



4.13H Volume of a Prism: Higher Tier Practice

EDEXCEL 1MA1 · Calculator allowed · about 70 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** A cylindrical tank has radius 0.9 m and height 2.5 m. Calculate the volume of the tank. Give your answer to 3 significant figures.

(Total for Question 1 is 3 marks)

- 2** A triangular prism has a triangular cross-section with base 8 cm and height 6 cm. The length of the prism is 40 cm. Calculate the volume of the prism in cubic centimetres.

(Total for Question 2 is 3 marks)

- 3** A right triangular prism has a triangular cross-section with base 5 m and height 3 m. The volume of the prism is 150 m^3 . Work out the length of the prism.

(Total for Question 3 is 3 marks)

- 4 The cross-section of a prism is a trapezium with parallel sides $6x$ cm and $(x + 4)$ cm and distance between the parallel sides 5 cm. The length of the prism is 12 cm. Express the volume of the prism in terms of x and simplify.

(Total for Question 4 is 3 marks)

- 5 Show that the volume, V cm³, of a prism whose cross-section is an isosceles triangle with sides $2x$, $2x$ and base 4 is $V = 4\sqrt{x^2 - 1} * L$, where L is the length of the prism.

(Total for Question 5 is 4 marks)

- 6 A metal prism has a triangular cross-section with base 9 cm and height 6 cm. The prism is 80 cm long. The metal has density 7.8 g/cm³. Calculate the mass of the prism in kilograms. Give your answer to 3 significant figures.

(Total for Question 6 is 5 marks)

- 7 A cylindrical column has height 3.6 m and volume 40.715 m³. Calculate the radius of the column. Give your answer correct to 2 decimal places.

(Total for Question 7 is 4 marks)

- 8** Two similar triangular prisms A and B have corresponding linear dimensions in the ratio $1 : k$. Prism A has cross-sectional area 24 cm^2 and length 15 cm . The volume of prism B is 2880 cm^3 . Find the scale factor k and the cross-sectional area of prism B.

(Total for Question 8 is 5 marks)

Mark scheme · 4.13H Volume of a Prism: Higher Tier Practice

Question 1

- **M1** Use of formula $V = \pi r^2 h$ with $r = 0.9$ and $h = 2.5$ or equivalent method
- **M1** substitution and evaluation to a correct intermediate value, e.g. $\pi * 0.9^2 * 2.5 = 6.362... \text{ m}^3$
- **A1** 6.36 m^3 awrt 3 s.f.
- **Answer: 6.36 m^3 (3 s.f.)**

Question 2

- **M1** Use of area triangle = $1/2 * \text{base} * \text{height} = 1/2 * 8 * 6 = 24 \text{ cm}^2$
- **M1** Multiply cross-sectional area by length: $24 * 40$
- **A1** 960 cm^3 cao
- **Answer: 960 cm^3**

Question 3

- **M1** Use $V = \text{area cross-section} * \text{length}$ and $\text{area} = 1/2 * 5 * 3 = 7.5 \text{ m}^2$
- **M1** Set up $\text{length} = V / \text{area} = 150 / 7.5$
- **A1** 20 m cao
- **Answer: 20 m**

Question 4

- **M1** Use area trapezium = $1/2 * (\text{sum parallel sides}) * \text{distance} = 1/2 * (6x + x + 4) * 5$
- **M1** Simplify $\text{area} = 1/2 * (7x + 4) * 5 = (35/2)x + 10$
- **A1** $\text{Volume} = 12 * ((35/2)x + 10) = 210x + 120 \text{ cm}^3$ cao
- **Answer: $210x + 120 \text{ cm}^3$**

Question 5

- **dM1** split the isosceles triangle into two right-angled triangles using the altitude from the apex to the base, each with hypotenuse $2x$ and base 2 (half of the base 4)
- **M1** use Pythagoras to find the altitude: $\sqrt{(2x)^2 - 2^2} = \sqrt{4x^2 - 4} = 2\sqrt{x^2 - 1}$
- **M1** $\text{area} = 1/2 * \text{base} * \text{height} = 1/2 * 4 * 2\sqrt{x^2 - 1} = 4\sqrt{x^2 - 1}$
- **A1** multiply area by length L to get $V = 4\sqrt{x^2 - 1} * L$, as required cso
- **Answer: $V = 4\sqrt{x^2 - 1} * L$ cso**

Question 6

- **M1** Find area triangle = $1/2 * 9 * 6 = 27 \text{ cm}^2$
- **M1** Find volume = $27 * 80 = 2160 \text{ cm}^3$
- **M1** Find mass in grams = $\text{volume} * \text{density} = 2160 * 7.8 = 16848 \text{ g}$
- **A1** Convert to kilograms: 16.848 kg
- **A1** Give answer to 3 s.f.: 16.8 kg awrt
- **Answer: 16.8 kg (3 s.f.)**

Question 7

- **M1** Use $V = \pi r^2 h$ and rearrange $r = \sqrt{V/(\pi h)}$
- **M1** Substitute values $r = \sqrt{40.715 / (\pi * 3.6)}$
- **M1** Evaluate to a correct numerical radius
- **A1** 1.90 m to 2 d.p. cao
- **Answer: 1.90 m**

Question 8

- **M1** Use similarity: areas scale as k^2 and lengths scale as k , so volumes scale as k^3
- **M1** Volume of A = $\text{area}_A \times \text{length}_A = 24 \times 15 = 360 \text{ cm}^3$; set up $360 \times k^3 = 2880$
- **M1** Solve $k^3 = 2880 / 360 = 8$, so $k = 2$
- **M1** Find $\text{area}_B = \text{area}_A \times k^2 = 24 \times 4 = 96 \text{ cm}^2$
- **A1** $k = 2$ and cross-sectional area = 96 cm^2 cao
- **Answer: $k = 2$, area of prism B = 96 cm^2**