Similar 3D Shapes — Volume and Area

Core Worksheet

Worked Examples & Guided Practice

I Do (Teacher Model) Two similar cylinders have heights 4 cm and 6 cm. The surface area of the smaller cylinder is 40 cm^2. Calculate the surface area of the larger cylinder.

We Do (Guided Practice) Two similar pyramids have volumes 64 cm^3 and 216 cm^3. The surface area of the larger pyramid is 135 cm^2. Calculate the surface area of the smaller pyramid.

You Do (Independent Practice) Two similar cones have surface areas 16π cm^2 and 25π cm^2. The volume of the smaller cone is 128 cm^3. Calculate the volume of the larger cone.

Challenge (Extension) Solid A and Solid B are mathematically similar and made of the same material. The mass of Solid A is 250 g and the mass of Solid B is 1600 g. Given the height of Solid A is 10 cm, calculate the height of Solid B.

Practice Perfect Questions

Q1. Two similar boxes have lengths 5 cm and 15 cm. The surface area of the smaller box is 30 cm^2. Find the surface area of the larger box.

Q2. Two similar bottles have heights 12 cm and 18 cm. The volume of the smaller bottle is 240 cm^3. Calculate the volume of the larger bottle.

Q3. Two similar statues have volumes 80 cm^3 and 270 cm^3. The height of the smaller statue is 12 cm. Calculate the height of the larger statue.

Q4. Two similar spheres have surface areas 36π cm^2 and 81π cm^2. The volume of the larger sphere is 243π cm^3. Calculate the volume of the smaller sphere.

Q5. A toy car and a real car are similar. The real car is 4 m long and has a volume of 8 m^3. If the toy car is 20 cm long, calculate its volume in cm^3.

Q6. Two similar metal ornaments have masses 54 g and 250 g. If the surface area of the smaller ornament is 72 cm^2, calculate the surface area of the larger ornament.

Answers & Worked Solutions

Model Solutions

- **I Do:** Linear scale factor $k = \frac{6}{4} = 1.5 \implies$ Area factor $= 1.5^2 = 2.25 \implies$ Area $= 40 \times 2.25 = 90$ cm^2
- **We Do:** Volume ratio $= \frac{216}{64} = \frac{27}{8} \implies k = \sqrt[3]{\frac{27}{8}} = \frac{3}{2} \implies$ Area ratio $= \left(\frac{3}{2}\right)^2 = \frac{9}{4} \implies$ Area $= 135 \div \frac{9}{4} = 60$ cm^2
- **You Do:** Area ratio $= \frac{25}{16} \implies k = \sqrt{\frac{25}{16}} = \frac{5}{4} \implies$ Volume ratio $= \left(\frac{5}{4}\right)^3 = \frac{125}{64} \implies$ Volume $= 128 \times \frac{125}{64} = 250$ cm^3
- **Challenge:** Mass ratio $=$ Volume ratio $= \frac{1600}{250} = \frac{32}{5} = 6.4 \implies k = \sqrt[3]{6.4} = 1.8566 \implies$ Height$_B = 10 \times 1.8566 \approx 18.6$ cm

Practice Perfect Questions Solutions

Q1. $k = \frac{15}{5} = 3 \implies$ Area factor $= 9 \implies$ Area $= 30 \times 9 = 270$ cm^2

Q2. $k = \frac{18}{12} = 1.5 \implies$ Volume factor $= 1.5^3 = 3.375 \implies$ Volume $= 240 \times 3.375 = 810$ cm^3

Q3. Volume ratio $= \frac{270}{80} = \frac{27}{8} \implies k = \sqrt[3]{\frac{27}{8}} = 1.5 \implies$ Height $= 12 \times 1.5 = 18$ cm

Q4. Area ratio $= \frac{36}{81} = \frac{4}{9} \implies k = \frac{2}{3} \implies$ Volume ratio $= \frac{8}{27} \implies$ Volume $= 243\pi \times \frac{8}{27} = 72\pi$ cm^3

Q5. $k = \frac{400 \text{ cm}}{20 \text{ cm}} = 20 \implies$ Volume factor $= 20^3 = 8000 \implies$ Toy volume $= \frac{8\,000\,000 \text{ cm}^3}{8000} = 1000$ cm^3

Q6. Mass ratio $= \frac{250}{54} = \frac{125}{27} \implies k = \frac{5}{3} \implies$ Area ratio $= \frac{25}{9} \implies$ Area $= 72 \times \frac{25}{9} = 200$ cm^2