Marketing Tricks

Purpose:

The purpose of this multi-level task is to encourage students to use algebraic techniques when solving a measurement problem.

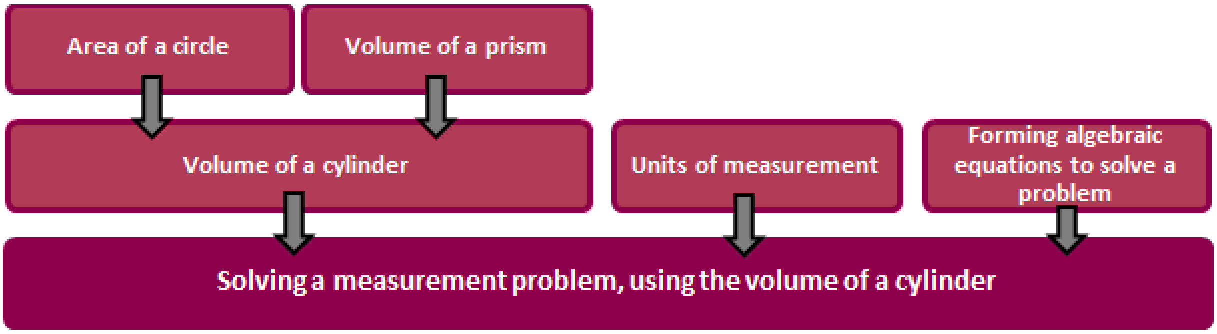
Achievement Objectives:

GM5-1: Select and use appropriate metric units for length, area, volume and capacity, weight (mass), temperature, angle, and time, with awareness that measurements are approximate.

GM5-4: Find the perimeters and areas of circles and composite shapes and the volumes of prisms, including cylinders.

Description of mathematics:

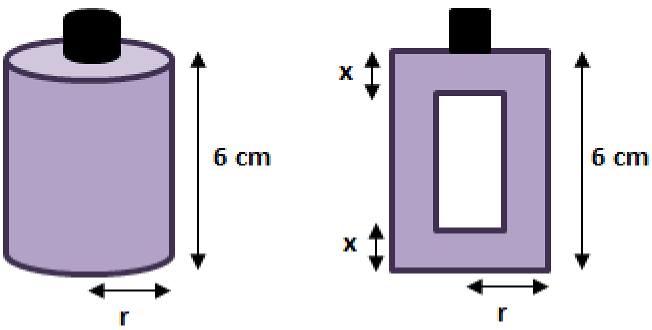
The background knowledge presumed for this task is outlined in the diagram below:



The task can be presented with graded expectations to provide appropriate challenge for individual learning needs.

Activity:

Task: A cosmetic company wants to sell a bottle of perfume that is cylindrical and holds 50 mL (50 cm^3) of scent, but looks like it holds 100 mL. The glass bottle will stand 6 cm high (not including the atomiser) with the side thickness of the glass being 0.50 cm.



