

What's Going On?

Checking In

Minds on

What's the Volume?

Action!

Unit Conversions & Rearranging
Formulas

Consolidation

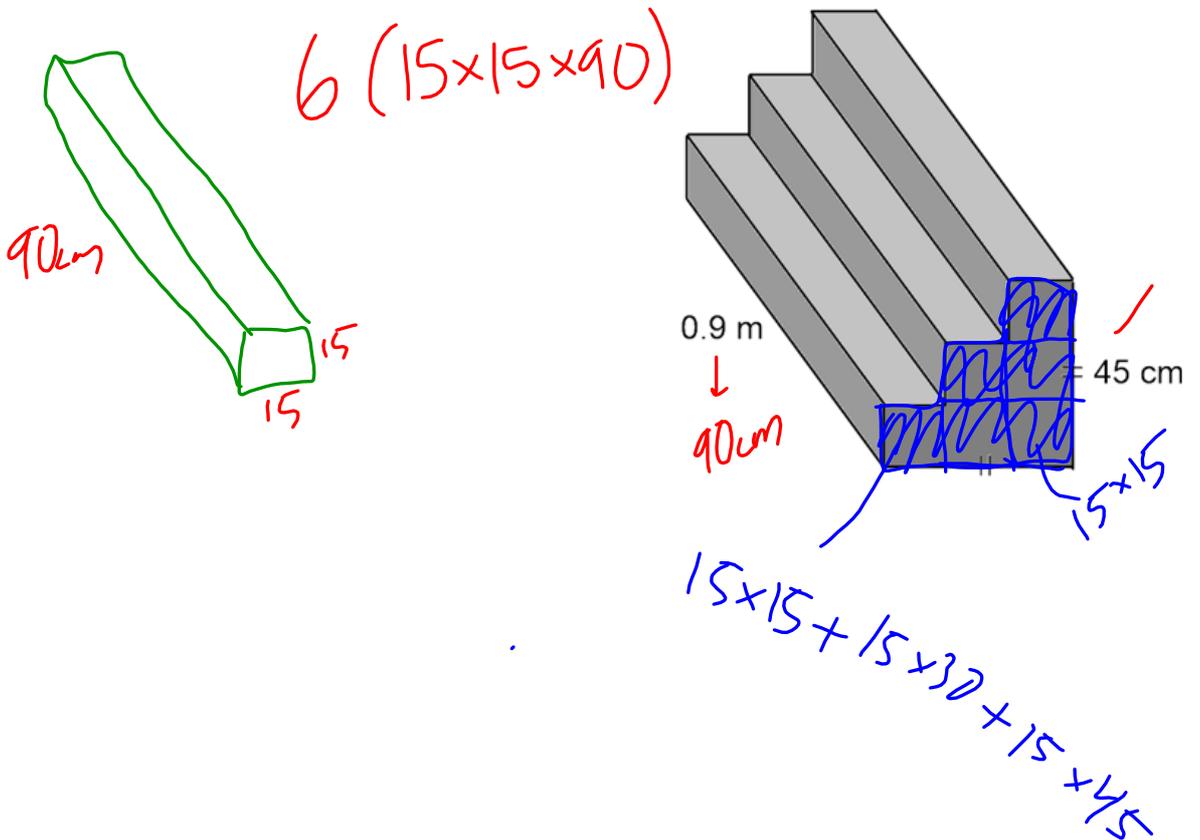
Putting it All Together

**Learning Goal - I will be able to rearrange formulas and
convert between units of measurement.**

Minds on

What's the Volume?

Determine the volume, to two decimal places, of concrete needed to construct this staircase.



Action!

