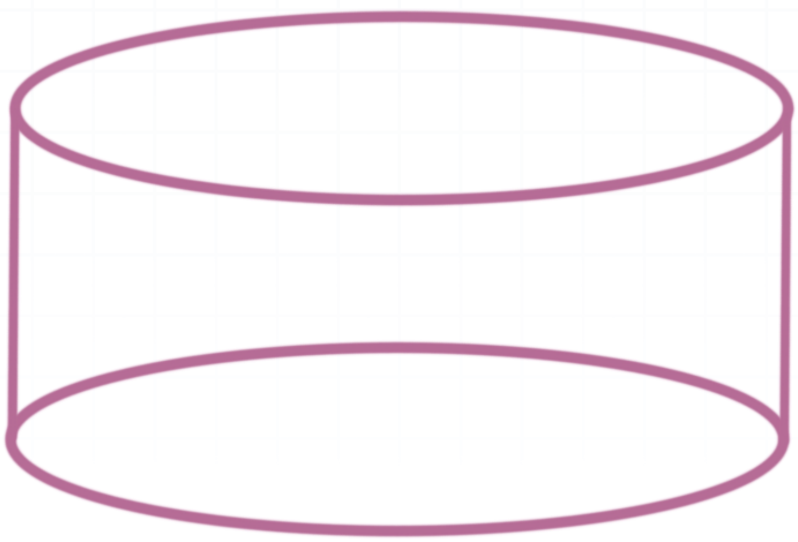
Nets/volume/surface area of cylinders

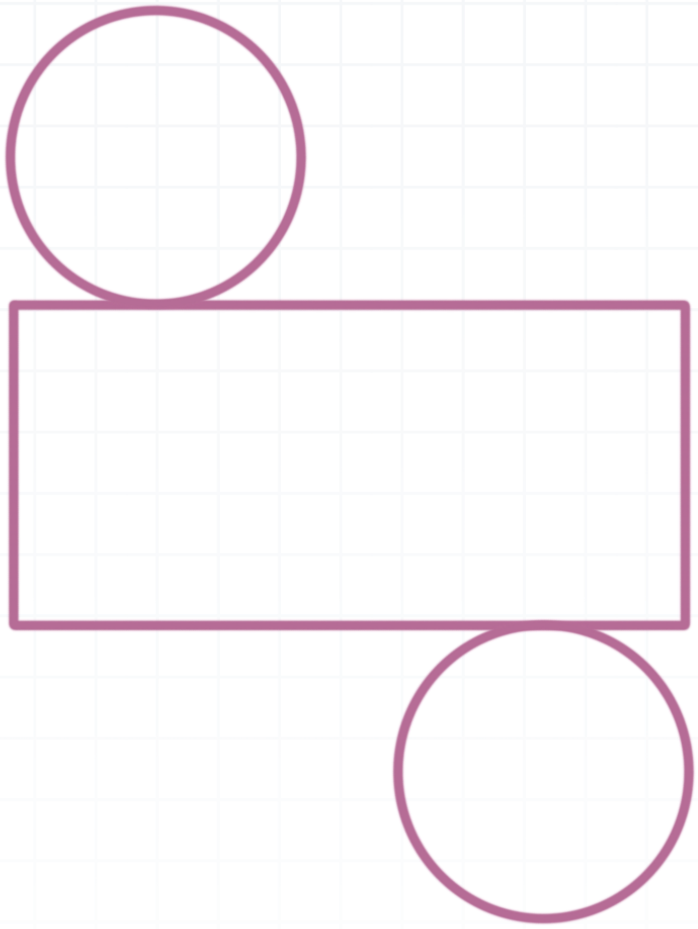
In this lesson we'll look at the nets, volume, and surface area of cylinders.

