4.13 Volume of a Prism: Test Pack

EDEXCEL 1MA1 · Calculator allowed · about 55 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

Formulae You May Need

Revision Library formulae reminder, styled on Edexcel 1MA1 formulae-sheet conventions; wording is original.

Volume of a prism = area of cross section x length

Area of a trapezium = (1/2) x (a + b) x h

Note: on the Edexcel formulae sheet, both of these formulae are given to you (foundation and higher tiers). You still need to recall the area of a rectangle (A = l x w), the area of a triangle (A = (1/2) x b x h) and the area of a parallelogram (A = b x h) yourself - these are not given.

1 litre = 1000 cm^3

1 m^3 = 1,000,000 cm^3 (since 1 m = 100 cm, and 100^3 = 1,000,000)

1 Lengths in a solid shape are measured in centimetres (cm).
What is the correct unit for the volume of the shape?

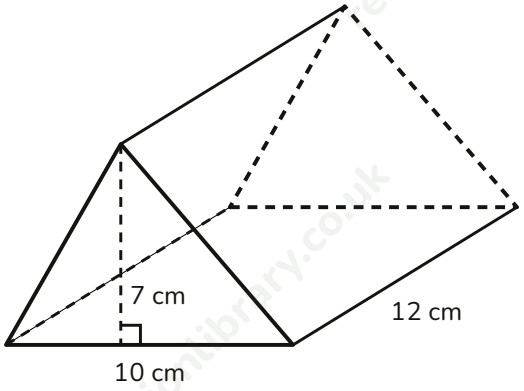
- ☐ A) cm
- ☐ B) cm^2
- ☐ C) cm^3
- ☐ D) cm^4

(Total for Question 1 is 1 mark)

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2 A prism has a cross-section that is a triangle with base 10 cm and perpendicular height 7 cm.
The prism is 12 cm long.
Work out the volume of the prism.

Diagram NOT accurately drawn

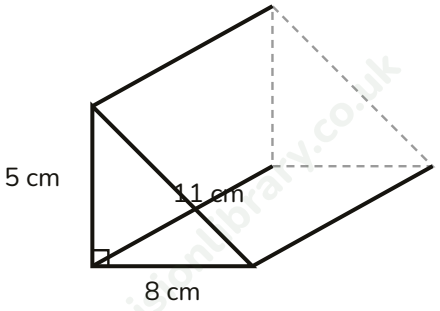


(Total for Question 2 is 3 marks)

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3 A triangular prism has a cross-section that is a right-angled triangle with base 8 cm and perpendicular height 5 cm. The prism has length 11 cm. Work out the volume of the prism.

Diagram NOT accurately drawn



(Total for Question 3 is 3 marks)

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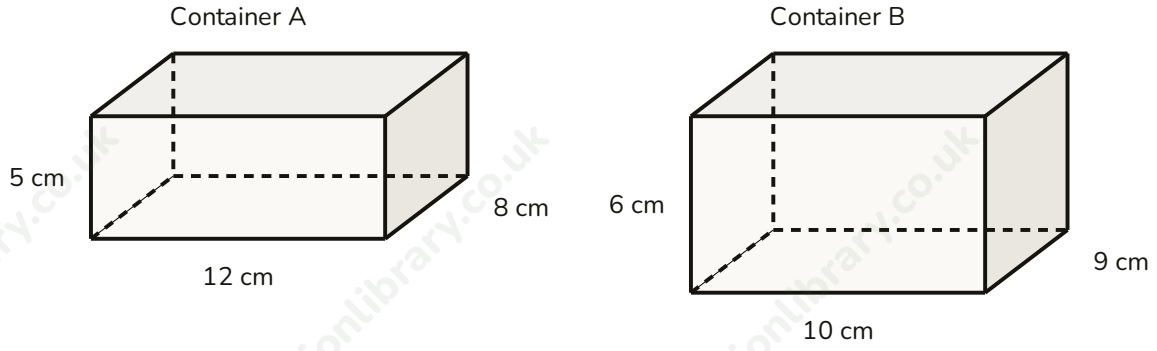
4 A cylindrical tank has radius 0.9 m and height 2.5 m. Calculate the volume of the tank. Give your answer to 3 significant figures.

(Total for Question 4 is 3 marks)

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5 Two water containers are both cuboids.
Container A measures 12 cm by 8 cm by 5 cm.
Container B measures 10 cm by 9 cm by 6 cm.
By calculating the volume of each container, determine which container has the greater capacity. You must show your working.