Solving Proportions

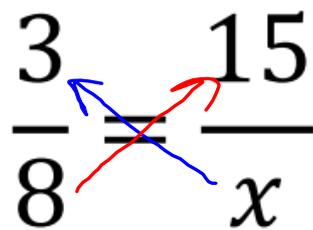
To solve a proportion we

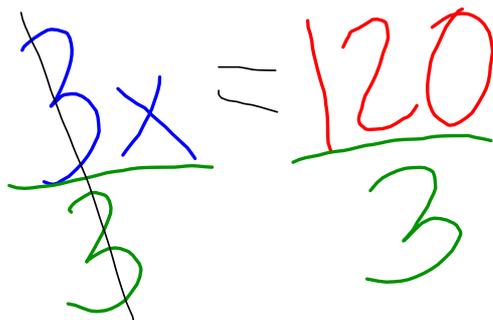
cross multiply

$$\frac{x}{5} = \frac{44}{20}$$

$$\frac{20x}{20} = \frac{220}{20}$$

$$x = 11$$

$$\frac{3}{8} = \frac{15}{x}$$
A diagram showing the cross-multiplication of the equation 3/8 = 15/x. A blue arrow points from the numerator 3 to the denominator x, and a red arrow points from the denominator 8 to the numerator 15. The equals sign is crossed out with a red line.

$$\frac{3x}{3} = \frac{120}{3}$$
Handwritten work showing the result of cross-multiplication. The equation 3x/3 = 120/3 is written in blue and red ink. A green horizontal line is drawn under the 3x and the 120. The 3 in the denominator on both sides is written in green.

$$x = 40$$
Handwritten solution showing the final value of x. The equation x = 40 is written in black ink.

$$\frac{3}{10} = \frac{x}{70}$$

$$\frac{210}{10} = \frac{10x}{10}$$

$$x = 21$$

$$\frac{20}{x} = \frac{300}{15}$$

$$\frac{300}{300} = \frac{300x}{300}$$

$$x = 1$$

$$\frac{x}{3.2} = \frac{6.8}{2.4}$$

$$\frac{2.4x}{2.4} = \frac{21.76}{2.4}$$

$$x = 9.1$$

Action!

Metric-Imperial Conversions

To convert metric units into imperial units, and vice versa, first we create a ratio to represent the information.

Then, we solve it!

*We must make sure that our ratio is created correctly. Our units must "line up".

Action!

Metric-Imperial Conversions

Example 1:

In Morocco, bottles of pop are 600 mL. How many fluid ounces is this?

$$1 \text{ fl. oz.} = 29.574 \text{ mL}$$

$$\frac{1}{29.574} = \frac{x}{600}$$

$$600 = \frac{29.574x}{29.574}$$

$$x = 20.3 \text{ fl. oz.}$$

Action!

Metric-Imperial Conversions

Example 2:

One cup is 8 fluid ounces. How many mL is this?

$$2 \text{ fl. oz.} = 29,574 \text{ mL}$$

$$\frac{1}{29,574} \times 8 = 236.6 \text{ mL}$$

15 mm into inches

$$1 \text{ inch} = 25.4 \text{ mm}$$

$$\frac{1}{25.4} = \frac{x}{15}$$

$$\frac{25.4x}{25.4} = \frac{15}{25.4}$$

$$x = 0.6 \text{ in.}$$

Action!

Multi-Step Conversions

Sometimes, we will need to convert between units where we don't know the ***conversion factor***.

These conversions require multiple steps.

Action!

Metric-Imperial Conversions

Example 3:

Convert 185 cm into inches.

1. Convert 185 cm into mm.

$$10 \text{ mm} = 1 \text{ cm}$$

$$\frac{10}{1} = \frac{x}{185}$$

$$1850 = x$$

$$x = 1850 \text{ mm}$$

2. Convert 1850 mm into inches.

$$1 \text{ inch} = 25.4 \text{ mm}$$

$$\frac{1}{25.4} = \frac{x}{1850}$$

$$\frac{1850}{25.4} = \frac{25.4x}{25.4}$$

$$x = 72.8 \text{ in.}$$

Action!

Metric-Imperial Conversions

Example 4:

Convert 1 ft 2 inches into centimetres.

