

GCSE Maths: Area and volume scale factors (Higher): answers

GCSE Maths - Transformations and Similarity - Higher - Lesson 21.9

Answers. Final answers to the worksheet questions. Full step-by-step solutions for every question are free at websink.site/gcse/maths/ch21-transformations-congruence-similarity/higher/area-and-volume-scale-factors/

Exercise 21J Area and volume scale factors Non-calculator

- 1 Each pair of shapes is similar. The length scale factor from the small shape to the large shape is given. Work out the area or volume of the large shape.

- (a) Length scale factor 2. Area of small shape = 5 cm^2 . Area of large shape?

Answer: 20 cm^2

- (b) Length scale factor 3. Area of small shape = 7 cm^2 . Area of large shape?

Answer: 63 cm^2

- (c) Length scale factor 2. Volume of small solid = 9 cm^3 . Volume of large solid?

Answer: 72 cm^3

- (d) Length scale factor 3. Volume of small solid = 4 cm^3 . Volume of large solid?

Answer: 108 cm^3

- 2 A square has sides of length 3 cm. A larger square has sides of length 6 cm. (a) Work out the area of each square. (b) Write the ratio of the areas in its simplest form. (c) Write down the ratio of the lengths, and compare it with the ratio of the areas.

- (a) Areas of the squares

Answer: 9 cm^2 and 36 cm^2

- (b) Ratio of the areas

Answer: $1 : 4$

- (c) Ratio of the lengths, and comparison

Answer: Lengths $1 : 2$; areas $1 : 4 = 1^2 : 2^2$

- 3 A cube has a volume of 5 cm^3 . A larger cube has lengths that are 3 times as long. Work out the volume of the larger cube.

Answer: 135 cm^3

- 4 The lengths of two similar shapes are in the given ratio. Write down the ratio of their areas and the ratio of their volumes.

- (a) $1 : 2$

Answer: Areas $1 : 4$; volumes $1 : 8$

- (b) $2 : 3$

Answer: Areas $4 : 9$; volumes $8 : 27$

(c) 3 : 4

Answer: Areas 9 : 16; volumes 27 : 64

(d) 4 : 10

Answer: Areas 4 : 25; volumes 8 : 125

- 5 A lawn has an area of 5 m^2 . A similar lawn has all its lengths 3 times as long. Work out the area of the larger lawn.

Answer: 45 m^2

- 6 A model of a ship is 20 cm long. The real ship is 100 times as long. The model has a deck area of 60 cm^2 . Work out the deck area of the real ship in m^2 .

Answer: 60 m^2

- 7 Two similar bottles have heights 10 cm and 20 cm. The smaller bottle holds 300 ml of juice. How much does the larger bottle hold?

Answer: 2400 ml

- 8 Tom says: "If I double all the lengths of a cuboid, its volume doubles." Explain why Tom is wrong. Use a cuboid 2 cm by 3 cm by 4 cm.

Answer: The volume becomes 8 times bigger: 24 cm^3 to 192 cm^3

- 9 A cylinder has a surface area of 50 cm^2 . It is enlarged with a scale factor of 2. Sophie says the new surface area is 100 cm^2 . Is she right? Explain.

Answer: No. Surface area is multiplied by $2^2 = 4$, so the new surface area is 200 cm^2

- 10 Two similar shapes have areas 20 cm^2 and 80 cm^2 . A side of the smaller shape is 7 cm. Work out the length of the matching side of the larger shape.

Answer: 14 cm

- 11 Two similar solids have volumes 8 cm^3 and 125 cm^3 . A length on the smaller solid is 6 cm. Work out the matching length on the larger solid.

Answer: 15 cm

- 12 The areas (or volumes) of two similar shapes are given as a ratio. Find the ratio asked for.

(a) Areas 4 : 9. Write the ratio of the volumes.

Answer: Volumes 8 : 27

(b) Areas 9 : 25. Write the ratio of the volumes.

Answer: Volumes 27 : 125

(c) Volumes 8 : 27. Write the ratio of the areas.

Answer: Areas 4 : 9

(d) Volumes 27 : 64. Write the ratio of the lengths.

Answer: 3 : 4

- 13 Two similar tins of beans have heights 8 cm and 12 cm. The smaller tin holds 400 ml and costs 80p. The larger tin costs £2.50. Work out the volume of the larger tin. Which tin is better value for money? Show your

working.

Answer: 1350 ml. The larger tin is better value (the same amount in small tins would cost £2.70).

- 14 Challenge.** Two similar statues are made of the same stone. The small statue is 40 cm tall and weighs 2 kg. The large statue is 1.2 m tall. Work out the weight of the large statue.

Answer: 54 kg

Exercise 21K Area and volume: problem solving Non-calculator

- 1** A pizza with a diameter of 20 cm costs £6. A similar pizza has a diameter of 30 cm and costs £12. Which pizza is better value? Explain. (Both pizzas have the same thickness and the same toppings.)

Answer: The 30 cm pizza: it has 2.25 times the area for only 2 times the price

- 2** A wall of area 12 m² needs 3 litres of paint. A similar wall has every length twice as long. How much paint does it need?

Answer: 12 litres

- 3** A model of a building is made to a scale of 1 : 50. The model has a surface area of 200 cm² and a volume of 120 cm³. Work out (a) the surface area, in m², of the real building, (b) the volume, in m³, of the real building.

- (a) (a) Surface area of the real building

Answer: 50 m²

- (b) (b) Volume of the real building

Answer: 15 m³

- 4** Two cubes have sides of 2 cm and 6 cm. Work out the ratio of their surface areas, in its simplest form.

Answer: 1 : 9

- 5** Dan says: "If I double the radius of a circle, the circumference doubles, so the area must double too." Show that Dan is wrong. Use a circle of radius 3 cm and leave your answers in terms of π .

Answer: Circumference doubles (6π to 12π) but the area is multiplied by 4 (9π to 36π)

- 6** Two similar cones have heights of 6 cm and 9 cm. The smaller cone has a curved surface area of 80 cm² and a volume of 150 cm³. Work out the curved surface area and the volume of the larger cone.

- (a) Curved surface area of the larger cone

Answer: 180 cm²

- (b) Volume of the larger cone

Answer: 506.25 cm³

- 7** Two similar jars are made of the same glass. The small jar is 10 cm tall and holds 400 ml. The large jar holds 1350 ml. Work out the height of the large jar.

Answer: 15 cm

- 8** Two similar triangles have areas of 18 cm² and 50 cm². The perimeter of the smaller triangle is 24 cm. Work out the perimeter of the larger triangle.

Answer: 40 cm

- 9 A cube has side a . A larger cube has side ka . Show that the ratio of their volumes is $1 : k^3$.

Answer: $a^3 : k^3 a^3 = 1 : k^3$

- 10 **Challenge.** A solid is enlarged so that its surface area increases by 125%. Work out the percentage increase in its volume.

Answer: 237.5%