

Area, Surface Area, and Volume: practice solutions, Grade 10 – download the PDF

Written solutions to the chapter problems. Check each step, then correct yourself.

1 Area of a triangle



$$A = \frac{1}{2}bh = \frac{1}{2} \cdot 12 \cdot 7 = 42.$$

The area is **42 cm²**.

2 A trapezoid garden



$$A = \frac{1}{2}(9 + 15) \cdot 6 = 12 \cdot 6 = 72.$$

The garden covers **72 m²**.

3 A shoebox



Volume: $V = 12 \cdot 7 \cdot 5 = 420$.

Surface area: $SA = 2(12 \cdot 7 + 12 \cdot 5 + 7 \cdot 5) = 2(84 + 60 + 35) = 358$.

The box holds **420 in³** and needs **358 in²** of cardboard.

4 A soup can



$$V = \pi r^2 h = \pi \cdot 16 \cdot 10 = 160\pi.$$

That is about **502.65 cm³**.

5 A party hat



$$\text{Slant height: } \ell = \sqrt{9^2 + 12^2} = \sqrt{225} = 15 \text{ cm.}$$

$$\text{Volume: } V = \frac{1}{3}\pi \cdot 81 \cdot 12 = 324\pi \approx 1017.88 \text{ cm}^3.$$

$$\text{Lateral area: } \pi r \ell = \pi \cdot 9 \cdot 15 = 135\pi \approx 424.12 \text{ cm}^2.$$

6 A globe



$$V = \frac{4}{3}\pi \cdot 125 = \frac{500\pi}{3} \approx 523.60 \text{ in}^3.$$

$$SA = 4\pi \cdot 25 = 100\pi \approx 314.16 \text{ in}^2.$$

7 Name the cross section



- A circle, congruent to the bases.
- A rectangle whose width is the diameter and whose height is the height of the cylinder.
- A triangle (isosceles), with the base diameter as its base.
- A square, smaller than the base.

8 Doubling the radius



False. For $r = 2$: $V = \frac{4}{3}\pi \cdot 8 = \frac{32\pi}{3}$. For $r = 4$: $V = \frac{4}{3}\pi \cdot 64 = \frac{256\pi}{3}$.

The ratio is $\frac{256}{32} = 8$, so the volume is multiplied by $2^3 = 8$. The surface area is multiplied by $2^2 = 4$.

9 A patio with a curved end



The semicircle has diameter 12 ft, so its radius is 6 ft.

Rectangle: $20 \cdot 12 = 240$. Semicircle: $\frac{1}{2}\pi \cdot 6^2 = 18\pi \approx 56.55$.

Total: $240 + 18\pi \approx 296.55 \text{ ft}^2$.

10 A hexagonal tile



Perimeter: $P = 6 \cdot 6 = 36 \text{ cm}$.

$$A = \frac{1}{2}aP = \frac{1}{2} \cdot 3\sqrt{3} \cdot 36 = 54\sqrt{3}.$$

That is about 93.53 cm^2 .

11 A tent shaped like a prism



Base area: $B = \frac{1}{2} \cdot 6 \cdot 8 = 24 \text{ cm}^2$.

Volume: $V = Bh = 24 \cdot 15 = 360 \text{ cm}^3$.

Perimeter of the base: $6 + 8 + 10 = 24 \text{ cm}$. Lateral area: $24 \cdot 15 = 360$. Then

$SA = 2 \cdot 24 + 360 = 408 \text{ cm}^2$.

12 A glass pyramid



Volume: $V = \frac{1}{3} \cdot 100 \cdot 12 = 400 \text{ m}^3$.

The slant height of a face joins the apex to the midpoint of a base edge:

$$\ell = \sqrt{12^2 + 5^2} = 13 \text{ m}.$$

Lateral area: $\frac{1}{2} \cdot 40 \cdot 13 = 260$. With the base: $\text{SA} = 100 + 260 = 360 \text{ m}^2$.

13 An ice cream cone



Height: $h = \sqrt{10^2 - 6^2} = \sqrt{64} = 8 \text{ cm}$.

Volume: $\frac{1}{3} \pi \cdot 36 \cdot 8 = 96\pi \approx 301.59 \text{ cm}^3$.

Lateral area: $\pi \cdot 6 \cdot 10 = 60\pi \approx 188.50 \text{ cm}^2$.

14 Slicing a cone



The section is a circle similar to the base with scale factor $k = \frac{12}{20} = 0.6$.

Its radius is $8 \cdot 0.6 = 4.8 \text{ cm}$, so $A = \pi \cdot 4.8^2 = 23.04\pi \approx 72.38 \text{ cm}^2$.

15 Slicing a sphere



The radius ρ satisfies $\rho^2 = 13^2 - 5^2 = 169 - 25 = 144$, so $\rho = 12 \text{ cm}$.

The area is $\pi \cdot 144 = 144\pi \approx 452.39 \text{ cm}^2$.

16 A water tank

The radius is 3 ft. $V = \pi \cdot 9 \cdot 5 = 45\pi \approx 141.37 \text{ ft}^3$.

Gallons: $141.37 \cdot 7.48 \approx 1057$.

The tank holds about **1,057 gallons**.

17 A steel rod

$V = \pi \cdot 4 \cdot 10 = 40\pi \approx 125.66 \text{ cm}^3$.

$m = \rho V = 7.85 \cdot 125.66 \approx 986.5$.

The mass is about **986.5 g**.

18 A hollow pipe

The material is the large cylinder minus the hollow cylinder.

$V = \pi \cdot 5^2 \cdot 20 - \pi \cdot 4^2 \cdot 20 = 500\pi - 320\pi = 180\pi$.

That is about **565.49 in³**.

19 A stack of coins

The stack height is $40 \cdot 0.2 = 8$ cm. Every horizontal slice of either stack is a disk of radius 1.2 cm, so the cross sections have equal area at every level.

By Cavalieri's principle the volumes are equal: $V = \pi \cdot 1.2^2 \cdot 8 = 11.52\pi \approx 36.19 \text{ cm}^3$.

20 An ice cream treat



Cone: $\frac{1}{3}\pi \cdot 9 \cdot 9 = 27\pi$.

Hemisphere: $\frac{1}{2} \cdot \frac{4}{3}\pi \cdot 27 = 18\pi$.

Total: $45\pi \approx 141.37 \text{ cm}^3$.

21 Scaling similar cones



The scale factor is $k = \frac{3}{2}$.

Volume scales by $k^3 = \frac{27}{8}$: $40 \cdot \frac{27}{8} = 135 \text{ cm}^3$.

Surface area scales by $k^2 = \frac{9}{4}$: $50 \cdot \frac{9}{4} = 112.5 \text{ cm}^2$.

22 A grain silo



Cylinder: $\pi \cdot 36 \cdot 20 = 720\pi$. Hemisphere: $\frac{2}{3}\pi \cdot 216 = 144\pi$. Total: $864\pi \approx 2714.34 \text{ ft}^3$.

Wheat volume: $0.8 \cdot 2714.34 \approx 2171.47 \text{ ft}^3$. Mass: $2171.47 \cdot 48 \approx 104,230$.

The wheat weighs about **104,230 lb**.

23 Designing a can



Set $\pi r^2 \cdot 12 = 355$, so $r^2 = \frac{355}{12\pi} \approx 9.417$.

Then $r \approx 3.07$. The radius is about **3.07 cm**.



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