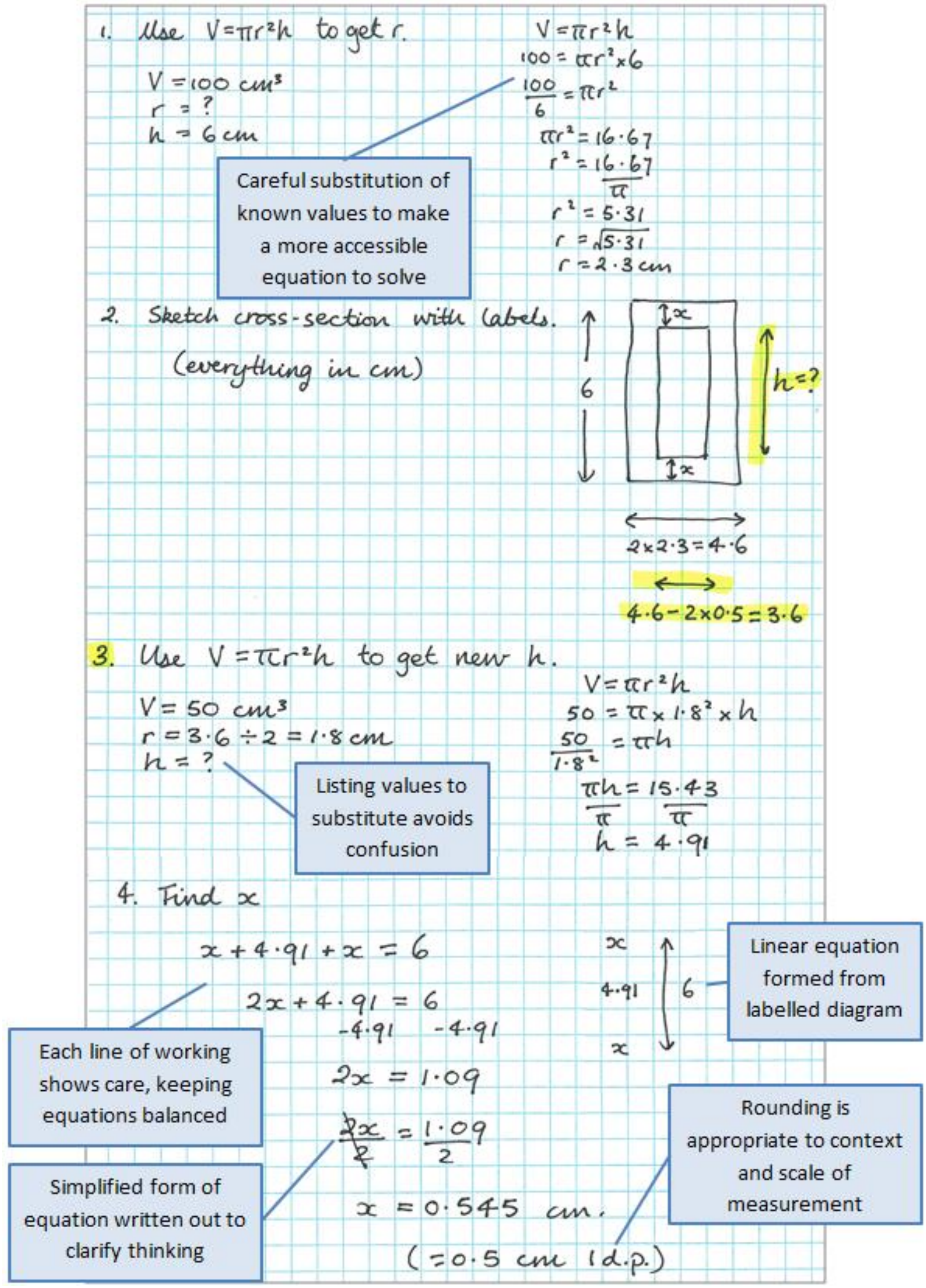
Find x, the thickness of the top and bottom of the perfume bottle.

The arithmetic approach

The student is able to find unknowns that lead to the solution of the problem, with guidance.

Prompts from the teacher could be:

