4.8 Similarity ratios and mixed practice

Name: _____ Class: _____ Date: _____ **Total: 29 marks**

KEY WORDS scale factor • similar

Similarity ratios and mixed practice

Objective

Use length : area : volume ratios $k : k^2 : k^3$ in both directions, on similar figures and solids, with maps and models, alongside mixed geometry and trigonometry chains (objectives Foundation 4.11 and Higher 4.11 A–C).

1 Key knowledge and worked examples

The ratio ladder. Similar figures: corresponding lengths scale by k, areas by k^2, volumes by k^3. Read backwards: an area ratio $4 : 9$ gives a length ratio $2 : 3$; a volume ratio $64 : 1$ gives $4 : 1$ for lengths. June 2024 2HR Q24's similar cone-plus-hemisphere solids gave $k^3 = 125/8$, so $k = 2.5$.

2 Practice

2.1 Two similar jugs have height ratio $2 : 5$. Write down their volume ratio. [2]

2.2 Two similar photographs have areas 18 cm^2 and 50 cm^2. Find the ratio of their widths. [3]

2.3 On a $1 : 25\,000$ map a road is 6 cm. Find the real length in km. [2]

2.4 A model car is built at $1 : 48$. The real car is 4.2 m long. Find the model length in cm. [3]

2.5 Similar cones have base radii 3 cm and 6 cm. The smaller has volume 12π cm^3. Find the larger's volume. [3]

3 Exam-style questions

3.1 *(Edexcel 4MA1 2HR June 2024 Q24 family, adapted.)* Solid B is similar to solid A, with every length of B equal to k times the corresponding length of A. The volumes satisfy $V_B = \frac{125}{8} V_A$. (a) Find k. (b) A third solid C has every length 4 times solid A's. Write down $V_C : V_A$. [4]

3.2 *(Original.)* Two similar tins of soup have heights 8 cm and 12 cm. The larger tin holds 486 cm^3. (a) Find the volume of the smaller tin. (b) The larger tin's label wraps its curved surface, area 150 cm^2. Find the label area of the smaller tin. [6]

3.3 *(Original, mixed transfer.)* A rectangular paddock measures 40 m by 25 m on a plan drawn at 1 : 1000. (a) Find the plan's dimensions in cm. (b) A scale model of a prize cow is 1 : 20; the real cow has volume-equivalent body mass 640 kg and the model uses material of the same density. Find the model's mass in grams. [6]