Investigation A :

How can you compare the surface areas of square-based prisms with the same volume?

Let's invesgate...

1. Use 16 interlocking cubes to build as many different square-based prisms as possible with a volume of 16 cubic units.

2 Calculate the surface area of each prism and record your results in the table.

Length	Width	Height	Volume	Surface Area
			16	
			16	
			16	

3. What are the dimensions of the square-based prism that has the minimum, or opmal, surface area?

4. Describe the shape of this prism compared to the other prisms.

5. Predict the dimensions of the square-based prism with minimum surface area if you use:

   a) 27 cubes   b) 64 cubes.   c) 125 cubes.

REFLECT: Summarize your findings.

a) Do any relaonships exist between the length, width, and height of a square-based prism with minimum surface area for a given volume?

b) What is the ideal shape for minimizing the surface area of a square-based prism when given a fixed volume?

c) How can you predict the dimensions of a square-based prism with minimum surface area if you know the volume?

EX. 1. Cardboard Box Dimensions

a) The Pop-a-Lot popcorn company ships kernels ofpopcorn to movie theatres in large cardboard boxes with avolume of 500 000 cm³. Determine the dimensions of the square-based prism box, to the nearest tenth of a cenmetre, that will require the least amount of cardboard.

b) Find the amount of cardboard required to make this box, to the nearest tenth of a square metre. Describe any assumpons you have made.

Investigation B :

How can you compare the volumes of square-based prisms with the same surface area?

Let's invesgate...

1. Each of the square-based prisms below has a surface area of 24 cm². Calculate the area of the base and the volume of each prism. Record your data in the table.

Prism 1:   5.5 cm   1cm   1cm

Prism 2:   2 cm   2cm   2cm

Prism 3:   0.5 cm   3 cm   3 cm
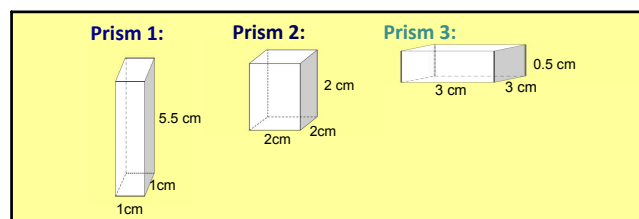
Prism Number	Side length of Base (cm)	Area of Base (cm²)	Surface Area (cm²)	Height (cm)	Volume (cm³)
1			24		
2			24		
3			24		

2. What are the dimensions of the square-based prism that has the maximum, or opmal, volume?

3. Describe the shape of this prism compared to the other prisms.

4. Predict the dimensions of the square-based prism with maximum volume if the surface area is 54 cm².

REFLECT: Summarize your findings.

a) Do any relaonships exist between the length, width, and height of a square-based prism with maximum volume for a given surface area?

b) What is the ideal shape for maximizing the volume of a square-based prism when given a fixed surface area?

c) How can you predict the dimensions of a square-based prism with maximum volume if you know the surface area?

EX. 2. Maximize the Volume of a Square-Based Prism
a) Determine the dimensions of the square-based prism with maximum volume that can be formed using 5400 cm² of cardboard.

b) What is the volume of the prism?