ST. JEAN DE BREBEUF
MATHEMATICS

CHAPTER 9.5

SOLVE PROBLEMS INVOLVING SURFACE AREA and VOLUME

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KEY CONCEPTS

When a figure is made up of a combination of shapes, use the appropriate formula for each shape to find the total required quantity.

It is important to read questions carefully and to plan the steps of your solution.

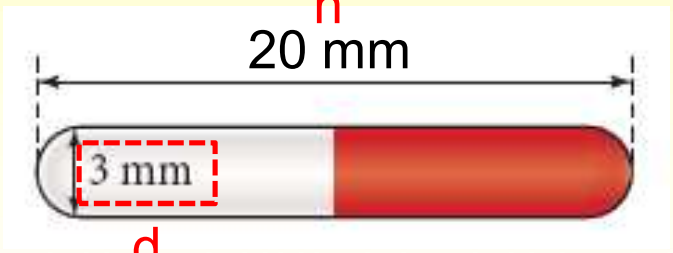
CHAPTER 9.5 SOLVE PROBLEMS INVOLVING SURFACE AREA and VOLUME

EXAMPLE 1 *Volume of a Pill*

A pill capsule is in the shape of a cylinder with half of a sphere (a hemisphere) on each end.

The *length* of the *cylindrical* portion is **20 mm** and the *diameter* is **3 mm**.

Find the **volume** of the capsule.



Need to find **radius**

r = d ÷ 2

= **3** ÷ 2

= **1.5 mm**

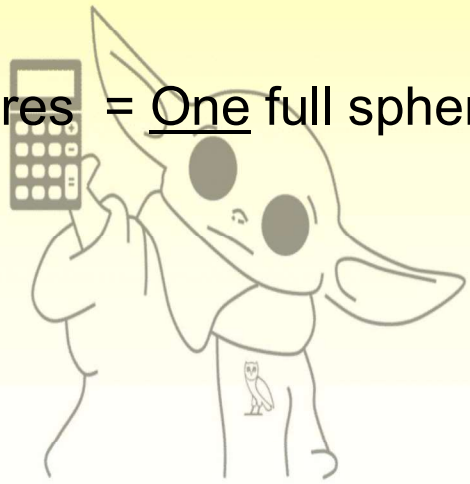
Step 1: Calculate the volume of the *cylindrical* portion

$$V = \pi r^2 h$$
$$= \pi(1.5)^2(20)$$
$$= 141.3\,mm^3$$

Step 2: Calculate the volume of the two *half spheres*

→ Two half spheres = One full sphere

$$V = \frac{4\pi r^3}{3}$$
$$= \frac{4\pi(1.5)^3}{3}$$
$$= 14.13\,mm^3$$



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EXAMPLE 1 *Volume of a Pill*

A pill capsule is in the shape of a cylinder with half of a sphere (a hemisphere) on each end.

The *length* of the *cylindrical* portion is **20 mm** and the *diameter* is **3 mm**.

Find the **volume** of the capsule.

Step 3: Add up the two volumes

V = 141.3 + 14.13
= 155.43 mm³

The total volume of the capsule is **155.43 cubic millimetres**

Step 1: Calculate the volume of the *cylindrical* portion

$$V = \pi r^2 h$$
$$= \pi(1.5)^2(20)$$
$$= 141.3\,mm^3$$

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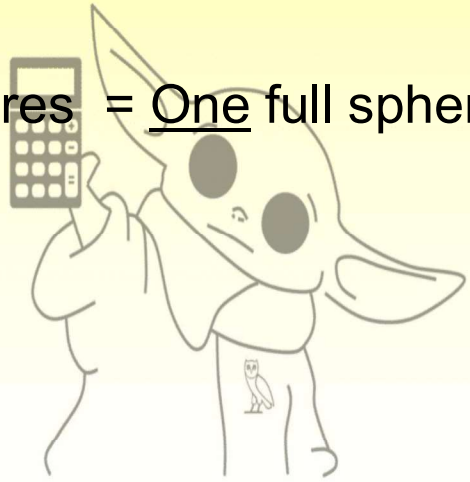

