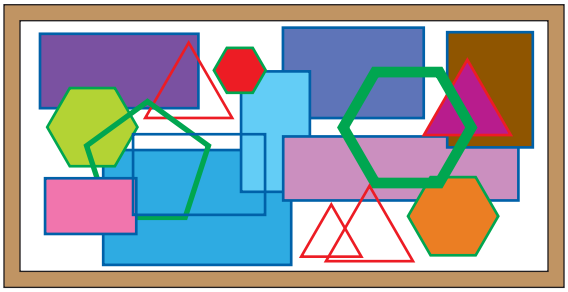


$\frac{60}{120} = \frac{x}{60}$
Building B is 30 m tall.

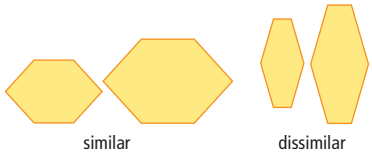
18. a) $x = 420.48$ m **b)** The shadow may not reach the street level due to surrounding buildings.
19. a) No, the corresponding angles are not equal. The angle measures of one triangle are: 50°, 60°, and 70°. The angle measures of the other triangle are: 50°, 50°, and 80°. **b)** Yes, the triangles are similar because they both have angle measures of 45°, 60°, and 75°.
20. a) 13.3 cm and 16.0 cm **b)** 1:2.67
21. First, measure your height, and the length of the building's shadow. After measuring your own shadow, find the ratio of your shadow to the building's shadow. Then, divide your height by that value to find the height of the building.
22. $ZY = 4.9$ cm
23. The area is 150 cm^2.

4.4 Similar Polygons, pages 157–159

3. a) Similar **b)** Not similar
4.

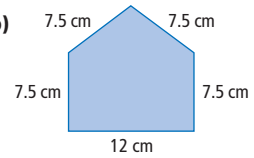


5. $x = 4$
6. $x = 2.8$ m
7. No. The corresponding angles must be the same.
8. a)



b) The two similar hexagons are similar to the photo because the interior angles are the same and the side lengths are related by a scale factor. The two dissimilar hexagons do not have these properties.
9. The side length of the game board will be 15.0 cm.
10. a) 7.5 m **b)** 1080°. Example: An octagon can be divided into six non-overlapping triangles.
11. a) The final enlargement should be 6 times the size of the original diagram. **b)** The corresponding angles are equal, and the dimensions are all enlarged by the same proportion.
12. 39.3 cm
13. 14.1 cm

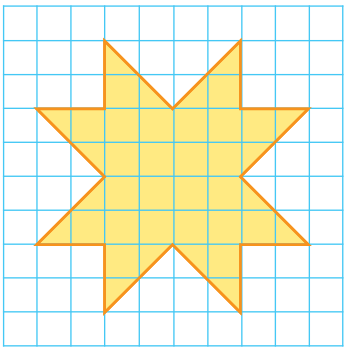
14. a) $\frac{1}{20}$ **b)**



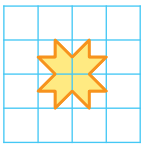
c) $\text{length}_{\text{model}} = 15$ cm, $\text{width}_{\text{model}} = 12$ cm
15. 19 250 L
16. The ratio of areas to the ratio of corresponding side lengths in similar polygons is equal to the scale factor comparing side lengths squared.
17. The volume ratio is the same as the side ratio cubed.
18. a) The similar polygons have 7 sides, so they are heptagons. **b)** Example: Each heptagon is a reduction of the centre heptagon, with the scale factor decreasing with distance from the centre.

Chapter 4 Review, pages 160–161

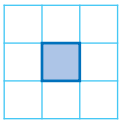
1. POLYGON
2. SIMILAR
3. SCALE FACTOR
4. PROPORTION
5. a)



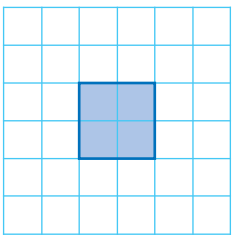
b)



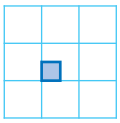
6. The vertical height of the drawing is 3 cm. The enlarged egg will have a vertical height of 9 cm.
7. The vertical height of the drawing is 3 cm. The reduced drawing will have a vertical height of 1.5 cm.
8. a)



b)



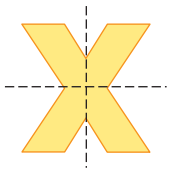
c)



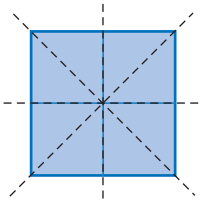
9. $\frac{2}{13}$
10. a) 14 cm **b)** 13.9 cm
11. 8.7 cm
12. $\frac{1}{10\ 000\ 000}$
13. No. The corresponding sides are not proportional.
14. $x = 10$
15. $x = 3$
16. The polygons are not similar.
17. 10.1 cm
18. $x = 7.2$; $y = 9.6$

