



Getting the Idea

The **surface area** of a three-dimensional figure is the sum of the **areas** of all of the figure's surfaces. Surface area is measured in square units. The table below shows the formulas to find the surface areas of some figures.

Figure	Formula
Rectangular Prism	$SA = 2lw + 2lh + 2wh$
Cube	$SA = 6e^2$, where e is the length of an edge
Cylinder	$SA = 2\pi rh + 2B$, where B is the area of one base or $SA = 2\pi rh + 2\pi r^2$
Square Pyramid	$SA = B + \frac{1}{2}Pl$, where B is the area of the base, P is the perimeter of the base, and l is the slant height of a triangular face

EXAMPLE 1

What is the surface area of this rectangular prism?

STRATEGY Use the formula for the surface area of a rectangular prism.

STEP 1 Substitute the values for the length (l), width (w), and height (h).

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

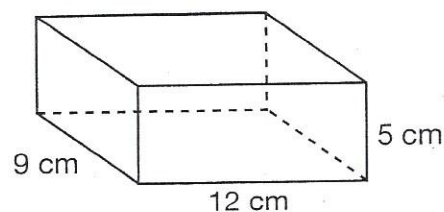
$$= (2 \times 12 \text{ cm} \times 9 \text{ cm}) + (2 \times 12 \text{ cm} \times 5 \text{ cm}) + (2 \times 9 \text{ cm} \times 5 \text{ cm})$$

STEP 2 Multiply then add to find the total surface area.

$$SA = 216 \text{ cm}^2 + 120 \text{ cm}^2 + 90 \text{ cm}^2$$

$$= 426 \text{ cm}^2$$

SOLUTION The surface area of the rectangular prism is 426 square centimeters.

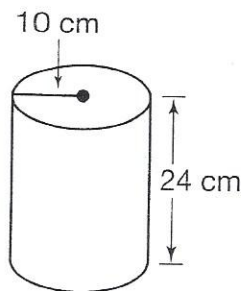


Surface Area p. 2

We often will use the number 3.14 to approximate π when finding the surface area of a cylinder. Because π is not exactly 3.14, the surface area we find is not exact either. To indicate that the number is an approximation rather than an exact answer, use the symbol \approx rather than an equal sign.

EXAMPLE 2

What is the approximate surface area of this cylinder? Use 3.14 for π .



STRATEGY Use the formula for the surface area of a cylinder.

STEP 1 Substitute the values for the radius (r) and height (h).

$$\begin{aligned} SA &= 2\pi rh + 2\pi r^2 \\ &= (2 \times 3.14 \times 10 \text{ cm} \times 24 \text{ cm}) + (2 \times 3.14 \times 10 \text{ cm} \times 10 \text{ cm}) \end{aligned}$$

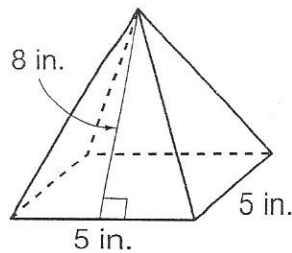
STEP 2 Multiply then add to find the total surface area.

$$\begin{aligned} SA &\approx (3.14 \times 480 \text{ cm}^2) + (3.14 \times 200 \text{ cm}^2) \\ &\approx 1507.2 \text{ cm}^2 + 628 \text{ cm}^2 \approx 2135.2 \text{ cm}^2 \end{aligned}$$

SOLUTION The approximate surface area of the cylinder is 2135.2 square centimeters.

EXAMPLE 3

What is the surface area of the square pyramid?



STRATEGY Use the formula for the surface area of a square pyramid.

STEP 1 Write the formula and determine what you need to find.

$$SA = B + \frac{1}{2}P\ell$$

You need to find B , the area of the base, and P , the perimeter of the base.

The slant height of the pyramid, ℓ , is 8 inches.

STEP 2 Find B , the area of the square base.

$$\begin{aligned} B &= s^2 \\ &= 5 \text{ in.} \times 5 \text{ in.} = 25 \text{ in.}^2 \end{aligned}$$

STEP 3 Find P , the perimeter of the square base.

$$\begin{aligned} P &= 4s \\ &= 4 \times 5 \text{ in.} = 20 \text{ in.} \end{aligned}$$

STEP 4 Substitute the values of B , P , and ℓ into the formula.

$$\begin{aligned} SA &= B + \frac{1}{2}P\ell \\ &= 25 \text{ in.}^2 + \frac{1}{2}(20 \text{ in.})(8 \text{ in.}) \\ &= 25 \text{ in.}^2 + 80 \text{ in.}^2 = 105 \text{ in.}^2 \end{aligned}$$

SOLUTION The surface area of the square pyramid is 105 square inches.

To find the surface area of a triangular prism, you can find the area of each face. There are 3 rectangular faces and 2 triangular faces, so you will need to use the formulas for the area of a rectangle and the area of a triangle.

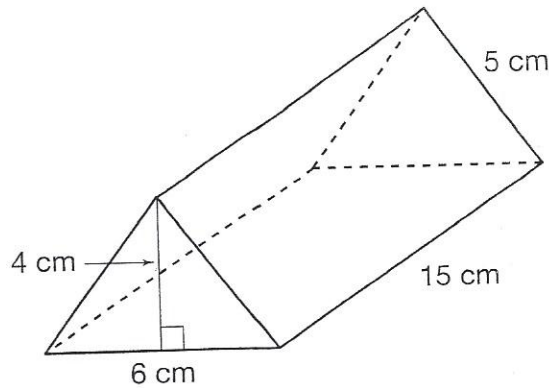
Rectangle: $A = lw$, where l is the length and w is the width

Triangle: $A = \frac{1}{2}bh$, where b is the base and h is the height

Surface Area p. 4 Section

EXAMPLE 4

What is the surface area of this triangular prism?



STRATEGY Find the area of each face. Then add the areas.

STEP 1 Write the dimensions of each face.

Front triangle: 4 cm by 6 cm

Back triangle: 4 cm by 6 cm

Left rectangle: 15 cm by 5 cm

Right rectangle: 15 cm by 5 cm

Bottom rectangle: 15 cm by 6 cm

STEP 2 Find the area of each triangle.

$$A = \frac{1}{2}bh$$

$$= \frac{1}{2} \times 4 \text{ cm} \times 6 \text{ cm} = 12 \text{ cm}^2$$

Each triangle has an area of 12 cm^2 .

STEP 3 Find the area of each rectangle.

$$A = lw$$

$$\text{Left rectangle: } 15 \text{ cm} \times 5 \text{ cm} = 75 \text{ cm}^2$$

$$\text{Right rectangle: } 15 \text{ cm} \times 5 \text{ cm} = 75 \text{ cm}^2$$

$$\text{Bottom rectangle: } 15 \text{ cm} \times 6 \text{ cm} = 90 \text{ cm}^2$$

STEP 4 Add the areas.

$$12 \text{ cm}^2 + 12 \text{ cm}^2 + 75 \text{ cm}^2 + 75 \text{ cm}^2 + 90 \text{ cm}^2 = 264 \text{ cm}^2$$

SOLUTION The surface area of the triangular prism is 264 square centimeters.

**COACHED EXAMPLE**

A box in the shape of a cube has 12-inch edges. What is the surface area of the box?

THINKING IT THROUGH

The formula for the surface area of a cube is $SA =$ _____.

Substitute the value for the variable.

$$SA = 6 \times \text{______}^2$$

Evaluate the exponent.

$$SA = 6 \times \text{______}$$

Multiply.

$$SA = \text{______}$$

The length of the edge is given in _____, so the units of the area are _____.

The surface area of the box is _____.