Diagram NOT accurately drawn

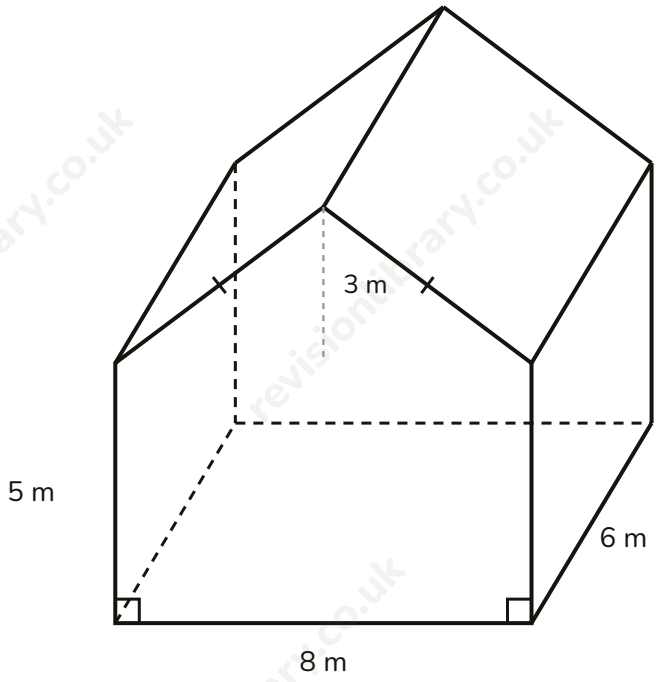


(Total for Question 5 is 3 marks)

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6 The diagram shows the end of a garden shed. The end is a pentagon made from a rectangle 8 m wide and 5 m tall, with an isosceles triangle on top of the rectangle. The triangle has a base of 8 m and a height of 3 m. The shed is a prism of length 6 m.
Work out the volume of the shed.

Diagram NOT accurately drawn

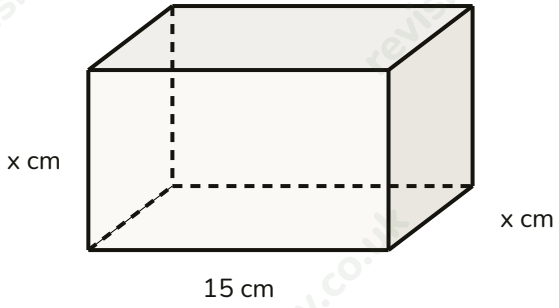


(Total for Question 6 is 5 marks)

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7 A cuboid has a square cross-section with side length x cm. The cuboid is 15 cm long. The volume of the cuboid is 540 cm^3.

Diagram NOT accurately drawn



(a) Show that $x^2 = 36$. **(2)**

(b) Work out the value of x. **(2)**

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(Total for Question 7 is 4 marks)

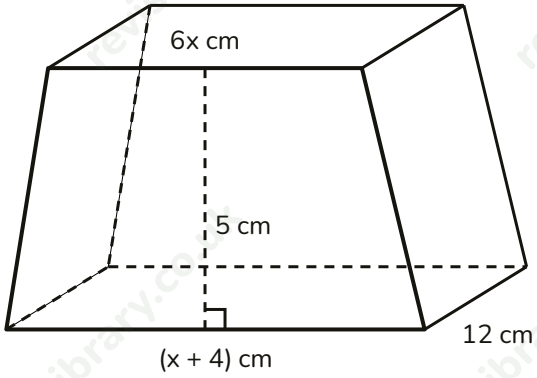
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8 A rectangular aquarium is 60 cm long, 30 cm wide and 40 cm high. Water is filled to a depth of 25 cm. Calculate the volume of water in litres. Give your answer to the nearest litre. (1 litre = 1000 cm^3)

(Total for Question 8 is 3 marks)

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9 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.

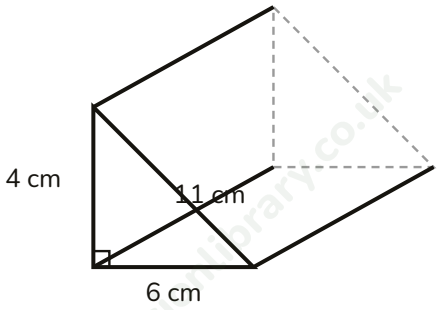


(Total for Question 9 is 3 marks)

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10 A factory makes solid rubber doorstops in the shape of a triangular prism. Each doorstop has a cross-section that is a right-angled triangle with base 6 cm and perpendicular height 4 cm, and the prism length is 11 cm.

Diagram NOT accurately drawn



(a) Show that the volume of one doorstop is 132 cm³. **(2)**

(b) The factory has a block of rubber with volume 3.168 m³. Work out the maximum number of complete doorstops that can be made from this block of rubber, assuming there is no wastage. **(3)**

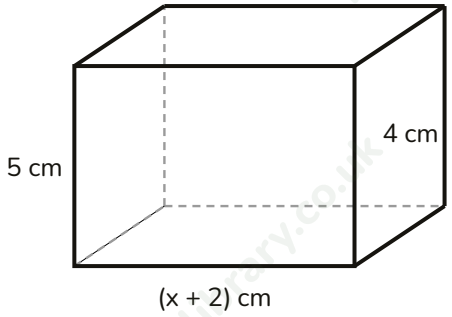
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(Total for Question 10 is 5 marks)

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11 A cuboid has length (x + 2) cm, width 4 cm and height 5 cm. The volume of the cuboid is 180 cm^3. Form an equation in terms of x, and solve it to find the value of x.

