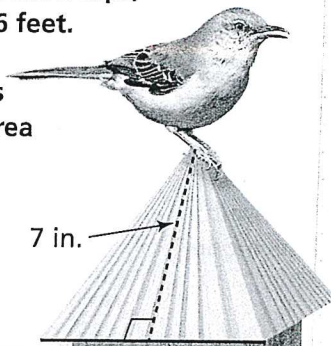


Solve & Discuss It!



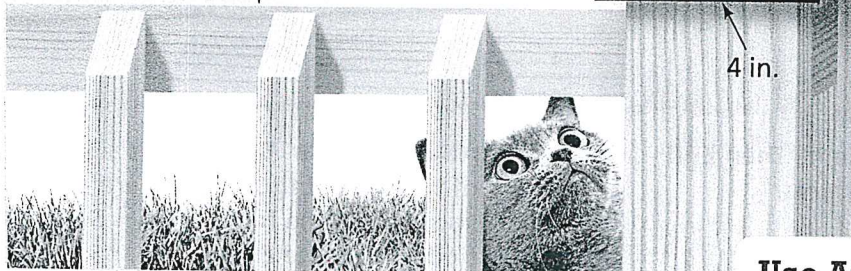
ACTIVITY

The fence in Marci's front yard has decorative tops, in the shape of square pyramids, every 6 feet. Marci paints each face of each top a different color before attaching the tops to the fence. What is the total surface area that she paints on each decorative top?



7 in.

4 in.



Use Appropriate Tools

What tools can you use to help solve this problem?


Lesson 7-7 Find Surface Areas of Pyramids



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I can...

draw a net of a pyramid and use it to find the pyramid's surface area.

-  **MAFS.6.G.1.4** Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems. Also 6.EE.1.2a, 6.EE.1.2c, 6.EE.2.6

MAFS.K12.MP.2.1, MP.3.1, MP.5.1, MP.7.1

Focus on math practices

Use Structure Suppose the side lengths of the square base of each decorative top are increased by 2 inches. What is the total surface area of each top?



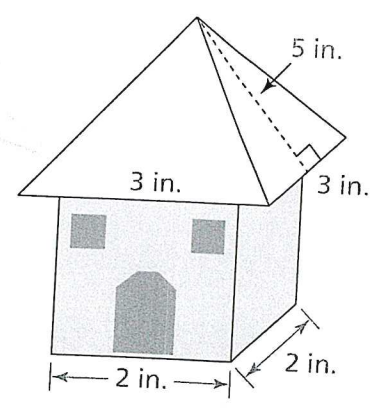
EXAMPLE 1

Find the Surface Area of a Square Pyramid

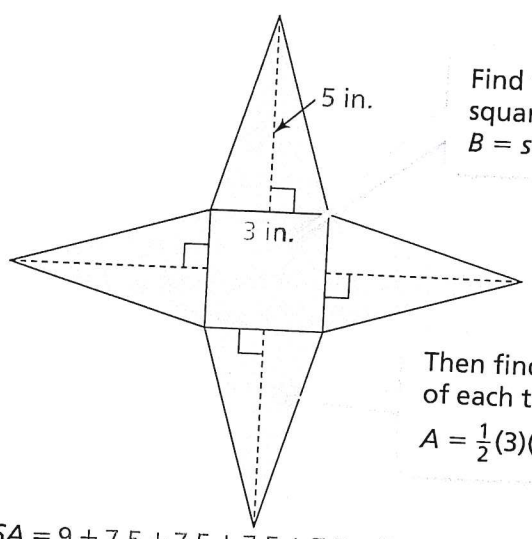


Maxwell made a model of a house using a cube for the bottom and a square pyramid for the top. He wants to paint the top of the house blue to match the bottom of the house. One tube of craft paint covers about 20 square inches. How many tubes of paint does Maxwell need to cover all the faces of the top of his model?

Because the base of this pyramid is a square, the triangular faces are identical.



ONE WAY Draw a net of the square pyramid. Then find the sum of the areas of the base and the faces.



Find the area of the square base (B).
 $B = s^2 = 3^2 = 9 \text{ in.}^2$

Then find the area (A) of each triangular face.
 $A = \frac{1}{2}(3)(5) = 7.5 \text{ in.}^2$

$$SA = 9 + 7.5 + 7.5 + 7.5 + 7.5 = 39$$

The surface area is 39 in.^2 , so Maxwell needs 2 tubes of craft paint.

