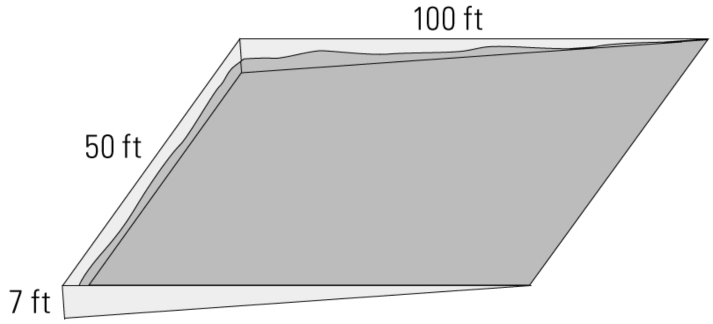
Section 6.3 Volume and Capacity of Prisms and Cylinders, Build Your Skills, p371–373
Student Resource p252–254

Build Your Skills

1. a)



b) Volume of pool:
$\frac{1}{2} \times 100 \times 7 \times 50 = 17\ 500$
The capacity of the pool is 17 500 ft^3.
Capacity of pool in US gallons:
$17\ 500 \times 7.48 = 130\ 900$
The capacity of the pool is 130 900 US gallons.
c) Use the Pythagorean theorem to calculate slope length (ℓ) of the bottom.
$c^2 = a^2 + b^2$
$\ell^2 = 7^2 + 100^2$
$\ell^2 = 10\ 049$
$\ell = \sqrt{10\ 049}$
$\ell \approx 100.24$
Total surface area:
$$7(50) + 2\left(\frac{1}{2}\right)(7)100 + 100.24(50) = 6062$$
The surface area of the inside of the pool is 6062 ft^2.

2. a) Calculate the cross-sectional area; multiply by length (converted to inches); convert to cubic feet.
Cross-sectional area:
$(8)(16) + (8)(40) = 448$ in^2
Volume of the footing:
$V = \ell \times w \times h$
$V = 16 \times 12 \times 8$
$V = 1536$
Volume of the foundation wall:
$V = \ell \times w \times h$
$V = 8 \times 12 \times 40$
$V = 3840$
Volume of concrete needed for one-foot length of wall:
$V = 1536 + 3840$

$V = 5376 \text{ in}^3$
Convert to cubic feet:
$5376 \div 12^3 \approx 3.11 \text{ ft}^3$
For a one-foot length of wall, 3.11 ft^3 of concrete is needed.
b) Total volume:
$25 \times 3.11 = 77.75 \text{ ft}^3$
Volume in cubic yards:
$\frac{77.75}{3^3} \approx 2.88$
2.88 or about 3 cubic yards are needed.

3. a) Volume = $\pi r^2 h$
$V = \pi \left(\frac{50}{2}\right)^2 \times (70)$
$V \approx 137\ 445$
One bin holds $137\ 445 \text{ cm}^3$ of flour.
b) Volume of sack = length × width × thickness
$V = 46 \times 80 \times 15$
$V = 55\ 200 \text{ cm}^3$
The number of sacks of flour in bin equals $\frac{\text{volume of bin}}{\text{volume of sacks}}$
The number of sacks of flour in bin equals $\frac{137\ 445}{55\ 200}$
$\frac{137\ 445}{55\ 200} \approx 2.49$
2.49 or about 2.5 sacks of flour fit in the bin.
c) Kilograms of flour = number of sacks × kilograms per sack
Kilograms of flour = 2.49 × 20
Kilograms of flour = 49.8 kg
The bin holds 49.8 kg or about 50 kg of flour.
d) Each of the three dimensions of the salt bin is one half the dimension of the flour bin (the radius is used twice in the volume calculation).
$V_{\text{salt}} = \left(\frac{1}{2}\right)^3 \times V_{\text{flour}}$
$V_{\text{salt}} = \frac{1}{8} \times V_{\text{flour}}$
$V_{\text{salt}} = \frac{1}{8} \times 137\ 445$
$V_{\text{salt}} \approx 17\ 181 \text{ cm}^3$

The volume of salt in the bin is $17\ 181 \text{ cm}^3$.