Chapters 1–4 Review, pages 166–168

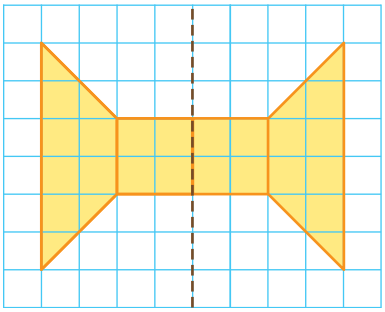
1. a)



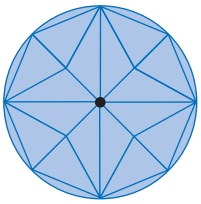
b)



2. Example: The shape could be traced and cut out, then flipped over the dashed line and traced as the reflected image or each point could be reflected over the dashed line and connected to create the shape.



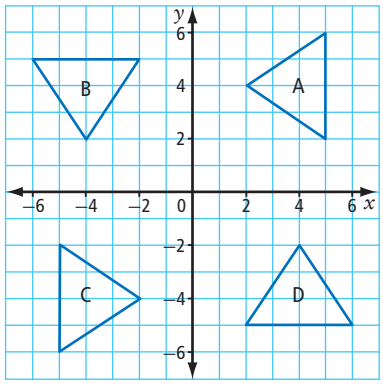
3.



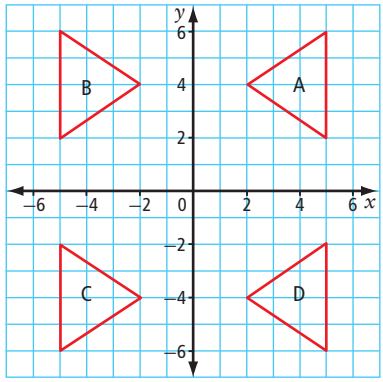
a) Example: There are four lines of symmetry, 1 vertical, 1 horizontal and 2 oblique. **b)** Example: 4
c) 90°, $\frac{1}{4}$ revolution

4. a) Example: Diameter of circular cake and side length of square cake are 25 cm. Height of both cakes is 10 cm. Square: 1625 cm^2, circle: 1276.5 cm^2
b) Example: Square: 2625 cm^2, an increase of 61.5%. Circle: 2276.3, an increase of 78.3%.

5. a)



b)



6. a) 11 250 cm² **b)** 10 000 cm², a decrease in surface area of 1250 cm²

7. $-2\frac{3}{4}, -0.9, -\frac{4}{5}, -\frac{2}{3}, 0.\overline{6}, 2.7$

8. $-6\frac{7}{20}$

9. a) −1, −0.68 **b)** 4, 3.6 **c)** 4, 4.6 **d)** −1, −1.07
e) −2, −2.03 **f)** −20, −22.26 **g)** 4, 3.41 **h)** 1, 1

10. a) $2, 2\frac{1}{5}$ **b)** $-1\frac{1}{3}, -1\frac{1}{15}$ **c)** $-\frac{25}{12}, -\frac{19}{12}$
d) $-\frac{1}{3}, -\frac{7}{24}$ **e)** $-\frac{3}{70}, -\frac{3}{70}$ **f)** $\frac{5}{6}, \frac{5}{6}$ **g)** $-2, -1\frac{17}{18}$
h) $6, 6\frac{1}{4}$

11. a) 2 cm, 1.6 cm **b)** 0.1 km, 0.1 km
c) 0.2 mm, 0.22 mm **d)** 1 km, 1.01 km

12. 6.8 m

13. 4^{17}

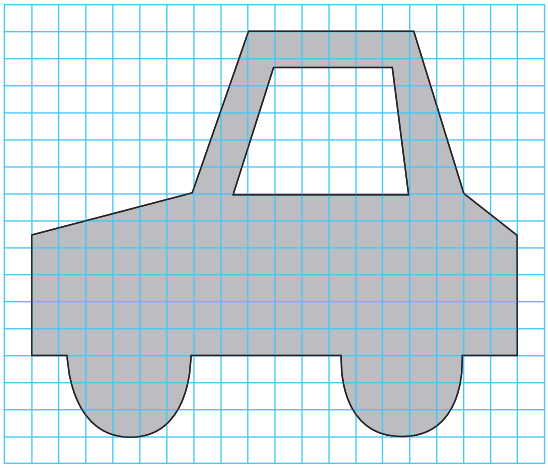
14. 3

15. $(-4)^9$, −262 144

16. $21 \times 21 \times 21 \times 21$, $3^4 \times 7^4$

17. a) 1600 **b)** 25 600

18.



19. a) 12 **b)** 18.5 **c)** 0.414

20. $x = 1$

21. 647 km; assuming the distance on the diagram measures 4.2 cm

22. Rectangles B and D and rectangles A and F are similar.

23. a) hexagons, triangles, heptagons **b)** The hexagons are similar, the triangles are similar, and the heptagons are similar. Example: Each triangle shares two edges with hexagons and one edge with a heptagon. The similar shapes decrease in size with distance from the centre.