FOUNDATION & HIGHER

SAME AT BOTH TIERS

Name ..... Class .....

R12: Similarity and scale

Reason about lengths, areas and volumes of similar shapes

20 marks · 25 minutes · Non-calculator

1) Explain why similar shapes with lengths in the ratio 1 : 3 have areas in the ratio 1 : 9

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[Question 1: 2 marks]

2) Show that similar solids with lengths in the ratio 2 : 5 have volumes in the ratio 8 : 125

[Question 2: 1 marks]

3) Kim says that doubling every length of a cube doubles its volume. Explain her mistake.

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[Question 3: 2 marks]

4) Two similar triangles have corresponding sides 4 cm and 10 cm. Show that the area of the larger triangle is 6.25 times the area of the smaller.

[Question 4: 2 marks]

5) Two similar cylinders have volumes 27 cm^3 and 64 cm^3. Show that their heights are in the ratio 3 : 4

[Question 5: 2 marks]

6) A model is made to a scale of 1 : 50. Explain why the model needs $\frac{1}{2500}$ of the paint needed for the real object.

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[Question 6: 2 marks]

7) Two similar shapes have areas 20 cm^2 and 45 cm^2. Show that their lengths are in the ratio 2 : 3

[Question 7: 2 marks]

8) Show that tan of the smallest angle is the same in a 3-4-5 triangle and a 6-8-10 triangle. Explain why.

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[Question 8: 2 marks]

9) Two similar bottles have heights 10 cm and 15 cm. The small bottle holds 400 ml. Show that the large bottle holds 1350 ml.

[Question 9: 2 marks]

10) Explain why all circles are similar.

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[Question 10: 1 marks]

11) Are a 4 cm by 6 cm rectangle and a 6 cm by 8 cm rectangle similar? Explain.

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[Question 11: 2 marks]

End of paper – 20 marks in total

Answers and brief mark scheme

Q	Answer	Method / notes
1	Explanation	Area uses two lengths (C1); $3^2 = 9$ (C1).
2	Shown	$2^3 : 5^3$ (C1).
3	Multiplies by 8	Three dimensions each doubled (C1); 2^3 (B1).
4	Shown	Scale factor 2.5 (M1); 2.5^2 (C1).
5	Shown	Cube roots 3 and 4 (M1); C1.
6	Explanation	Paint covers area (C1); area factor $50^2 = 2500$ (C1).
7	Shown	Area ratio 4 : 9 (M1); square roots (C1).
8	Both $\frac{3}{4}$	Equal values (M1); triangles are similar so angles are the same (C1).
9	Shown	Volume factor $1.5^3 = 3.375$ (M1); C1.
10	Explanation	Each is an enlargement of any other (C1).
11	No	Scale factors 1.5 and $\frac{4}{3}$ differ (M1); C1.