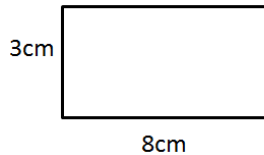
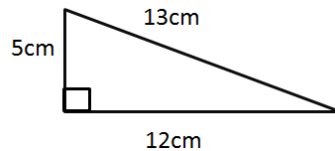


Level 4: Volume and Surface Area

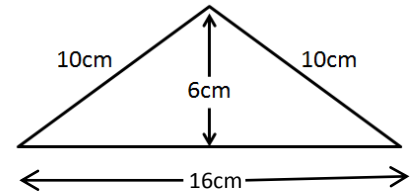
1) In Level 3 we learned how to find the area of a rectangle or a triangle.



$$\begin{aligned}\text{Area} &= \text{length} \times \text{breadth} \\ &= 8 \times 3 \\ &= 24\text{cm}^2\end{aligned}$$

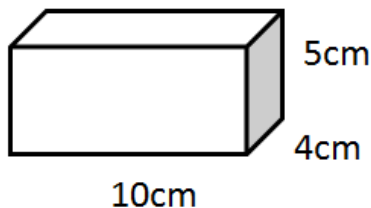


$$\begin{aligned}\text{Area} &= \frac{1}{2} \text{ base} \times \text{height} \\ &= \frac{1}{2} 12 \times 5 \\ &= \frac{1}{2} \text{ of } 60 \\ &= 30\text{cm}^2\end{aligned}$$



$$\begin{aligned}\text{Area} &= \frac{1}{2} \text{ base} \times \text{height} \\ &= \frac{1}{2} 16 \times 6 \\ &= \frac{1}{2} \text{ of } 96 \\ &= 48\text{cm}^2\end{aligned}$$

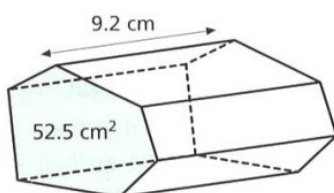
2) In Level 3 we learned how to find the volume of a cuboid.



$$\begin{aligned}V &= \text{length} \times \text{breadth} \times \text{height} \\ &= 10 \times 4 \times 5 \\ &= 200\text{cm}^3\end{aligned}$$

We also learned that $1\text{cm}^3 = 1$ millilitre and 1000 millilitres = 1 litre

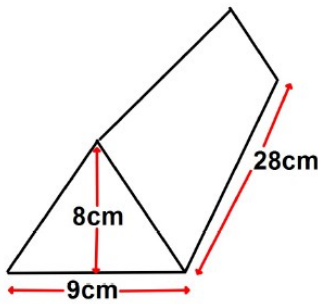
3) In Level 4 we will learn how to find the volume of a prism, for example: -



Volume of prism = Area \times length (or depth or height)

$$\begin{aligned}&= 52.5 \times 9.2 \\ &= 483\text{cm}^3\end{aligned}$$

4) In Level 4 we will learn how to find the volume of a triangular prism, for example: -



$$\text{Area of triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 9 \times 8$$

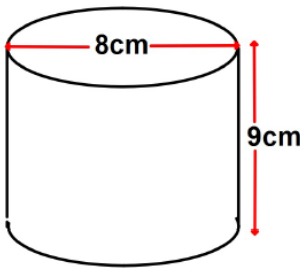
$$= 36\text{cm}^2$$

$$\text{Volume of prism} = \text{Area} \times \text{length}$$

$$= 36 \times 28$$

$$= 1008\text{cm}^3$$

5) In Level 4 we will learn how to find the volume of a cylinder, for example: -



$$\text{Radius} = 8 \div 2 = 4\text{cm}$$

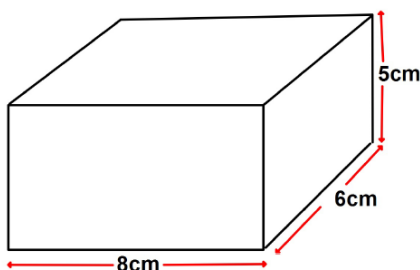
$$\text{Volume} = \pi \times r^2 \times h$$

$$= 3.14 \times 4^2 \times 9$$

$$= 452.16\text{cm}^3$$

Notice that diameter is given and radius is needed to calculate volume.

6) In Level 4 we will learn how to find the surface area of a cuboid, for example: -



$$\text{Area of front} = 8 \times 5 = 40$$

$$\text{Area of side} = 6 \times 5 = 30$$

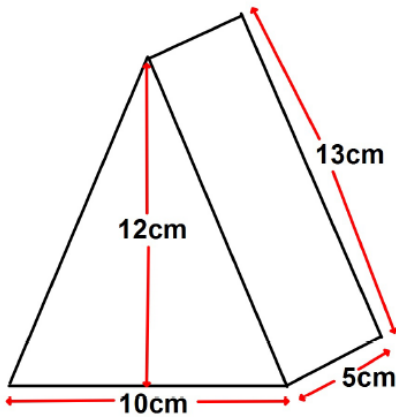
$$\text{Area of top} = 8 \times 6 = 48$$

$$\text{Total so far} = 118$$

$$\text{Surface area} = 118 \times 2 = 236\text{ cm}^2$$

Notice that we find the area of front, side and top then double it to allow for the back, the other side and the bottom.

