What's Going On?

Checking In

Minds on Revisiting Yesterday's Work

Action! iPad Investigations

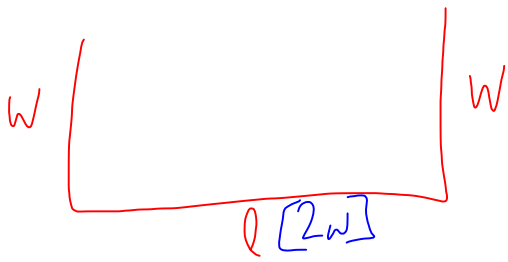
Consolidation Formulating Formal Formulae

Learning Goal - I will be able to optimize the volume and surface area of square-based prims and cylinders.

Minds on

Warm Up Question

A garden enclosed on 3 sides has an optimal area of 242 m². What are the dimensions of the garden?



$A = lw$

$A = (2w)w$

$A = 2w^2$

$A = 2w^2$

$\frac{242}{2} = \frac{\cancel{2}w^2}{\cancel{2}}$

$\sqrt{121} = \sqrt{w^2}$

$w = 11$

$l = 22$

Minds on

To Minimize or To Maximize?

You have started a cereal company. You want to package 500 g of cereal. To do so, you need a box.

Do you want to minimize or maximize the surface area of the box? Why?

Minds on

To Minimize or To Maximize?

You want to send a care package to a friend. You have a particular amount of cardboard to use to make a box.

Do you want to minimize or maximize the volume of the box? Why?

Action!

iPad Investigations

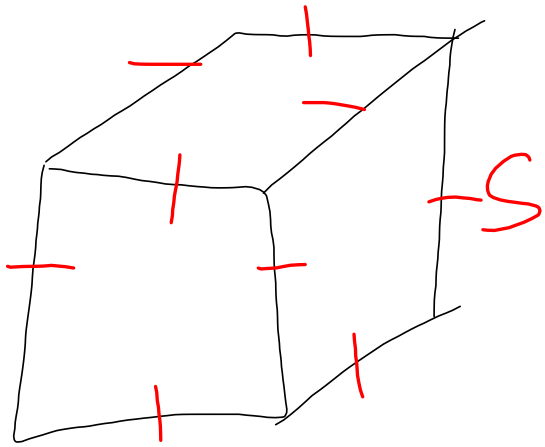
Consolidation

Formulating Formal Formula

Square-Based Prisms

Optimizing Volume (Fixed Surface Area)

$$V = lwh$$



$V = sss$

$V = s^3$

Volume is $27\,cm^3$, what is side length?

$s = \sqrt[3]{V}$

Consolidation

Formulating Formal Formula

Square-Based Prisms

Optimizing Surface Area (Fixed Volume)

$$SA = 2(lw + lh + wh)$$

$$SA = 2(ss + ss + ss)$$

$$SA = 2(s^2 + s^2 + s^2)$$

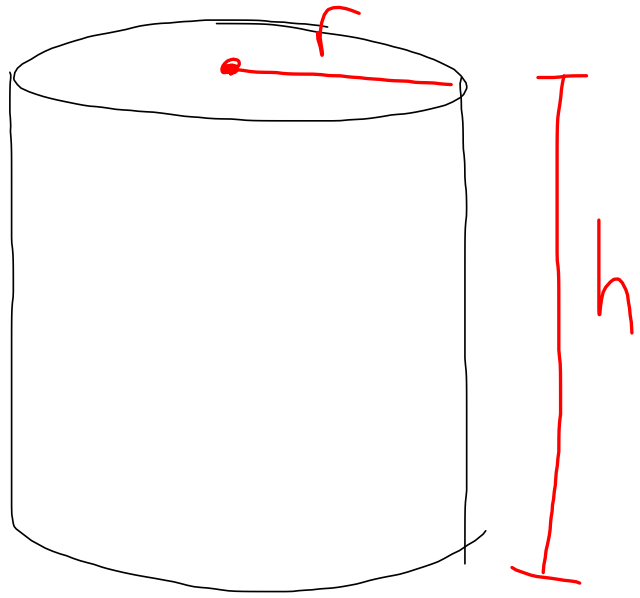
$$SA = 2(3s^2)$$

$$\boxed{SA = 6s^2}$$

$$\frac{SA}{6} = \frac{\cancel{6}s^2}{\cancel{6}}$$

$$\sqrt{\frac{SA}{6}} = \sqrt{s^2}$$

$$s = \sqrt{\frac{SA}{6}}$$


r
h

Consolidation

Formulating Formal Formula

Cylinders

Optimizing Volume (Fixed Surface Area)

* the radius is half the height

$$V = \pi r^2 h$$

$$V = \pi r^2 (2r)$$

$$V = 2\pi r^2 (r)$$

$$V = 2\pi r^3$$

Consolidation

Formulating Formal Formula

Cylinders

Optimizing Surface Area (Fixed Volume)

$$SA = 2\pi r^2 + 2\pi rh$$

$$SA = 2\pi r^2 + 2\pi r(2r)$$

$$SA = 2\pi r^2 + 4\pi r^2$$

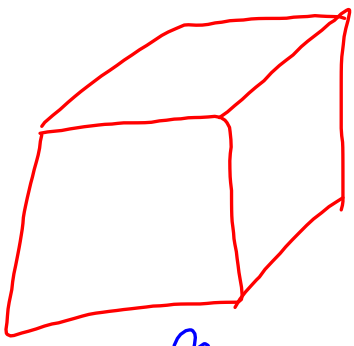
$$SA = 6\pi r^2$$

Consolidation

Exit Question

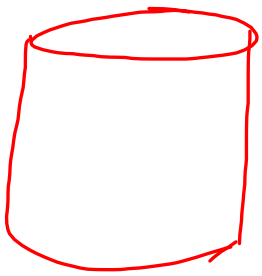
Two optimized containers both have a volume of 1,000 cm^3. One container is a box, the other is a cylinder.

Which container uses more material?



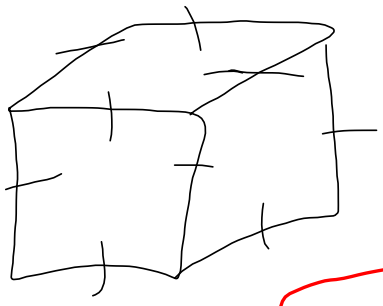
$V = s^3$

$SA = 6s^2$



$V = 2\pi r^3$

$SA = 6\pi r^2$



$V = s^3$

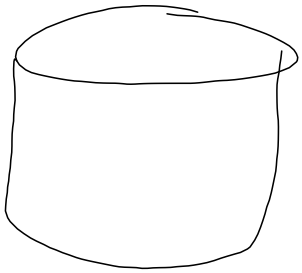
$\sqrt[3]{1000} = \sqrt[3]{s^3}$

$s = 10\text{cm}$

$SA = 6s^2$

$SA = 6(10)^2$

$SA = 600\text{cm}^2$



$V = 1000\,cm^3$

$V = 2\pi r^3$

$$\frac{1000}{2} = \frac{\cancel{2}\pi r^3}{\cancel{2}}$$

$$\frac{500}{\pi} = \frac{\cancel{\pi} r^3}{\cancel{\pi}}$$

$$\sqrt[3]{r^3} = \sqrt[3]{159.15}$$

$r = 5.42\,cm$

$SA = 2\pi r^2 + 2\pi r h$

$SA = 6\pi r^2$

$SA = 6\pi(5.42)^2$

$SA = 553.73\,cm^2$

Therefore, the box uses more material than the cylinder.