Optimization in 3D – part 1

You have been hired by Husky Cola to design a new pop can. Husky wants the can to have a volume of 355 cm^3. Your job is to find the dimensions (radius and height) of the pop can that would minimize the amount of aluminum needed to make the can.

$$A = 2\pi rh + 2\pi r^2 \qquad\qquad V = \pi r^2 h$$

1. Suppose that the radius of your pop can were 2 centimetres. What would be the height?
   a. Rearrange the formula for Volume to solve it for h, the height.

   b. Substitute 355 cm^3 for V and 2 cm for r in the formula and solve for h.

2. Using a radius of 2 cm and the height that you calculated above, calculate the surface area of the can.

3. Repeat this process (find h, then find A) to complete the table for different values of r.

Radius (cm)	Height (cm)	Surface Area (cm^2)
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		

4. Make a prediction about how the radius should relate to the height of a cylinder in order to minimize the surface area.

Optimization in 3d – part 2

You have been hired by the Husky Juice Company to design a new container. Husky wants the container to have a volume of 355 cm^3. Your job is to find the dimensions (length and height) of a square-based prism container ($w = l$) that would minimize the amount of cardboard used.

$$A = 2l^2 + 4lh \qquad V = l^2 h$$

1. Suppose that the length of your juice container were 5 centimetres. What would be the height?
    a. Rearrange the formula for Volume to solve it for h, the height.

    b. Substitute 355 cm^3 for V and 5 cm for l in the formula and solve for h.

2. Using a length of 5 cm and the height that you calculated above, calculate the surface area of the container.

3. Repeat this process (find h, then find A) to complete the table for different values of l.

Length (cm)	Height (cm)	Surface Area (cm^2)
5.0		
5.5		
6.0		
6.5		
7.0		
7.5		
8.0		

4. Make a prediction about how the length should relate to the height of a square-based prism in order to minimize the surface area.