12 → 14 inches 1 inch = 25.4 mm

$$\frac{1}{25.4} = \frac{14}{x}$$

$$x = 355.6 \text{ mm}$$

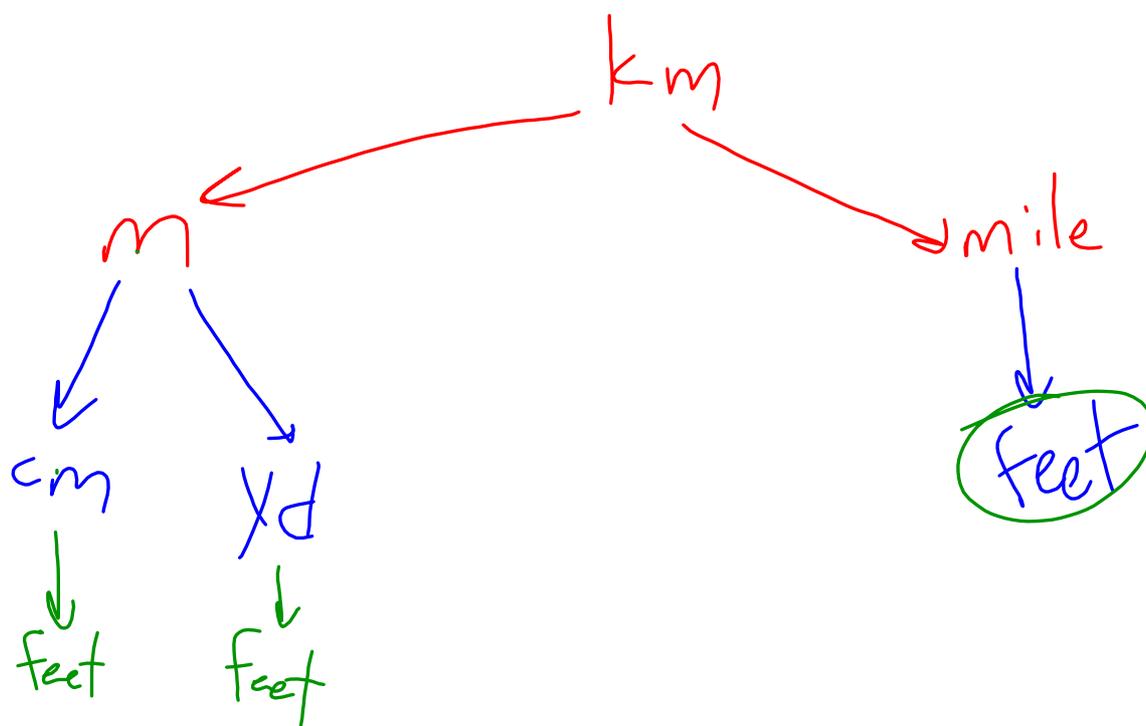
$$10 \text{ mm} = 1 \text{ cm}$$

$$\frac{10}{1} = \frac{355.6}{x}$$

$$\frac{10x}{10} = \frac{355.6}{10}$$

$$x = 35.6 \text{ cm}$$

Convert 1.5 km into feet.



Convert 1.5 km into feet.

1. Convert 1.5 km into m.

$$1500 \text{ m} \quad (1000\text{m} = 1\text{km})$$

2. Convert 1500m into cm.

$$150000 \quad (100\text{cm} = 1\text{m})$$

3. Convert 150,000cm into feet.

$$1 \text{ Foot} = 30.48 \text{ cm}$$

$$\frac{1}{30.48} = \frac{x}{150,000}$$

$$\frac{150,000}{30.48} = \frac{30.48x}{30.48}$$

$$x = 4921.3 \text{ feet}$$

Action!

Area and Volume Conversions

Converting areas and volumes is the same as regular conversions with 1 extra step.

Before we set up our ratios, we must square or cube our conversion factor.

Minds on

What's the Volume?

