10.5 Surface Areas of Prisms and Cylinders

Goal: Find the surface areas of prisms and cylinders.

Vocabulary

Surface area of a solid: *the sum of the areas of the faces*

Net: *2-D drawing of a 3-D shape*

Lateral faces of a prism:

Lateral area of a prism:

Lateral surface of a cylinder:

Lateral area of a cylinder:

> In your textbook, every prism is a *right prism*, which means that the edges connecting the bases are perpendicular to the bases.

Example 1 Using a Net to Find Surface Area

A storage chest has the shape of a rectangular prism. The net represents the storage chest. Use the net to find the surface area of the storage chest.
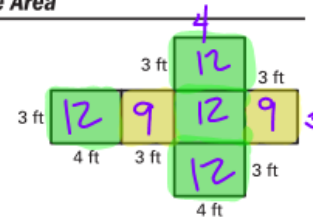
1. Find the area of each face.

Area of a rectangular face: $4 \cdot 3 = 12 \text{ ft}^2$

Area of a square face: $3 \cdot 3 = 9 \text{ ft}^2$

2. Find the sum of the areas of the faces.

$(4 \cdot 12) + (2 \cdot 9) = 66 \text{ ft}^2$

$48 + 18$

Answer: The surface area of the storage chest is *66 square feet*

The formula applies to any prism. When finding the surface area of a rectangular prism, you can substitute ℓw for B and $2\ell + 2w$ for P. So, the formula becomes $S = 2\ell w + (2\ell + 2w)h$.

Surface Area of a Prism

Words The surface area S of a prism is the sum of twice the base area B and the product of the base perimeter P and the height h.

$h = 10$
$w = 4$
$\ell = 6$
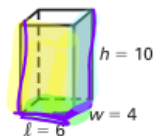
Algebra $S = 2B + Ph$

Numbers $S = 2(6 \cdot 4) + [2(6) + 2(4)]10 = 248$ square units

(handwritten)
f/b: 6·10 = 60·2 = 120
t/b: 6·4 = 24·2 = 48
ℓ/r: 4·10 = 40·2 = 80
—————
248 units²

Example 2 — Using a Formula to Find Surface Area

Find the surface area of the prism.

The bases of the prism are right triangles.

13 in.
5 in.   20 in.
12 in.

$S = 2B + Ph$ *(crossed out)*

$= 2(\boxed{}) + (\boxed{})(\boxed{})$ Substitute.

$= \boxed{}$ Simplify.

Answer: The surface area of the prism is $\boxed{}$

Write formula for surface area.
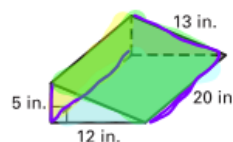
(handwritten)
triangles: $A = \frac{1}{2} \cdot b \cdot h$
$= \frac{1}{2} \cdot 12 \cdot 5$
$= 30 \cdot 2$ → 60 in²
↑ 2 triangles
base: 12·20 = 240 in²
back: 5·20 = 100 in²
top: 13·20 = 260 in²
+
660 in²
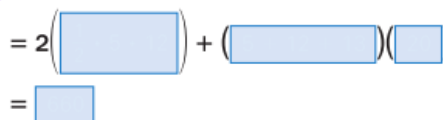
In your textbook, all cylinders are *right* cylinders, which means that the segment connecting the centers of the bases is perpendicular to the bases.

Surface Area of a Cylinder

Words The surface area S of a cylinder is the sum of twice the base area B and the product of the base circumference C and the height h.
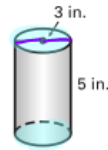
$r = 4$
$h = 10$
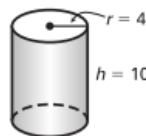
Algebra $S = 2B + Ch = 2\pi r^2 + 2\pi rh$

Numbers $S = 2\pi(4)^2 + 2\pi(4)(10) \approx 352$ square units

Example 3   Using a Formula to Find Surface Area

Soup Can Find the surface area of the can of soup. Round your answer to the nearest tenth of an inch.

3 in.

5 in.

① $A = \pi \cdot r^2$
$= \pi \cdot 1.5^2$
$= 7.1 \times 2 = \boxed{14.2 \, in^2}$
↑ circles

7.06↑

$C = \pi d$
$C = 2\pi r$

Solution

The radius is one half of the diameter, so $r = 1.5$ inches.

② $C = \pi \cdot 3 = 9.4$

③ $9.4 \cdot 5 = \boxed{47 in^2}$
  $l \cdot w$

$S = 2\pi r^2 + 2\pi rh$ Write formula for surface area of a cylinder.

$= 2\pi()^2 + 2\pi()()$ Substitute.

④ 14.2
  $+47$

$= \pi$ Simplify.

$\boxed{61.2 in^2}$
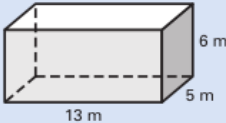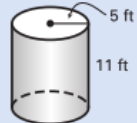
$\approx $ Evaluate. Use a calculator.

Answer: The surface area of the can of soup is about

_____ .

> Although you used 3.14 as an approximation for π previously, you can obtain a more accurate approximation by using the π key on a calculator.

✔ **Checkpoint**   Find the surface area of the prism or cylinder. Round to the nearest whole number.

1.

6 m
5 m
13 m

2.

5 ft
11 ft

Area of cylinder

① find area of circle
  • double it
② find circumference of circle
  (this is the rectangle's length)
③ circumference x height,
  (this is the rectangle's area)
④ add