

Solve & Discuss It!

Alaya will paint the outside of a box with three different colors. Decide how she could paint the box. What is the total area that each color will cover?

32 in.
16 in.
14 in.

Make Sense and Persevere
What do you know about the faces of a rectangular prism?

Lesson 8-8

Solve Problems Involving Surface Area

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I can...
find the area and surface area of 2-dimensional composite shapes and 3-dimensional prisms.

Focus on math practices

Reasoning Trista paints each pair of opposite sides of the box with the same color. How many different areas does she need to find to determine the total area covered by each color? Explain.

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Essential Question How is finding the area of composite two-dimensional figures similar to finding the surface area of three-dimensional figures?

EXAMPLE 1 Find the Area of Composite Figures

A city planner wants all neighborhood parks to have more green space than non-green space. Does this park meet the requirements? Explain.

Look for Relationships
How are the areas of the green and non-green spaces related to the total area of the park?

The shape of the non-green space is a composite figure. A **composite figure** is the combination of two or more geometric shapes.

Scan for Multimedia

Divide the park into familiar shapes. Use the information given to find the dimensions.

Add the areas of the non-green shapes.

$$14 \cdot 24 = 336$$

$$11 \cdot 24 = 264$$

$$\frac{1}{2}(24) \cdot 24 = 288$$

$$336 + 264 + 288 = 888 \text{ ft}^2$$

The total non-green area is 888 ft^2 .

Find the area of the green space.

Area of entire park

$$(49 \cdot 36) - 888$$

$$= 1,764 - 888$$

$$= 876 \text{ ft}^2$$

The park does not meet the requirements since the non-green area, 888 ft^2 , is greater than the green area, 876 ft^2 .

Try It!

This diagram shows the area of a room to be carpeted. What will be the area of the new carpet?

A = = ft^2 B = = ft^2

Total area = +

The area of the new carpet is square feet.

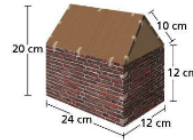
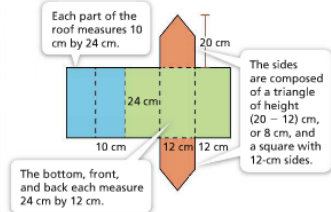
Convince Me! How does knowing the area of familiar shapes help find the total area of a composite shape?

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EXAMPLE 2 Solve Surface Area Problems

Gavin constructed a model building and wants to cover the outside with paper. How much paper will he need to cover the entire model?

STEP 1 Find the area of each face of the model.



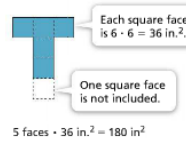
STEP 2 Find the total surface area of the model.

$$(240 \cdot 2) + (288 \cdot 3) + (144 \cdot 2) + (48 \cdot 2) = 1,728 \text{ cm}^2$$

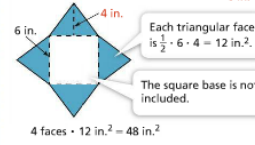
EXAMPLE 3 Solve Mathematical Problems Involving Surface Area

What is the surface area of the composite figure shown?

STEP 1 Find the surface area of the bottom of the composite figure.



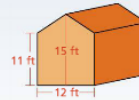
STEP 2 Find the surface area of the top of the composite figure.



The total surface area of the composite figure is $180 + 48 = 228 \text{ in.}^2$.

Try It!

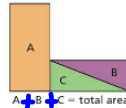
Hiroimi is painting the front and back of a barn. Each can of paint covers 32 square feet. How many cans of paint does Hiroimi need to cover the entire front and back of the barn?



KEY CONCEPT

The area of a two-dimensional composite figure is the sum of the areas of all the shapes that compose it. The surface area of a three-dimensional composite figure is the sum of the areas of all its faces.

Two-dimensional composite figure



Three-dimensional composite figure

Add the areas of each face of the rectangular prism, but not the face that is shared with Figure B.

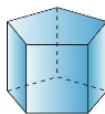


Add the areas of each face of the triangular prism, but not the face that is shared with Figure A.

$$\text{Surface area of shape A} + \text{Surface area of shape B} = \text{Surface area of composite shape}$$

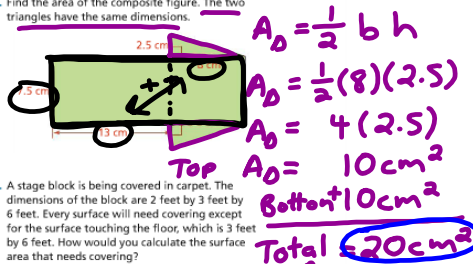
Do You Understand?

- Essential Question** How is finding the area of composite two-dimensional figures similar to finding the surface area of three-dimensional figures?
- Make Sense and Persevere** Laine wants to determine the amount of fabric needed to cover a triangular prism-shaped box. She begins by measuring the dimensions of the box. Explain her next steps.
- Use Structure** Explain how you would find the surface area of the figure below.



Do You Know How?

- Paula is painting a henhouse. If a can of paint will cover 24 square feet, how many cans of paint does she need to buy? Explain the steps she might take to solve this problem.
- Find the area of the composite figure. The two triangles have the same dimensions.
- A stage block is being covered in carpet. The dimensions of the block are 2 feet by 3 feet by 6 feet. Every surface will need covering except for the surface touching the floor, which is 3 feet by 6 feet. How would you calculate the surface area that needs covering?



Total Area
 $20 \text{ cm}^2 + 157.5 \text{ cm}^2$
 177.5 cm^2

$A_D = (13+8)(7.5)$
 $A_D = 21(7.5)$
 $= 157.5 \text{ cm}^2$

Name: _____

Practice & Problem Solving

Leveled Practice In 7, fill in the boxes to solve.