Determine the volume, to two decimal places, of concrete needed to construct this staircase.

$$V = 121,500 \text{ cm}^3$$

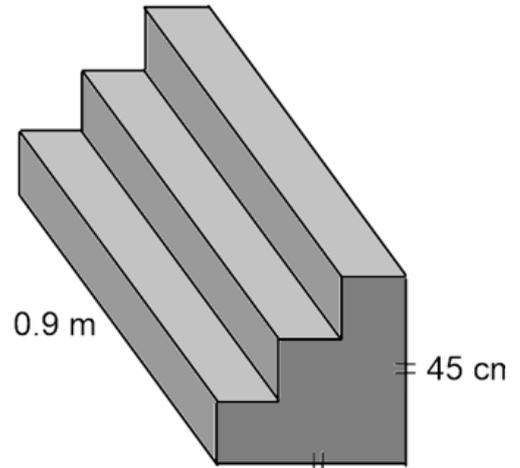
Convert into

a. Cubic Feet

b. Cubic Inches

$$a. (7 \text{ foot})^3 = (30.48 \text{ cm})^3$$

$$1 \text{ ft.}^3 = 28,316.8 \text{ cm}^3$$



$$\frac{1}{28,316.8} \quad \times \quad \frac{x}{121,500}$$

$$\frac{121,500}{28,316.8} = \frac{28,316.8 \times x}{28,316.8}$$

$$x = 4.3 \text{ ft}^3$$

Action!

Rearranging Formulas

Sometimes we will need to rearrange a formula to solve for a variable within the formula.

To do this, use opposite operations until you have isolated your variable of interest.

Rearrange $s = \frac{d}{t}$ for d .

$$t \times s = \frac{d}{\cancel{t}} \times \cancel{t}$$
$$d = t \times s \quad \text{or} \quad d = st$$

Rearrange $s = \frac{d}{t}$ for t .

$$t \times s = \frac{d}{t} \times t$$

$$\frac{t \cancel{s}}{s} = \frac{d}{\cancel{s}}$$

$$t = \frac{d}{s}$$

Rearrange $y = mx + b$ for m .

$$y = mx + b$$

Handwritten work showing the first step: $y = mx + b$. A blue $-b$ is written below the y . A green diagonal line is drawn through the $+b$ term, with a blue $-b$ written below it.

$$\frac{y-b}{x} = \frac{mx}{x}$$
$$m = \frac{y-b}{x}$$

Handwritten work showing the second step: $\frac{y-b}{x} = \frac{mx}{x}$. A blue horizontal line is drawn under $y-b$ and x . A blue horizontal line is drawn under mx and x . A red diagonal line is drawn through the mx term. Below this, the final result is written: $m = \frac{y-b}{x}$.

Rearrange $y = mx + b$ for b .

$$y = \cancel{mx} + b$$

$-mx$ $-mx$

$$b = y - mx$$

Rearrange $V = \frac{\pi r^2 h}{3}$ for h .

$$3 \times V = \frac{\pi r^2 h}{3} \times 3$$

$$\frac{3V}{\pi r^2} = \frac{\pi r^2 h}{\pi r^2}$$

$$h = \frac{3V}{\pi r^2}$$

Rearrange $V = \frac{\pi r^2 h}{3}$ for r .

$$3 \times V = \frac{\pi r^2 h}{3} \times 3$$

$$\frac{3V}{\pi h} = \frac{\pi r^2 h}{\pi h}$$

$$r^2 = \frac{3V}{\pi h}$$

$$r = \sqrt{\frac{3V}{\pi h}}$$

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

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

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

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

$$r = \sqrt[3]{\frac{3V}{4\pi}}$$

Consolidation

Putting it All Together

A cylindrical container is to be planted with flowers. The container is to be 2 feet high, and must hold 1.5 m^3 of soil. What is the minimum diameter, to the nearest centimeter?

Draw a diagram and use your unit conversion sheets from yesterday to help you get started!

$$V = \pi r^2 h$$

$$1 \text{ foot} = 30.48 \text{ cm}$$

$$1 \text{ foot} = 0.3048 \text{ m}$$

$$\frac{30.48}{.100}$$

$$\frac{1}{0.3048} = \frac{2}{x}$$

$$x = 0.6096 \text{ m}$$

$$V = \frac{\pi r^2 h}{\pi h}$$

$$\sqrt{r^2} = \frac{V}{\pi h}$$

$$r = \sqrt{\frac{V}{\pi h}}$$

$$r = \sqrt{\frac{1.5}{\pi (0.6096)}}$$

$$r = 0.445 \text{ m}$$

$$r = 44.5 \text{ cm}$$

$$d = 177 \text{ cm}$$