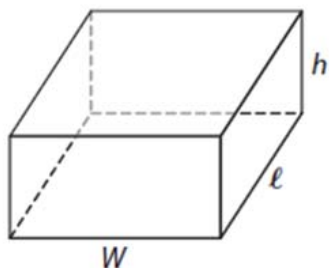Objective: Find the volume of rectangular and trapezoidal prisms.

Concept

A **Prism** is a three-dimensional figure with rectangular sides and parallel bases.

Rectangular Prism
Rectangular bases
Rectangular sides

Cube
Square bases
Square sides

Trapezoidal Prism
Trapezoid bases
Rectangular sides

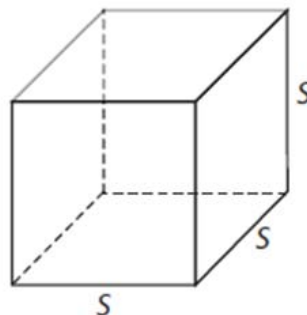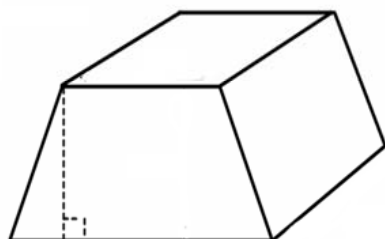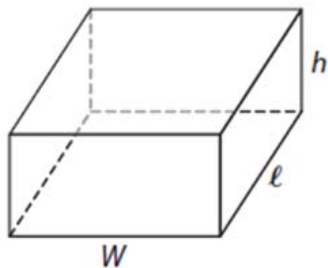Objective: Find the volume of rectangular and trapezoidal prisms.

Concept

Volume is a measure indicating the amount of space that an object occupies, or the capacity of a container.
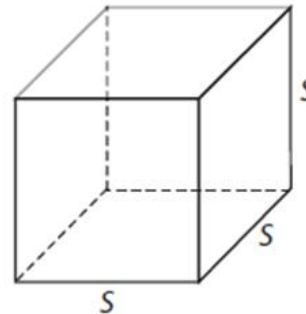
The Volume of a Prism is calculated by multiplying the area of the prism's base and the prism's height. This concept can be written as the formula $V = B \cdot h$ where B **is the area of the prism's base** and h **is the prism's height**.

Rectangular Prism
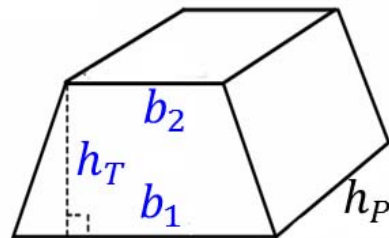$$V = B \cdot h$$
$$V = l \cdot w \cdot h$$

Cube
$$V = B \cdot h$$
$$V = s \cdot s \cdot s$$
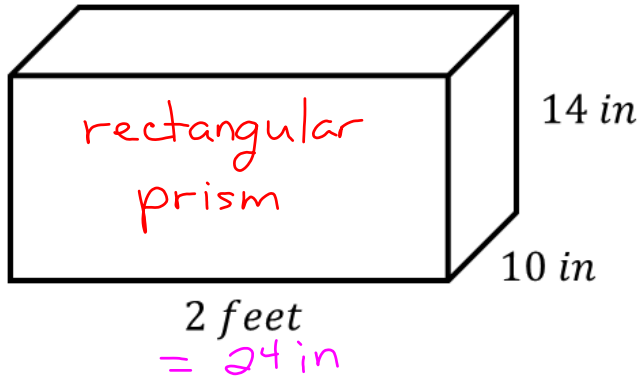$$V = s^3$$

Trapezoidal Prism
$$V = B \cdot h$$
$$V = \left(\frac{b_1 + b_2}{2} \right) \cdot h_T \cdot h_P$$

Objective: Find the volume of rectangular and trapezoidal prisms.

Ex) Clarisse needs a shipping box with a volume between $3000\ in^3$ and $3300\ in^3$. Does the shipping box shown below meet her needs? Explain your reasoning.

rectangular prism

14 in

10 in

2 feet
= 24 in

① convert feet to inches

$\dfrac{2\ ft}{1} \cdot \dfrac{12\ in}{1\ ft} = 24\ in$

③ conclusion

The shipping box does not meet Clarisse's needs because the volume is 60 in³ larger than the 3300 in³ maximum.

② find volume

$V = B \cdot h$

$V = \ell \cdot w \cdot h$

$V = (24\ in)(10\ in)(14\ in)$

$= 3360\ in^3$

Objective: Find the volume of rectangular and trapezoidal prisms.