Diagram NOT accurately drawn

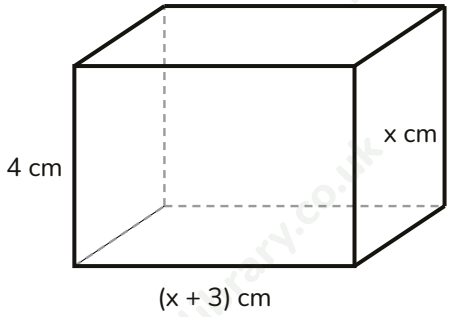


(Total for Question 11 is 3 marks)

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12 A cuboid has length (x + 3) cm, width x cm and height 4 cm. The volume of the cuboid is 280 cm^3.

Diagram NOT accurately drawn



(a) Show that $x^2 + 3x - 70 = 0$. **(3)**

(b) Hence find the value of x, giving a reason why one of the solutions to the equation should be rejected. **(3)**

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(Total for Question 12 is 6 marks)

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Mark scheme · 4.13 Volume of a Prism: Test Pack

Question 1

cm^3 identified (C) cao **B1**

Answer: C) cm^3

Question 2

area of triangle 1/2 x 10 x 7 = 35 **M1**

35 x 12 **M1**

420 cm^3 **A1**

Answer: 420 cm^3

Question 3

area of triangle = (1/2) x 8 x 5 (oe), = 20 cm^2 **M1**

correct substitution into V = area of cross section x length, e.g. 20 x 11 (oe, ft their area) **M1**

220 cm^3 (cao) **A1**

Answer: 220 cm^3

Question 4

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. $\pi * 0.9^2 * 2.5 = 6.362...$ m^3 **M1**

6.36 m^3 awrt 3 s.f. **A1**

Answer: 6.36 m^3 (3 s.f.)

Question 5

12 x 8 x 5 (= 480) oe **M1**

10 x 9 x 6 (= 540) oe **M1**

Container B, with both volumes correctly compared oe **A1**

Answer: Container B (540 cm^3 compared with 480 cm^3)

Question 6

8 x 5 (= 40) oe **M1**

0.5 x 8 x 3 (= 12) oe **M1**

40 + 12 ft (= 52, total cross-sectional area) **M1**

52 x 6 ft (their area x 6) **M1**

312 cao (units m^3) **A1**

Answer: 312 m^3

Question 7

(a) x^2 x 15 = 540 oe **M1**

(a) x^2 = 540 / 15 = 36 cso (correct working shown leading to the given answer) **A1**

(a) Answer: $x^2 = 36$ (shown)

(b) $\sqrt{36}$ ft (their part (a)) **M1**

(b) x = 6 cao (units cm, positive root only) **A1**

(b) Answer: x = 6 cm

Question 8

find volume in cm^3: 60 x 30 x 25 = 45000 cm^3 **M1**

convert to litres: 45000 / 1000 = 45 litres **M1**

45 litres cao **A1**

Answer: 45 litres

Question 9

Use area trapezium = 1/2*(sum parallel sides)*distance = 1/2*(6x + x + 4)*5 **M1**

Simplify area = 1/2*(7x + 4)*5 = (35/2)x + 10 **M1**

Volume = 12 * ((35/2)x + 10) = 210x + 120 cm^3 cao **A1**

Answer: 210x + 120 cm^3

Question 10

(a) area of triangle = (1/2) x 6 x 4 = 12 cm^2 **M1**

(a) 12 x 11 = 132 cm^3 fully shown with no errors (cso) **A1**

(a) Answer: 132 cm^3 (shown)

(b) converts 3.168 m^3 to cm^3, e.g. 3.168 x 1,000,000 (oe), = 3,168,000 cm^3 **M1**

(b) 3,168,000 / 132 (oe, ft their cm^3 volume and the value from part (a)) **M1**

(b) 24000 doorstops (cao) **A1**

(b) Answer: 24000 doorstops

Question 11

forms a correct equation, e.g. (x + 2) x 4 x 5 = 180, or 20(x + 2) = 180 (oe) **M1**

correct rearrangement, e.g. x + 2 = 9 (oe) **M1**

x = 7 (cao) **A1**

Answer: x = 7

Question 12

(a) forms a correct volume equation, e.g. (x + 3) x (x) x 4 = 280, or 4x(x + 3) = 280 (oe) **M1**

(a) correctly expands, e.g. $4x^2 + 12x = 280$ (oe) **M1**

(a) divides through by 4 and rearranges to $x^2 + 3x - 70 = 0$ fully shown with no errors (cso) **A1**

(a) Answer: $x^2 + 3x - 70 = 0$ (shown)

(b) correct factorisation (x - 7)(x + 10) = 0 (oe), or correct use of the quadratic formula **M1**

(b) x = 7 or x = -10 identified (both values found) **M1**

(b) x = 7, with a reason given for rejecting x = -10 (e.g. a length cannot be negative) **A1**

(b) Answer: x = 7 (x = -10 is rejected, since a length cannot be negative)

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