Unit 1: Measurement

In this unit we will solve problems involving:

✓ linear measurement

✓ conversion within or between SI and imperial systems of measurement

Ch2 - surface area and volume of 3-D objects

Ch3 - right triangles and trigonometry

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# Chapter 2: Surface Area and Volume

Chapter Goals:

- Solve problems that involve units of area and volume with SI and imperial systems.

- Solve problems involving SA and V of many 3-D shapes

- Solve problems involving square roots and cube roots of numbers.

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2.1 Units of Area and Volume

Tiles imported from different countries sometimes have imperial dimensions. A tile layer may need to convert from square feet to square centimetres.

One type of floor tiles is sold in squares measuring 1 ft by 1 ft.

30.48cm

1 ft = ? cm

1in = 2.54cm

12in = 1ft
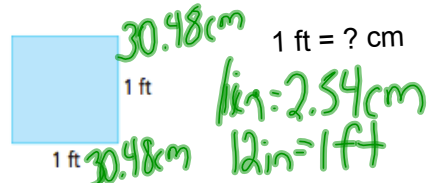
a) What is the area of one tile in square centimetres?

1 ft   30.48cm

1ft = 30.48cm

b) The tile layer is working with an area that measures 8 ft by 4 ft. What is the area, to the nearest hundredth of a square centimetre? to the nearest square metre?

a) $(30.48cm)^2 = 929.0304 cm^2$

$1ft = 0.3048 m$

$1m = 3.2808 ft$

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$1m = 3.2808 ft$

$3.5m =$

$11.4828 ft$

Sahid has numerous boxes to load onto a moving truck.

U MOVE

2.2 m $= 7.2ft$

$2.3m =$

$7.55 ft$

3.5 m   2.3 m

What is the volume of the truck, to the nearest cubic foot?

$V = lwh$ V in meter

$= (3.5m)(2.3m)(2.2m)$

$V = 17.71 m^3$

$V = lwh$

$(11.4828ft)(7.2ft)(7.55ft)$

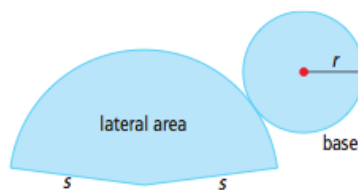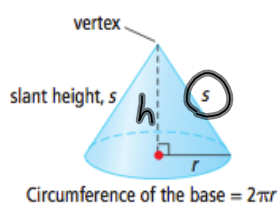$V = 625.4 ft^3$

$V = 625 ft^3$

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Homework: Pg 61 #1ac, 4, 7, 9, 12

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2.2 Surface Area: Right Cone

Surface Area of a Right Cone

Consider a right **cone** with **slant height** s and base radius r.
Construct a net of the cone, including the **lateral area** and the base.

Circumference of the base = $2\pi r$

slant height

- the shortest lateral distance from the edge of the base of a cone or pyramid to its highest point

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Building the SA formula of a Right Cone

Video on how to derive the surface area
of a cone formula

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The total surface area of a right cone is the sum of the areas of the base and the lateral surface.
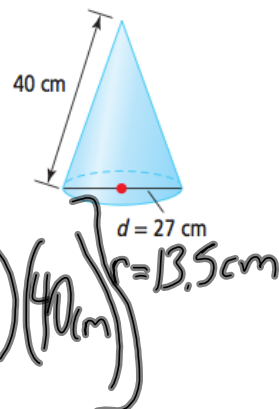
$$SA_{cone} = \pi r^2 + \pi rs$$

SA = Area of base + lateral area

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Example

A right cone has a circular base with diameter 27 cm and slant height 40 cm. Calculate the surface area of the cone, to the nearest tenth of a square centimetre.

40 cm

d = 27 cm

r = 13.5 cm

$$SA = \pi (13.5 cm)^2 + \left(\pi (13.5 cm)(40 cm) \right)$$
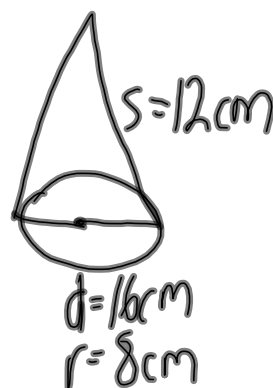
$$SA = 2269.02 \, cm^2$$

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Example

Sketch a right cone with diameter 16 cm and slant height 12 cm. What is its surface area?

$$SA = \pi (8)^2 + \pi (8)(12)$$

$$SA = 502.655 \, cm^2$$

S = 12 cm

d = 16 cm
r = 8 cm

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2.2 Surface Area: Sphere & Right Pyramid

Surface Area of a Sphere

To formulate the SA of a sphere it is helpful to consider the area of a right cylinder. Imagine we wrap a right cylinder around the sphere as shown.