ANOTHER WAY Because the side lengths of the base of the pyramid are all equal, you can use the formula $SA = B + (nA)$ to find the surface area (SA).

B = area of the base of the pyramid, 9

n = number of faces, 4

A = area of each triangular face, 7.5

$$SA = B + (n \times A)$$

$$SA = 9 + (4 \times 7.5)$$

$$SA = 39$$

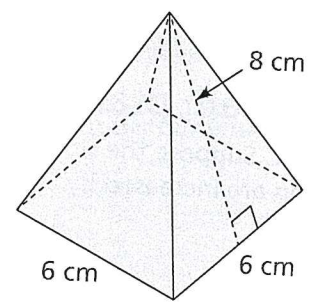
The formula finds the sum of the areas of the base and each face in the net.

The surface area is 39 in.^2 , so Maxwell needs 2 tubes of craft paint.

Try It!

Find the surface area of the square pyramid. Draw a net to find the areas of the base and each face of the pyramid.

Convince Me! For the pyramid in the Try It!, what values would you use for B , n , and A in the formula $SA = B + (nA)$?



EXAMPLE 2



Find the Surface Area of a Triangular Pyramid

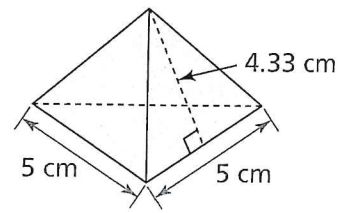


ACTIVITY

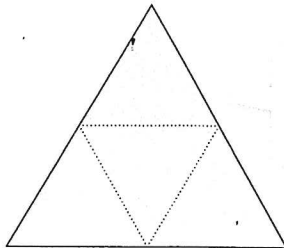


ASSESS

Tamara made a small gift box that has the shape of a triangular pyramid. The faces of the box are identical equilateral triangles. How many square centimeters of cardboard did Tamara use for the box?



STEP 1 Draw a net.



The faces of the triangular pyramid are 4 identical equilateral triangles.

STEP 2 Find the area (T) of each equilateral triangle.

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

$$T = \frac{1}{2}(5)(4.33)$$

$$= 10.825 \text{ cm}^2$$

STEP 3 Find the surface area (SA) of the triangular pyramid.

$$SA = 4T$$

$$SA = 4 \times 10.825$$

$$= 43.3 \text{ cm}^2$$

Tamara used 43.3 cm^2 of cardboard for the box.

Reasoning If you know the faces are identical equilateral triangles, then you just find the area of one triangle and multiply by 4.



Try It!

Draw a net and find the surface area of the triangular pyramid.

Find the area (T) of each equilateral triangle.

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

$$T = \frac{1}{2} \times \quad \times$$

=

The area of each equilateral triangle is $\quad \text{m}^2$.

Find the surface area (SA) of the triangular pyramid.

$$SA = 4T$$

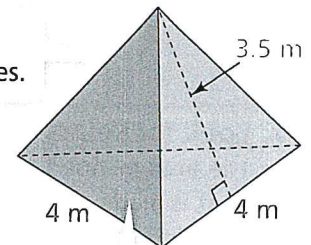
$$SA = \quad \times T$$

$$SA = 4 \times$$

=

The surface area of the triangular pyramid is $\quad \text{m}^2$.

There are 4 identical faces.

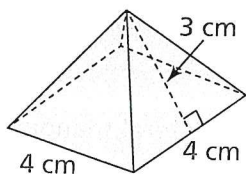


The faces are equilateral triangles.

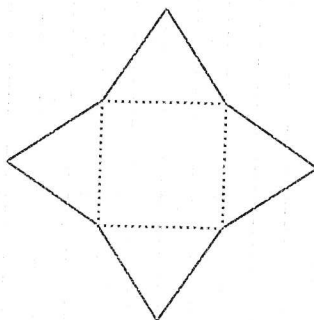




You can use a net to help find the surface area of a pyramid.



Use the dimensions shown on the pyramid to draw an accurate net.



Square base:

$$B = s^2$$

$$= 4 \cdot 4 = 16$$

Each triangular face:

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

$$= \frac{1}{2} \cdot 4 \cdot 3 = 6$$

Surface area:

$$SA = 16 + 4 \times 6$$

$$= 16 + 24$$

$$= 40$$

The surface area is 40 cm^2 .

Do You Understand?

1. **Essential Question** How can you find the surface area of a pyramid?