7) In Level 4 we will learn how to find the surface area of other shapes, including triangular prism, for example: -



$$\text{Area of triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 10 \times 12$$

$$= 60\text{cm}^2$$

$$\text{Area of sides (each)} = 13 \times 5 = 65\text{cm}^2$$

$$\text{Area of bottom} = 10 \times 5 = 50\text{cm}^2$$

$$\text{Total surface area} = 2 \times 60 + 2 \times 65 + 50 = 300\text{cm}^2$$

Two triangles

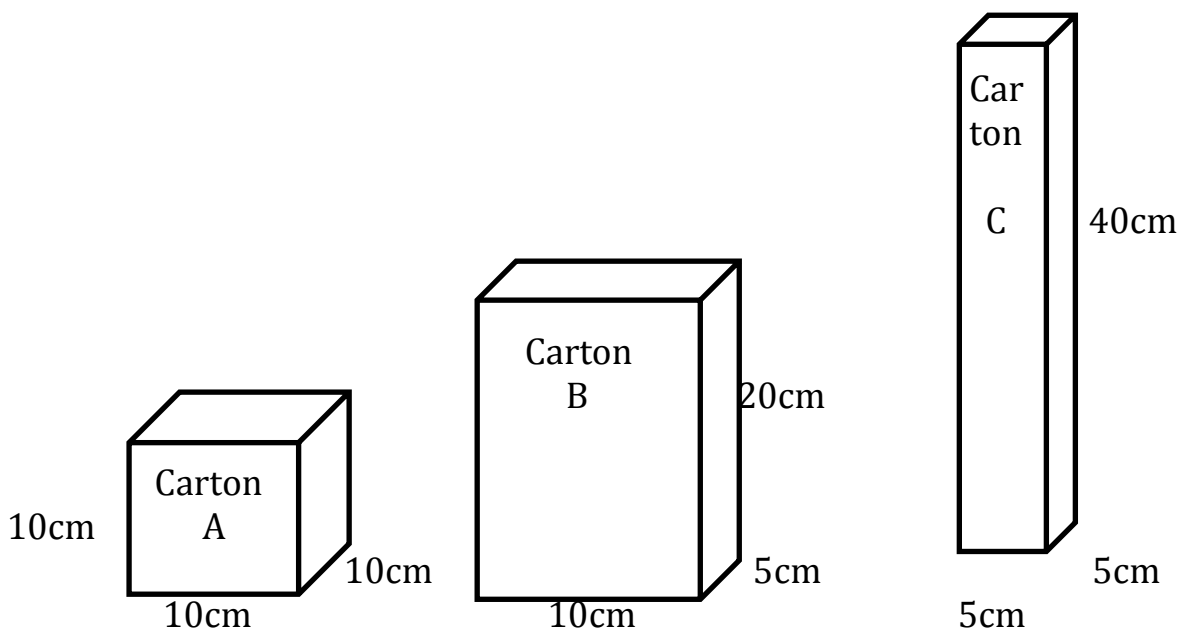
Two rectangles (sides)

Bottom

8) In Level 4 we will learn to solve problems by calculating volume and surface area, for example: -

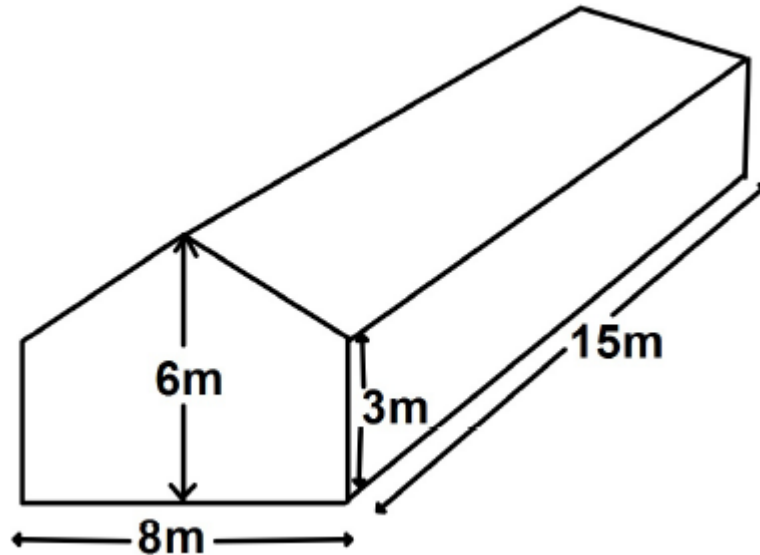
a) Below are three designs of carton being considered for production.

- i) Calculate the volume of each carton.
- ii) Which carton will use the least cardboard?



- b) The village hall is always cold. Looking on a website, Jim finds some heaters which he thinks will work well in the hall. The company recommends one heater should be fitted for every 75m^3 to be heated.

Use Jim's sketch of the village hall below to work out how many heaters are needed to heat the hall properly.



- c) How many glasses can be filled from a 2 litre bottle of juice if the glasses are cylinders 6cm in diameter and 10cm high. (Assume the glasses are filled up to within 1cm of the top so no juice is spilled when people pick the glasses up.)

**REMEMBER TO SHOW ALL YOUR WORKING
AND EXPLAIN YOUR ANSWER FULLY!**