4. a) $V = \pi r^2 h$
$V = \pi \left(\frac{62.2}{2}\right)^2 (149.9)$
$V \approx 455\ 483 \text{ cm}^3$
Convert centimetres to litres.
1 litre = 1000 cm^3

$V = \dfrac{455\ 483}{1000}$

$V \approx 455$ L

The total volume is 455 litres.

b) $\dfrac{\text{Hot water tank capacity}}{\text{Total volume}} \times 100$

$\dfrac{270}{455} \times 100 \approx 59.3\%$

The rated water capacity of the tank is 59.3%, or just over one half its total volume.

A hot water tank has a rated capacity, but also has a discharge rate that is measured in either litres per second or gallons per minute. Have students research what the current discharge rate is for today's energy-efficient hot water tanks and determine how quickly it would take the hot water tank in this question to be drained.

5. a) Area of bubble wrap = surface area of shaft

surface area of shaft = πdh

$A = \pi(40)(475)$

$A \approx 59\ 690$ mm^2

Convert millimetres to centimetres.

1 cm^2 = (10 × 10) mm^2

$\dfrac{59\ 690}{100} \approx 597$ cm^2

The area of bubble wrap needed is 597 cm^2.

b) Volume of box = volume of (shaft + bubble wrap)

Volume of box = 6 × 6 × 50

6 × 6 × 50 = 1800 cm^3

Volume of (shaft + bubble wrap) = $\pi r^2 h$

For the radius, use the radius of the shaft plus one layer of bubble wrap thickness.

$r = \left(\dfrac{4}{2} + 1\right)$

$r = 3$ cm

Volume of (shaft + bubble wrap) = $\pi(3)^2(47.5)$

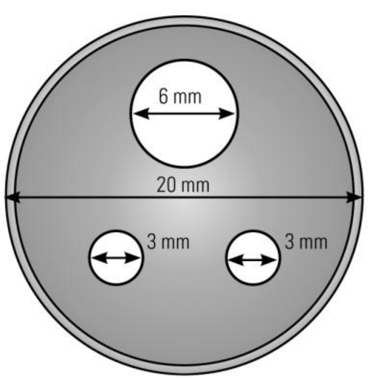
V ≈ 1343 cm^3

Volume of additional packing = 1800 − 1343

1800 − 1343 = 457

The volume of additional packaging is 457 cm^3.

6.



Total volume = (Cross-section of outer pipe − cross-section of inner holes) × length

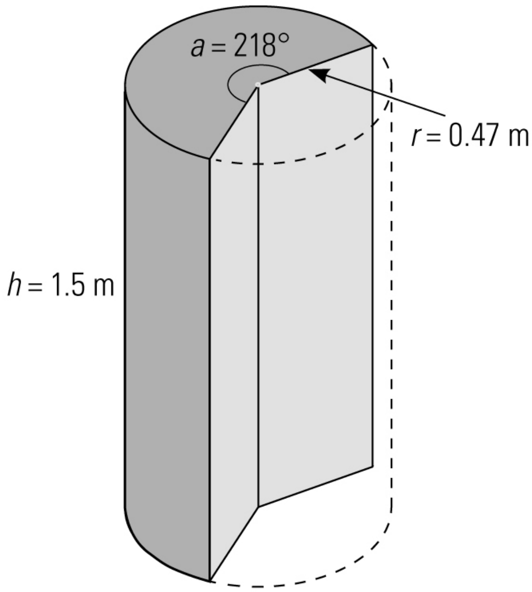
$$V = \left[\pi\left(\frac{20}{2}\right)^2 - \pi\left(\frac{6}{2}\right)^2 - 2\pi\left(\frac{3}{2}\right)^2\right] \times 1000$$

$V \approx 271\ 748$ mm^3

For each metre of extrusion, 271 748 mm^3 of plastic are needed.

Extend Your Thinking

7.



Volume of a cylinder = area of base × height

The area of the base will be proportional to the total circular area by the ratio of the angle to the total angles in a circle, or $\frac{218°}{360°}$.

$V = \pi r^2 \times \left(\frac{218}{360}\right)$

$V = \pi 0.47^2(1.5)\left(\frac{218}{360}\right)$

$V \approx 0.63$

The volume of the section is 0.63 m^3.