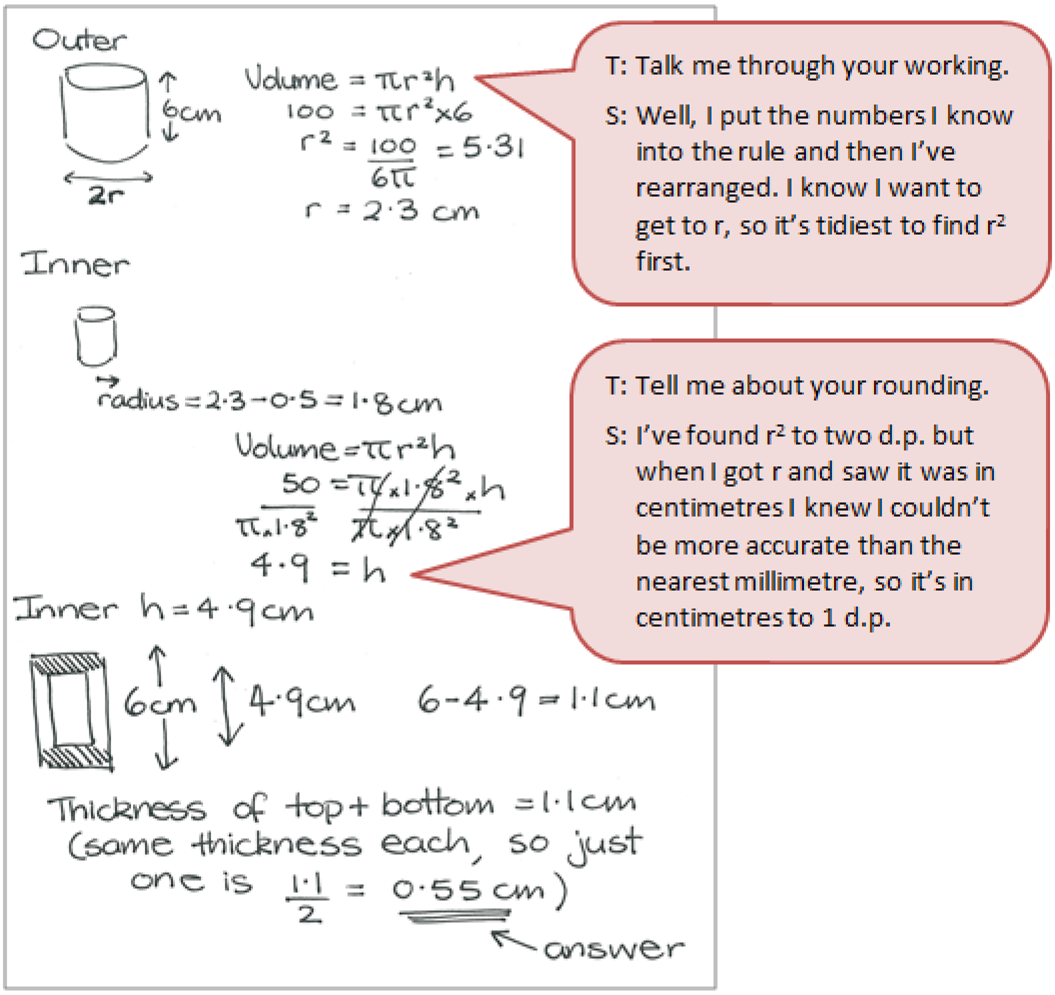
1. Use the rule for volume of a cylinder to find the outer radius of the bottle. This rule is $V=\pi r^2h$. You have been given a value of 100 cm^3 for the volume and 6 cm for the height.
2. Sketch the cross-sectional view of the bottle and label all the values that you have. Also label the inside height (work this out), inside radius (h) and thickness of top and bottom (x).
3. Use the inside height, inside radius to get the thickness of top and bottom (x). Hint, again, you will need to use the rule for the volume of a cylinder.



The procedural algebraic approach

The student is able to find unknowns that lead to the solution of the problem.

A prompt from the teacher could be to suggest sketching diagrams of the outside of the bottle, the inside (where the perfume will go) and a cross section of the bottle.



The conceptual algebraic approach

The student is able to find unknowns that lead to the solution of the problem, independently and with appropriate accuracy.

$V(B) = \pi r^2 h$ unknown is r:

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

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

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

Outside: $V = 100\text{ cm}^2$, $h = 6\text{cm}$

$$r = \sqrt{\left(\frac{100}{\pi \times 6}\right)}$$

$$= 2{\cdot}30\text{ cm}$$

Inside: unknown is h:

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

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

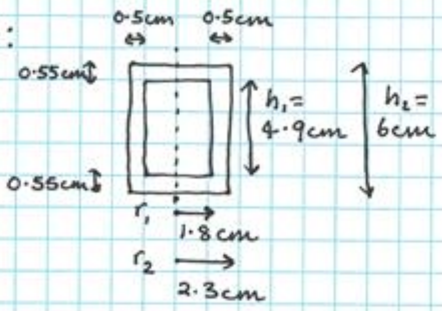
$V = 50\text{cm}^2$, $r = 2{\cdot}30 - 0{\cdot}5 = 1{\cdot}8\text{cm}$

$$h = \frac{50}{\pi \times (1{\cdot}8)^2}$$

$$= 4{\cdot}9\text{ cm}$$

Final Dimensions:

(Cross Section)



T: Tell me about your rearranging.

S: I worked out what I wanted to get – the subject – then I rearranged like we've done in algebra. I put the numbers I know in at the end.