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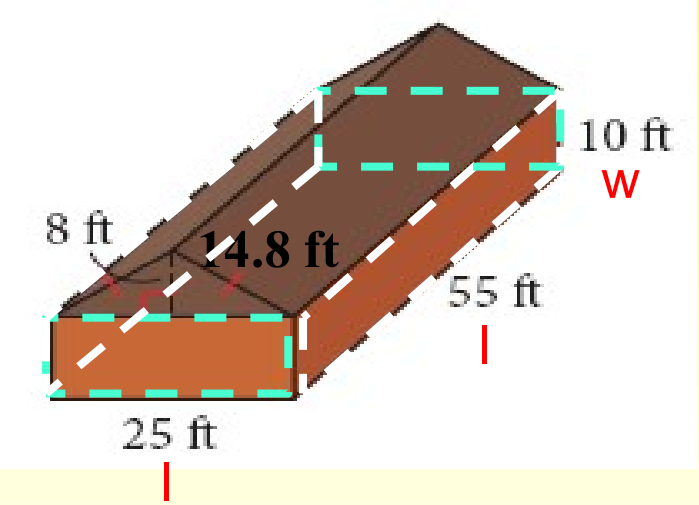
EXAMPLE 2 *Surface Area: Painting a Barn*

The exterior walls of a barn are to be painted. The barn is in the shape of a rectangular prism with an isosceles triangular prism for a roof.



(a) Calculate the **total area** to be painted

Easiest way to solve this is to calculate the **areas** of all of the sides and adding them together!

Step 1: Calculate the area of the *rectangular* front and back

$$A = 2 \times (l \times w)$$
$$= 2 \times (25 \times 10)$$
$$= 500\ ft^2$$

Step 2: Calculate the area of the *rectangular* sides

$$A = 2 \times (l \times w)$$
$$= 2 \times (55 \times 10)$$
$$= 1100\ ft^2$$

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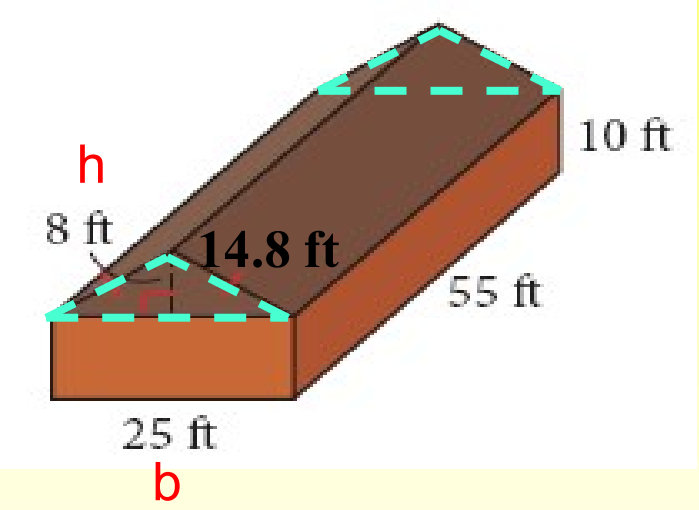


(a) Calculate the **total area** to be painted

Easiest way to solve this is to calculate the **areas** of all of the sides and adding them together!

Step 3: Calculate the area of the *triangular* front and back

$$A = 2 \times \left(\frac{bh}{2} \right)$$

$$= 2 \times \left(\frac{(25)(8)}{2} \right)$$

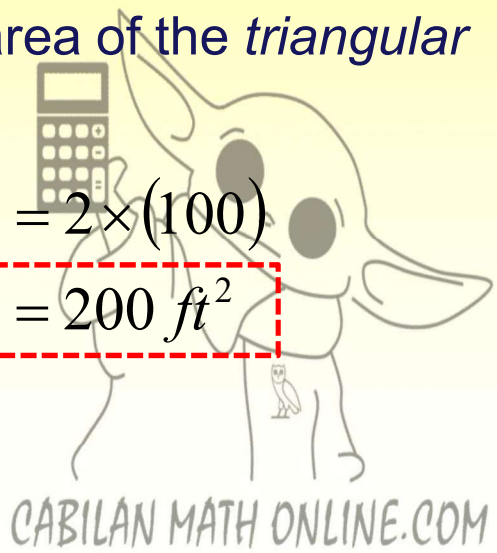
$$= 2 \times \left(\frac{200}{2} \right)$$

$$= 2 \times (100)$$

$$= 200\ ft^2$$

$$A = 500\ ft^2$$

$$A = 1100\ ft^2$$



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EXAMPLE 2 *Surface Area: Painting a Barn*

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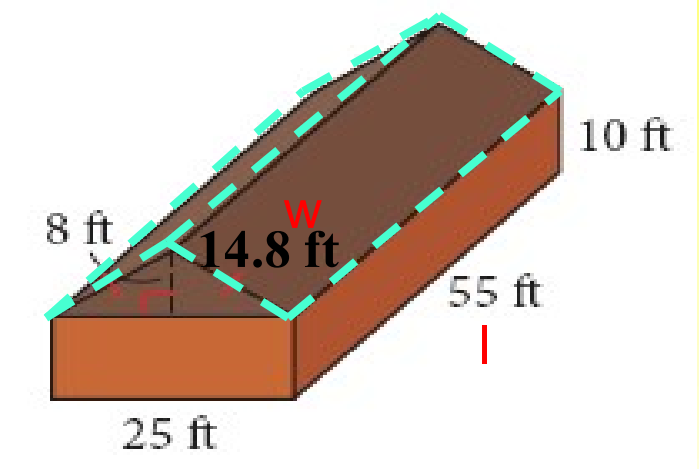

(a) Calculate the **total area** to be painted

Easiest way to solve this is to calculate the **areas** of all of the sides and adding them together!