Ex) A shark and ray tank at the aquarium has the dimensions shown.

a) Estimate the volume of water to the nearest gallon. Use the conversion $1\ gallon = 0.134\ ft^3$.
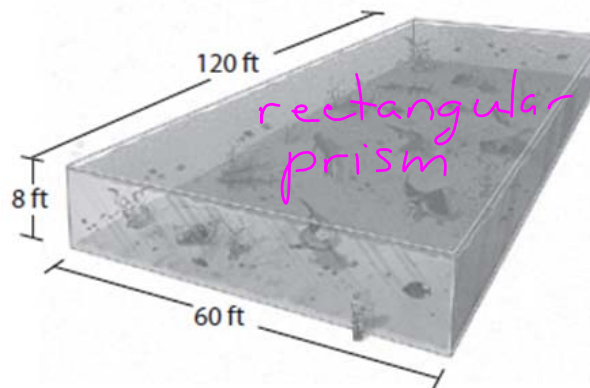
① find volume

$V = B \cdot h$

$V = l \cdot w \cdot h$

$V = (60ft)(8ft)(120ft)$

$= 57,600\ ft^3$

rectangular prism

120 ft

8 ft

60 ft

② convert ft^3 to gallons

$\dfrac{57,600\ ft^3}{1} \cdot \dfrac{1\ gallon}{0.134\ ft^3} \approx 429,851\ gallons$

③ The volume of water in the tank is about 429,851 gallons.

b) Estimate the weight of the water to the nearest pound. ($1\ gallon = 8.33\ pounds$)

① convert gallons to pounds

$\dfrac{429,851\ gallons}{1} \cdot \dfrac{8.33\ pounds}{1\ gallon} \approx 3,580,659\ pounds$

② The water weighs about 3,580,659 pounds.

Objective: Find the volume of rectangular and trapezoidal prisms.

Ex) Colin is buying dirt to fill a garden bed that is 9 feet by 13 feet.

height

a) If he wants to fill it to a depth of 4 in, how many **cubic yards** of dirt does he need? If necessary, round to the nearest tenth of a cubic yard.
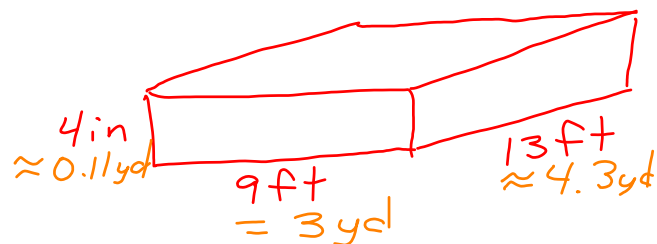
① convert to yards

★ 1 yard = 3 feet

$$\frac{9 \text{ ft}}{1} \cdot \frac{1 \text{ yd}}{3 \text{ ft}} = 3 \text{ yd}$$

$$\frac{13 \text{ ft}}{1} \cdot \frac{1 \text{ yd}}{3 \text{ ft}} \approx 4.3 \text{ yd}$$

$$\frac{4 \text{ in}}{1} \cdot \frac{1 \text{ ft}}{12 \text{ in}} \cdot \frac{1 \text{ yd}}{3 \text{ ft}} \approx 0.11 \text{ yd}$$

③ Colin needs about 1.4 yd³ of dirt.

4 in ≈ 0.11 yd
9 ft = 3 yd
13 ft ≈ 4.3 yd

② volume
$$V = B \cdot h$$
$$V = \ell \cdot w \cdot h$$
$$V = (3 \text{ yd})(4.3 \text{ yd})(0.11 \text{ yd})$$
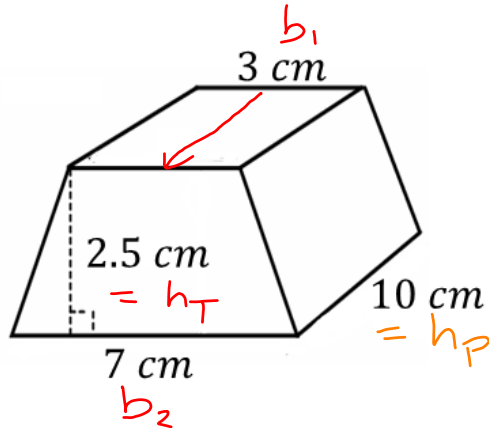$$\approx 1.4 \text{ yd}^3$$

b) If dirt costs $30 per yd^3, how much will the project cost?

$$\frac{\$30}{1 \text{ yd}^3} \cdot \frac{1.4 \text{ yd}^3}{1} = \$42$$

The project will cost $42.

Objective: Find the volume of rectangular and trapezoidal prisms.

Ex) A bar of gold is in the shape of a trapezoidal prism. Find the volume of the bar of gold in cubic centimeters.

b_1

3 cm

2.5 cm
= h_T

7 cm
b_2

10 cm
= h_P

① Volume = $\dfrac{\text{Area of a}}{\text{trapezoid}} \cdot \dfrac{\text{height of}}{\text{the prism}}$

$$V = \left(\frac{b_1 + b_2}{2}\right) \cdot h_T \cdot h_P$$

$$V = \left(\frac{3 + 7}{2}\right)^{cm} \cdot 2.5^{cm} \cdot 10^{cm}$$

$$= 125 \text{ cm}^3$$

② The volume of the bar of gold is 125 cm³.

Objective: Find the volume of rectangular and trapezoidal prisms.

Closure

Sia says that if you triple each of the dimensions of a rectangular prism, the volume will also triple. Do you agree or disagree with Sia? Explain your reasoning.

I disagree with Sia because tripling the dimensions of a rectangular prism does not triple the volume. For example a rectangular prim with dimensions of $1in \times 1in \times 1in$ has a volume of 3 cubic inches, and a prism with dimensions of $3in \times 3in \times 3in$ has a volume of 27 cubic inches, which is 27 times larger, not three times larger.