Cylinders

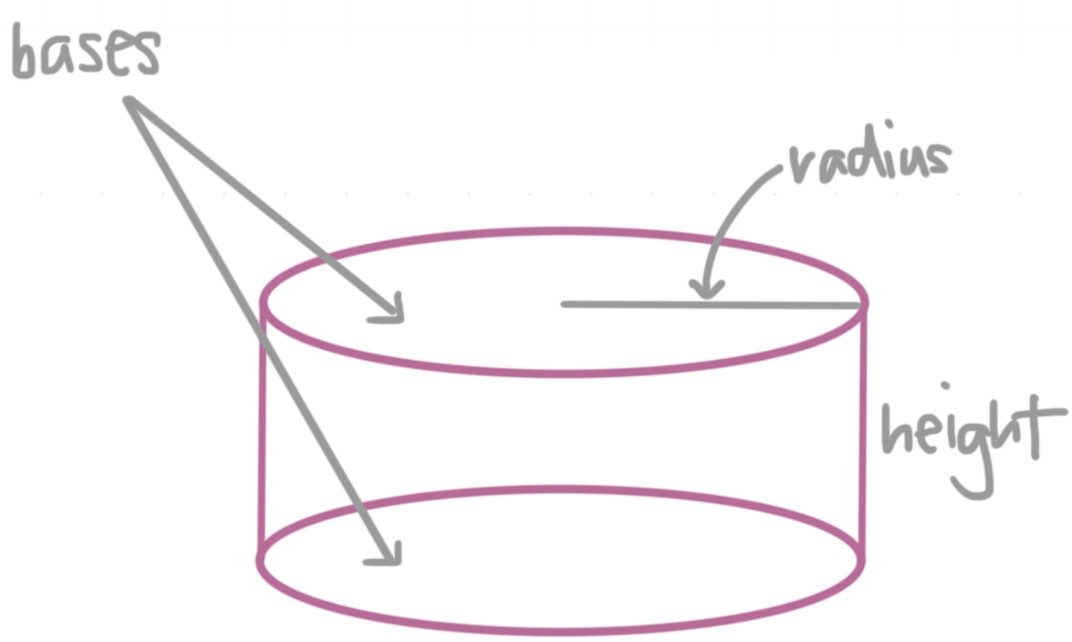
A **right circular cylinder** (the only kind of cylinder we're dealing with in this lesson) has a pair of parallel, congruent circular bases.



The net of a cylinder looks like a rectangle with two circles attached at opposite ends.



We also define a base radius for the cylinder as the radius of the base, and the height of the cylinder as the distance between the bases.



Volume and surface area

The volume of a cylinder is the product of π, the square of the radius, and the height of the cylinder. Sometimes we use the estimated value of $\pi \approx 3.14$, and sometimes we use the symbol π to represent the exact value.

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

And the surface area of a cylinder is given by

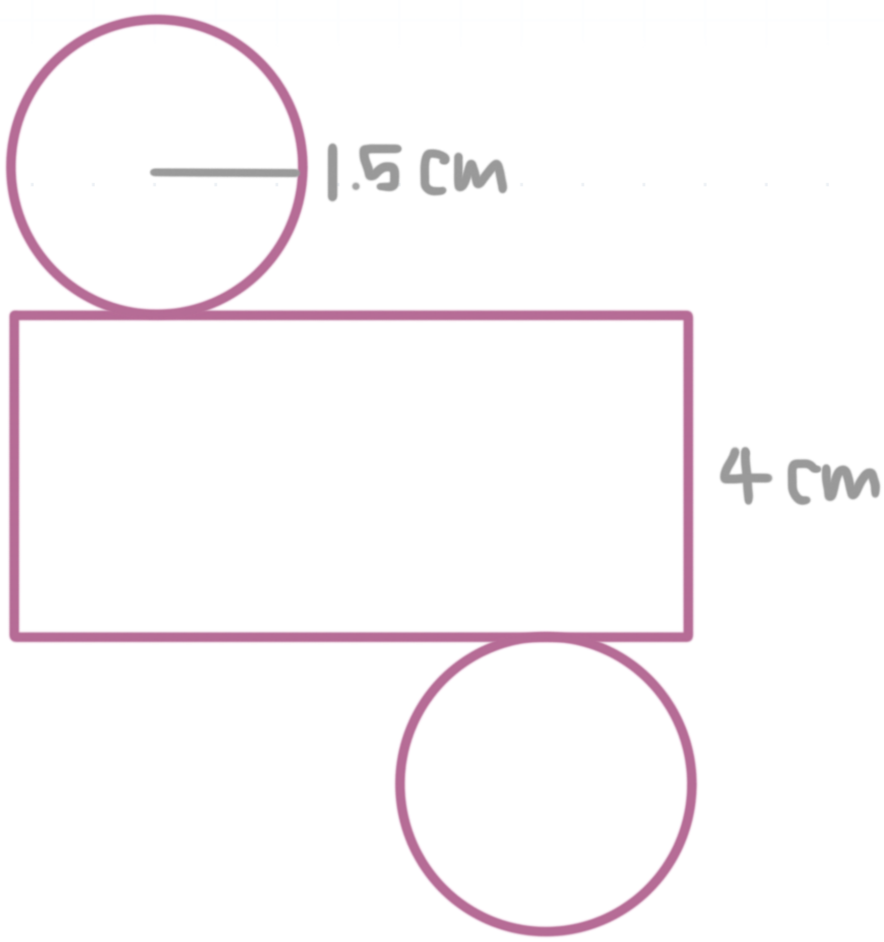
$$S = 2\pi rh + 2\pi r^2$$

where r is the radius of the cylinder and h is the height of the cylinder.

