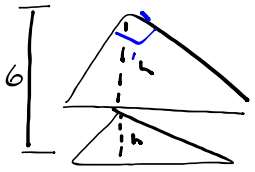
Unit 12: Solving for an unknown

Strategies for word questions



$h_1 + h_2 = 6$

- Read question carefully / Draw a sketch / label
- Translate sentences into math equations
- Identify on your sketch what you're looking for.
- Create equations based on the diagram given.
- Create equations based on the properties of the shapes.

Recall:

right triangle → $c^2 = a^2 + b^2$

right triangle → SOH CAH TOA

$\sin\theta = \frac{O}{H}$ $\cos\theta = \frac{A}{H}$ $\tan\theta = \frac{O}{A}$

similar shapes or solid

SOS → $\frac{S_1}{S_2} = k$ SOA → $\frac{A_1}{A_2} = k^2$ SOV → $\frac{V_1}{V_2} = k^3$

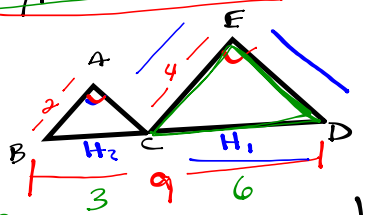
equivalent shapes (2D) / equivalent solids (3D)

$A_1 = A_2$ $V_1 = V_2$

- For two unknowns, either create 2 equations and then use the comparison method

—or— write the 2nd unknown in terms of the first!

The two triangles are similar. The hypo of the big Δ is 2 times larger than the hypo of the small Δ. What is the perimeter of the Big Δ?



$H_1 = 2 \cdot 3$

① $H_1 = 2 \cdot H_2$

$H_1 + H_2 = 9 - H_2$

② $H_1 = 9 - H_2$

$2H_2 = 9 - H_2 + H_2$

$2H_2 + H_2 = 9$

$\frac{3H_2}{3} = \frac{9}{3}$

$H_2 = 3$

$c^2 = a^2 + b^2$

$CD^2 = CE^2 + ED^2$

$6^2 - 4^2 = 4^2 - 4^2 + ED^2$

$\sqrt{ED^2} = \sqrt{6^2 - 4^2}$

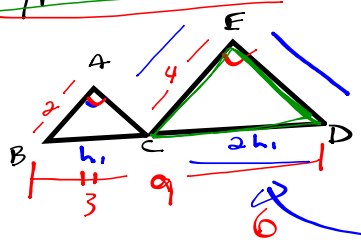
$ED = 4.47$

$P = CD + CE + ED$

$P = 6 + 4 + 4.47$

$P = 14.47$ units

The two triangles are similar. The hypo of the big Δ is 2 times larger than the hypo of the small Δ. What is the perimeter of the Big Δ?



6

$h_2 = 2h_1$

$h_1 + 2h_1 = 9$

$\frac{3h_1}{3} = \frac{9}{3}$

$h_1 = 3$

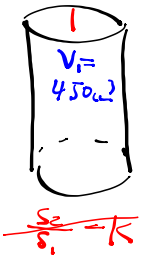
A company creates a cylinder water bottle that can hold a max of $450 cm^3$ of liquid. They are thinking about enlarging the bottle proportionally such that the area of the base of similar cylinder is $55 cm^2$ and its height is 9 cm. However, the label for the bigger bottle cost 2 times more than the smaller one. Should the company stay with the 1st model or go for the second one?

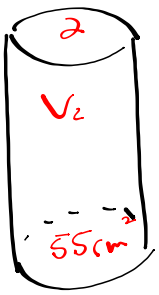
Similar

$\frac{V_2}{V_1} = k^3$

$\frac{A_2}{A_1} = k^2$

$\frac{s_2}{s_1} = k$





9 cm

(area of base) · 9

$V_2 = 55 \cdot 9$

$V_2 = 495 cm^3$

$A_{L_2} = \frac{2}{1} A_{L_1}$

k^2 (involving areas)

$\frac{V_2}{V_1} = k^3$

$\frac{495}{450} = k^3$

$\sqrt[3]{1.1} = \sqrt[3]{k^3}$

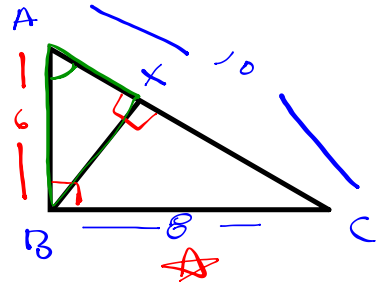
$k = 1.03$

$k^2 = 1.03^2$

$k^2 = 1.06$

The company should stay with the 1st model because the second's area is 1.06 times than the first, yet they would have to pay 2 times more. It's a rip off. It's unfair

$\triangle ABC$ is similar to $\triangle AXB$. The ratio of their areas is $\frac{25}{9}$. What's the area of $\triangle ABC$?



$\frac{S_{Big}}{S_{small}} = k \quad \frac{AC}{AB} = k$

$\frac{A_{Big}}{A_{small}} = k^2 \quad \left(\frac{AC}{6}\right) = \left(\frac{5}{3}\right)\frac{6}{1}$

$AC = \frac{30}{3}$

$AC = 10$

$\frac{A_{ABC}}{A_{AXB}} = \frac{25}{9}$

$\sqrt{\frac{25}{9}} = \sqrt{k^2}$

$k = \frac{\sqrt{25}}{\sqrt{9}}$

$k = \frac{5}{3}$

$A = \frac{1 \times h}{2}$

$A = \frac{6 \times 8}{2}$

$A = 24 \text{ units}^2$

use $c^2 = a^2 + b^2$ to find BC

$AC^2 = AB^2 + BC^2$

$10^2 = 6^2 + BC^2$

$BC = \sqrt{(10^2 - 6^2)}$

$BC = 8$

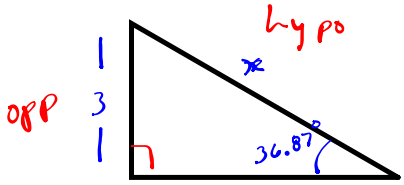
Recall: SOH CAH TOA

(these equations are only applicable to right triangles)

$\sin\theta = \frac{\text{opposite}}{\text{hypo}}$,

$\cos\theta = \frac{\text{adjacent}}{\text{hypo}}$

$\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$



Find x

use SOH

$\sin\theta = \frac{O}{H}$

$\sin 36.87 = \frac{3}{H}$

isolate h!

$h \sin 36.87 = 3$

$\frac{h \sin 36.87}{\sin 36.87} = \frac{3}{\sin 36.87}$

$h = 4.999$

This metal plate is composed of a rectangle topped by a right triangle. The two shapes are equivalent.

What is the height of the metal plate?