7. Jacob is putting tiles on the sections of his yard labeled A, B, and C. What is the area of the parts that need tiles?

Part A = · = m²

Part B = · = m²

Part C = $\frac{1}{2}$ · · = m²

Total area = + + = m²

8. What is the total area of the figure?

9. Find the surface area of the prism.

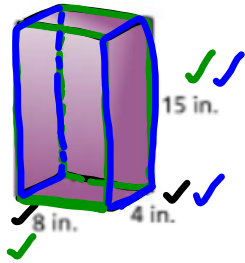
10. Find the surface area of the triangular prism. The base of the prism is an isosceles triangle.

11. A block of wood has the shape of a triangular prism. The bases are right triangles. Find its surface area.

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9. Find the surface area of the prism.



Top + Bottom

$$A = (8 \text{ in.})(4 \text{ in.}) = 32 \text{ in}^2 \quad \text{Top}$$

$$+ 32 \text{ in}^2 \quad \text{Bottom}$$

$$\hline 64 \text{ in}^2$$

Front + Back

$$A = (8 \text{ in.})(15 \text{ in.}) = 120 \text{ in}^2 \quad \text{Front}$$

$$+ 120 \text{ in}^2 \quad \text{Back}$$

$$\hline 240 \text{ in}^2$$

Left + Right

$$A = (4 \text{ in.})(15 \text{ in.}) = 60 \text{ in}^2 \quad \text{Left}$$

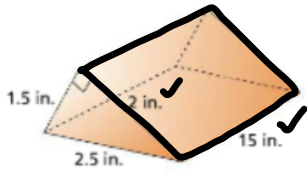
$$+ 60 \text{ in}^2 \quad \text{Right}$$

$$\hline 120 \text{ in}^2$$

Overall Total Area

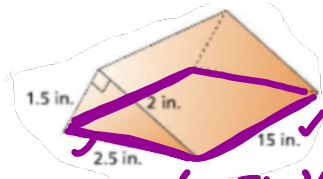
$$\begin{array}{r} 64 \text{ in}^2 \\ 240 \text{ in}^2 \\ + 120 \text{ in}^2 \\ \hline 424 \text{ in}^2 \end{array}$$

11. A block of wood has the shape of a triangular prism. The bases are right triangles. Find its surface area.



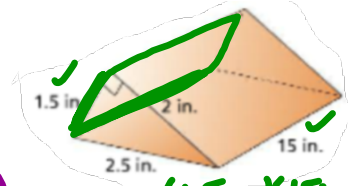
$$A_{\square} = (2 \text{ in.})(15 \text{ in.})$$

$$30 \text{ in}^2$$



$$A_{\square} = (2.5 \text{ in.})(15 \text{ in.})$$

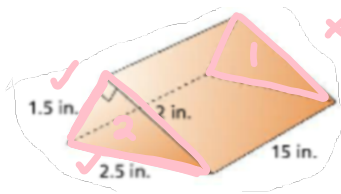
$$37.5 \text{ in}^2$$



$$A_{\square} = (1.5 \text{ in.})(15 \text{ in.})$$

$$22.5 \text{ in}^2$$

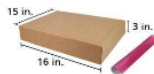
Total Area
add up all Areas



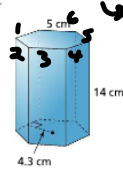
$$A_{\triangle} = \frac{1}{2} (2.5 \text{ in.})(1.5 \text{ in.})$$

$$1.875 \text{ in}^2 \times 2 = 3.75 \text{ in}^2$$

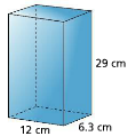
12. A box has the shape of a rectangular prism. How much wrapping paper do you need to cover the box?



13. Higher Order Thinking Find the surface area of the rectangular hexagonal prism. Show your work.



14. A box has the shape of a rectangular prism with a height of 29 centimeters. If the height is increased by 0.7 centimeter, by how much does the surface area of the box increase?

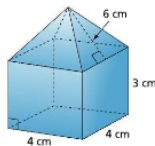


15. The base of a prism is an equilateral triangle with an area of 73.2 square centimeters. The area of each lateral face is 104 square centimeters. Riley incorrectly claims that the surface area is 250.4 square centimeters.

- What is the correct surface area?
- What could have been Riley's error?

Assessment Practice

16. The bottom part of this block is a rectangular prism. The top part is a square pyramid. How much paper is needed to completely cover the block? Explain.



13. Higher Order Thinking Find the surface area of the rectangular hexagonal prism. Show your work.



6 rectangles

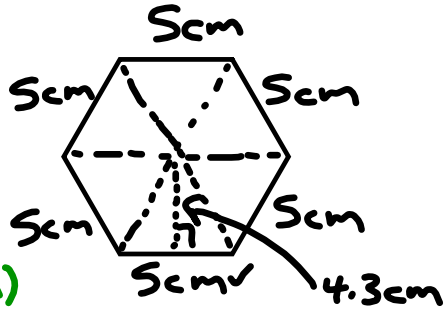
each \square

$$A = (5\text{cm})(14\text{cm})$$

$$A = 70\text{cm}^2$$

$$\text{Total } \square A = 420\text{cm}^2$$

4.3 cm
h of Δ



$$A_{\Delta} = \frac{1}{2} \cdot b \cdot h$$

$$A_{\Delta} = \frac{1}{2} (5\text{cm})(4.3\text{cm})$$

$$A_{\Delta} = 10.75\text{cm}^2$$

$\times 6$

Total Δ
Area

$$= 64.5\text{cm}^2$$

Total Area
overall

$$420 + 64.5$$

$$484.5\text{cm}^2$$