Then the __diameter__ of the sphere is equal to the height of the cylinder.

The circumference of the sphere will be the __length__ of the cylinder.

If we where to flatten the lateral area of a cylinder we would form a rectangle. (We want to find the area of the rectangle to find the SA of the sphere).

SA of sphere =

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Example

A satellite is wrapped with polyester film to protect it during transportation. How much film is required to cover the Echo Satellite that has a circumference of 95.8 m? Express your answer to the nearest tenth of a square metre.

$SA_{sphere} = 4\pi r^2$ How can we find the radius?

$$\frac{C}{2\pi} = \frac{2\pi r}{2\pi}$$

$$r = \frac{C}{2\pi}$$

$$r = \frac{95.8m}{(2\pi)}$$

$$r = 15.247m$$

$$SA = 4\pi r^2$$

$$SA = 4\pi (15.247m)^2$$

$$SA = 2921.3m^2$$

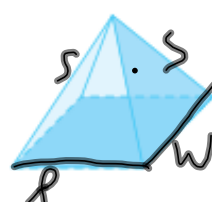Aug 1-2:02 PM

Homework Pg 74 #1, 3c, 4, 6, 9, 13

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Surface Area of a Right Pyramid

$$SA = base + lateral$$

In this case, the base is a rectangle, and the lateral area is comprised of triangles.

$$SA = base + lateral$$

$$SA_{pyramid} = lw + 2[\tfrac{1}{2}ls_1] + 2[\tfrac{1}{2}ws_2]$$

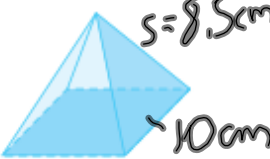For a
square = $lw + 4\left(\dfrac{ls}{a}\right)$
base.

$$A_T = \dfrac{bh}{2}$$

$$A_T = \dfrac{ws}{2}$$

$$= \dfrac{1}{2}ws$$

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Sketch a right rectangular pyramid with a square base measuring 10 cm on each side. The slant height of each face is 8.5 cm. What is the surface area of the pyramid?

$$SA = lw + 2\left(\frac{ls_1}{2}\right) + 2\left(\frac{ls_2}{2}\right)$$

s = 8.5 cm

10 cm

$$= (10cm)^2 + 2\left(\frac{10 \cdot 8.5}{2}\right) + 2\left(\frac{10 \cdot 8.5}{2}\right)$$

$$= 100 cm^2 + 85 \& 85 cm^2$$

$$SA = 270 cm^2$$

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SA Row Game

Oct 21-2:33 PM

SA of Composite Objects

Remember: The **Surface** Area only counts the portion of the object on the **SURFACE** of the object.

A farm equipment manufacturer in Yorkton, SK, has decided to construct a grain bin using galvanized steel. How much steel is required to construct the grain bin as shown? Express your answer to the nearest hundredth of a square foot. Do not include overlap of the steel sheets where they are fastened together.

25 ft

21 ft

d = 19 ft
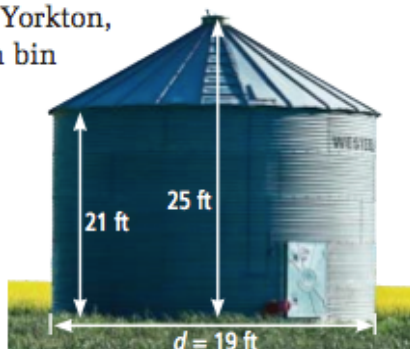
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Homework: Pg 74# 1d, 2, 5, 12, 16, 19, 20

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2.3 Volume

Video on Volume

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Therefore, the volume of a cone, $V_{\text{cone}} = \frac{1}{3}\pi r^2 h$

the volume of a pyramid, $V_{\text{pyramid}} = \frac{1}{3}lwh$

and the volume of a sphere, $V_{\text{sphere}} = \frac{4}{3}\pi r^3$

$$V_{\text{sphere}} = \frac{2}{3}(V \text{ of cylinder})$$

$$V = \frac{2}{3}(4\pi r^2 h) \qquad h = 2r$$

$$V = \frac{2}{3}4\pi r^2(2r)$$

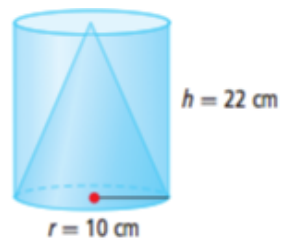$$= \frac{2}{3}4\pi \cdot 2 \cdot r^2 \cdot r$$

$$= \frac{2}{3} \cdot \frac{2}{1} \cdot \pi \cdot r^3$$

$$V = \frac{4}{3}4\pi r^3$$

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Example

a) What is the volume of the right cylinder, to the nearest cubic centimetre?

b) What is the volume of the right cone, to the nearest cubic centimetre?
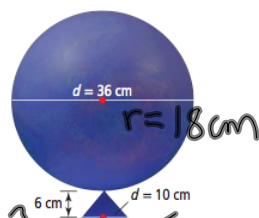

$h = 22$ cm

$r = 10$ cm

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Find the diameter, to the nearest centimetre, of a sphere with volume 4188.8 cm³.