Step 4: Calculate the area of the *rectangular* sides of the roof

$$A = 2 \times (l \times w)$$

$$= 2 \times (55 \times 14.8)$$

$$= 1628\ ft^2$$

$A = 500\ ft^2$

$A = 1100\ ft^2$

$A = 200\ ft^2$

Step 5: Add up all the areas

Total area

= 500 + 1100 + 200 + 1628

= **3428 ft²**

The total area to be painted is **3428 square feet**

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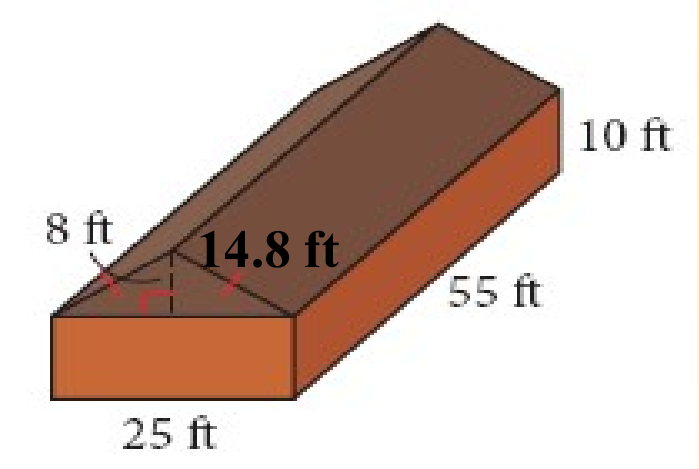
EXAMPLE 2 *Surface Area: Painting a Barn*

The exterior walls of a barn are to be painted. The barn is in the shape of a rectangular prism with an isosceles triangular prism for a roof.



The total area to be painted is **3428 square feet**

(b) If one gallon of paint will cover **900 ft²**, how many gallons will be required to paint this barn?

# of gallons of paint required
= Total area ÷ area covered by 1 gallon
= 3428 ÷ 900
= **3.8 gallons**

3.8 gallons of paint will be required to paint the barn.

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EXAMPLE 3 *Combination of Rectangular Prism and Cylinder*

l w

A rectangular piece of wood has a **length of 8 in.**, **width of 24 in.** and **height of 1 in.**

h

Twelve cylindrical holes, each with a **radius** of **2 in.** and **height** of **1 in.** are drilled through the wood.

(a) What is the **volume** of the wood before the holes were drilled?

$$V = lwh$$
$$V = (8)(24)(1)$$
$$V = 192\,in^3$$

The volume of the wood is **192 cubic inches**.

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EXAMPLE 3 *Combination of Rectangular Prism and Cylinder*

A rectangular piece of wood has a **length of 8 in.**, **width of 24 in.** and **height of 1 in.** $V = 192\,in^3$

Twelve cylindrical holes, each with a **radius** of **2 in.** (r) and **height** of **1 in.** (h) are drilled through the wood.

(b) What is the **volume** of the wood *after* the holes were drilled?

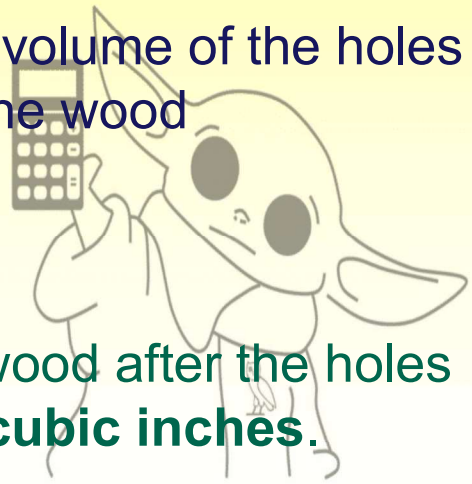
Step 1: Calculate the volume of the 12 cylindrical holes

$$V = 12 \times (\pi r^2 h)$$
$$= 12 \times (\pi [2]^2 [1])$$
$$= 150.72\,in^3$$

Step 2: Subtract the volume of the holes from the volume of the wood

V = 192 – 150.72

= 41.28 in³



The volume of the wood after the holes are drilled is **41.28 cubic inches**.

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Homework:

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