Let's do a few examples.

Example

What is the area of the rectangle shown in the net?



The area of the rectangle in the net of a cylinder is the product of the circumference of the circle (which is the length of the horizontal dimension of the rectangle in this net) and the height of the cylinder (which is the length of the vertical dimension of the rectangle in this net). The circumference of a circle is $C = 2\pi r$, so the area of the rectangle is $A = 2\pi rh$. You'll notice this shows up in the first part of the surface area formula for a cylinder.

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

Area of the rectangle

Area of the circles

Let's go ahead and calculate the area.

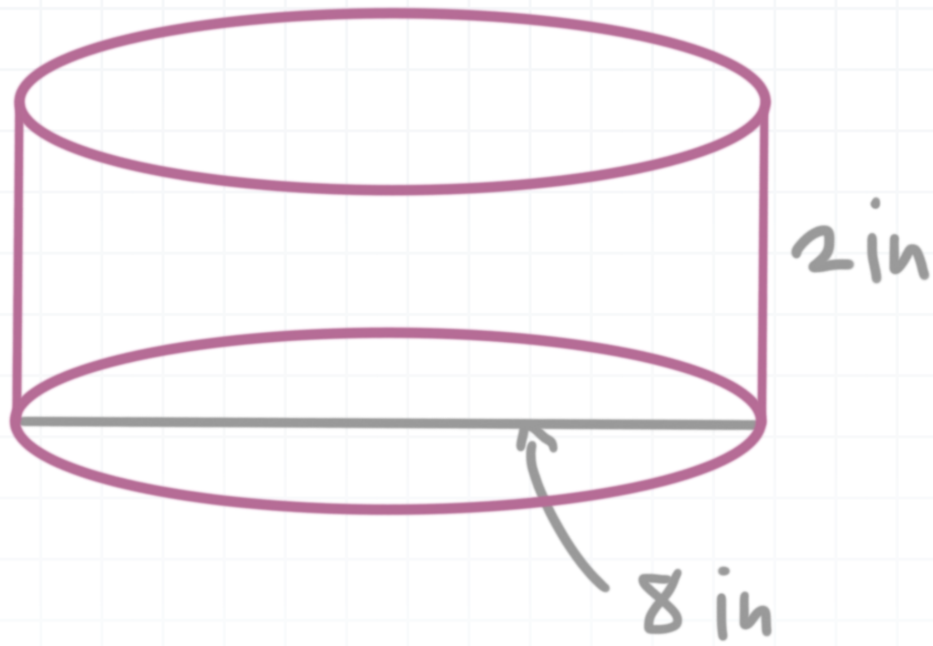
$$A = 2\pi(1.5 \text{ cm})(4 \text{ cm})$$

$$A = 12\pi \text{ cm}^2$$

Let's do a volume problem.

Example

What is the volume of the cylinder, assuming $\pi \approx 3.14$.



Use the formula for volume.

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

The diameter of the cylinder is 8, so we need to divide it by 2 to get the radius.

$$r = \frac{d}{2} = \frac{8 \text{ in}}{2} = 4 \text{ in}$$

Plugging in the dimensions of the cylinder, we get

$$V \approx 3.14(4 \text{ in})^2(2 \text{ in})$$

$$V \approx 3.14(16 \text{ in}^2)(2 \text{ in})$$

$$V \approx 100.48 \text{ in}^3$$

Let's do a surface area problem.

Example

A cylinder has a radius of 12 ft and a surface area of $1{,}356.48$ ft^2. What is the height of the cylinder, assuming $\pi \approx 3.14$?

We'll plug what we know into the surface area formula.

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

$$1{,}356.48 \text{ ft}^2 = 2(3.14)(12 \text{ ft})(h) + 2(3.14)(12 \text{ ft})^2$$

Now we can solve for the height.

$$1{,}356.48 \text{ ft}^2 = (75.36 \text{ ft})(h) + 904.32 \text{ ft}^2$$

$$452.16 \text{ ft}^2 = (75.36 \text{ ft})(h)$$

$$\frac{452.16 \text{ ft}^2}{75.36 \text{ ft}} = h$$

$$h = 6 \text{ ft}$$