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Esther is creating a clay sculpture that includes a sphere attached to a right cone. What volume of clay, in cubic centimetres, does she need to make the sculpture?

$d = 36$ cm
$r = 18$ cm

6 cm $d = 10$ cm
$r = 5$ cm

$$V_{cone} = \frac{1}{3} \pi r^2 h$$

$$= \frac{1}{3} \pi (5)^2 (6)$$

$$= 157.08 \text{ cm}^3$$

$$V_{sphere} = \frac{4}{3} \pi r^3$$

$$= \frac{4}{3} \pi (18)^3$$

$$= 24429.02 \text{ cm}^3$$
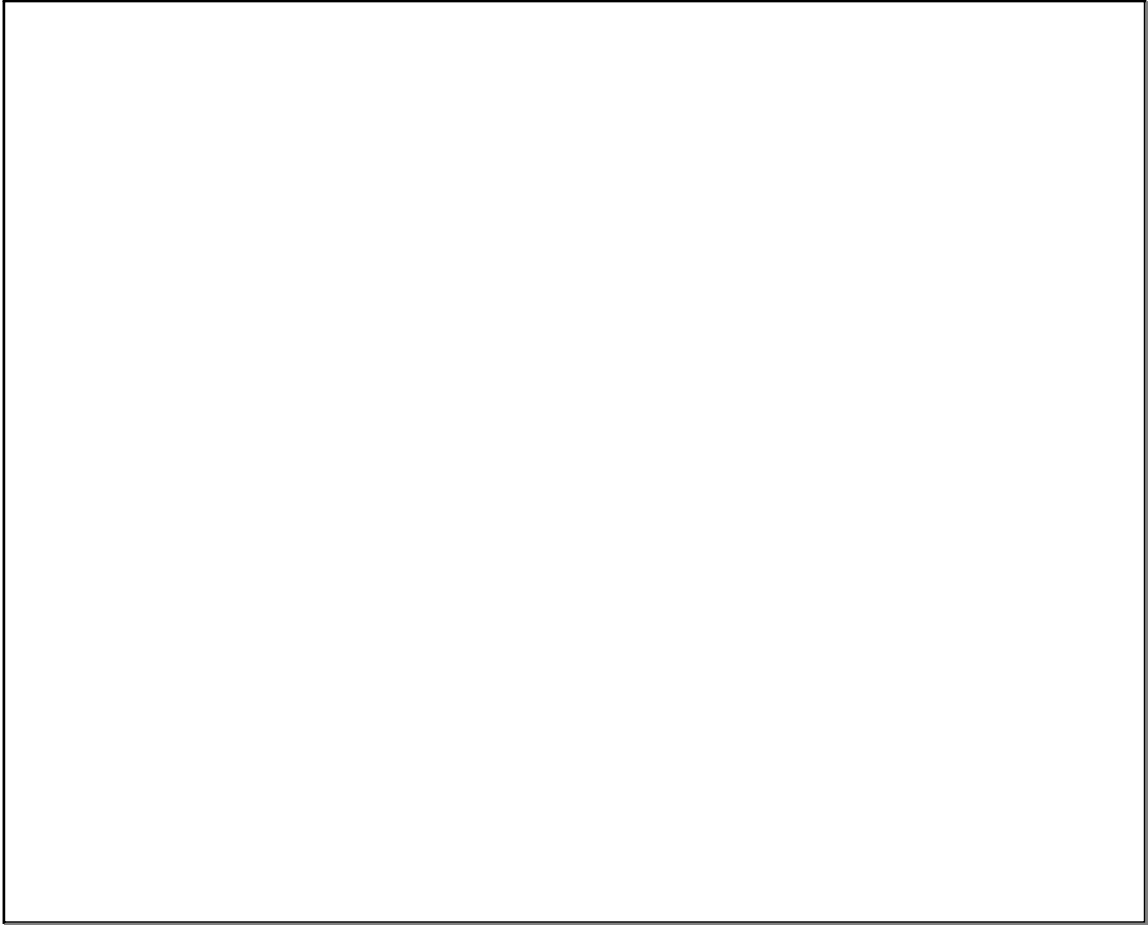
$$V_{cone} + V_{sphere}$$

$$= 24586.10 \text{ cm}^3$$

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Homework: Pg 86 #1, 2, 3, 5, 7, 10bc

Aug 1-9:02 PM

Perfect Packaging Project

Oct 8-9:37 PM

Oct 28-9:21 AM