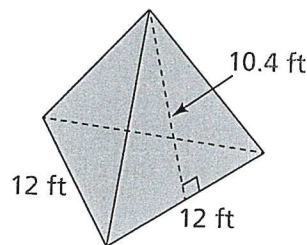
2. **Look for Relationships** How does finding the area of one face of a triangular pyramid that is made up of equilateral triangles help you find the surface area of the triangular pyramid?

3. **Make Sense and Persevere** In the formula $SA = 4T$, for the surface area of a triangular pyramid in which the faces are equilateral triangles, what does the variable T represent?

Do You Know How?

4. Each side of the base of a square pyramid is 4 inches and the height of each triangular face is 3 inches. Draw a net for this pyramid and find its surface area.

5. The faces of this triangular pyramid are equilateral triangles. Draw a net of the pyramid and use it to find the surface area.



Name: _____



PRACTICE



TUTORIAL

Practice & Problem Solving

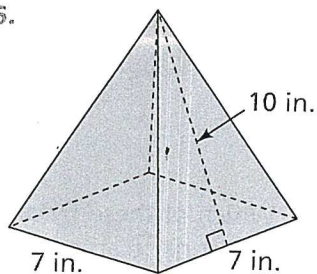


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Multimedia



Leveled Practice In 6 and 7, find the surface area of each pyramid. The faces of each triangular pyramid are equilateral triangles.

6.



Area of base, B : $7 \times 7 =$ _____

Area of each triangular face, A :

$\frac{1}{2} \times 7 \times$ _____ $=$ _____

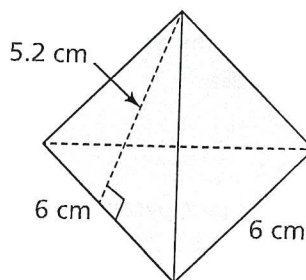
Number of triangular faces, n :

$SA = B + (n \times A)$

$SA =$ _____ $+ ($ _____ \times _____ $) =$ _____

The surface area is _____ in.^2 .

7.



Area of each triangular face, T :

$\frac{1}{2} \times$ _____ \times _____ $=$ _____

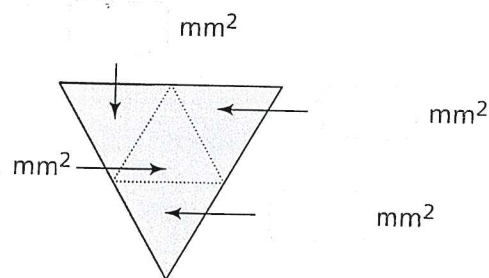
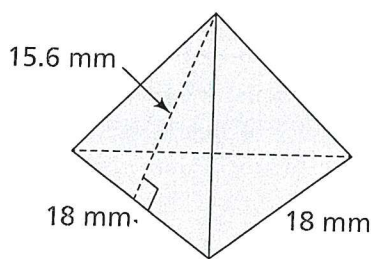
$SA = 4T$

$SA = 4 \times$ _____

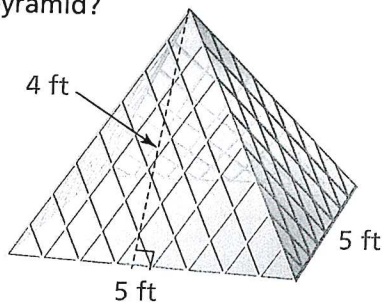
$SA =$ _____

The surface area is _____ cm^2 .

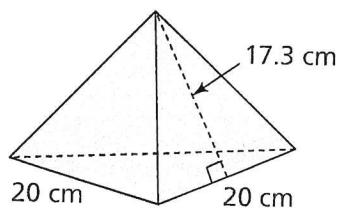
8. Complete the net at the right to find the surface area of this triangular pyramid. The faces of the pyramid are equilateral triangles.



9. Simone is designing a piece of artwork in the shape of a square pyramid for a hotel. She wants to cover the pyramid with decorative glass. How many square feet of glass does Simone need to cover the entire pyramid?

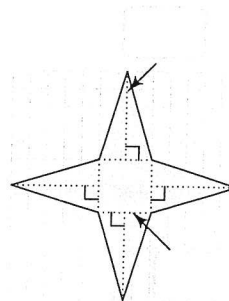
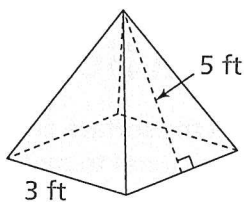


10. **Critique Reasoning** Kurt says that the surface area of this triangular pyramid with faces that are equilateral triangles is 173 cm^2 . Do you agree with Kurt? Explain.



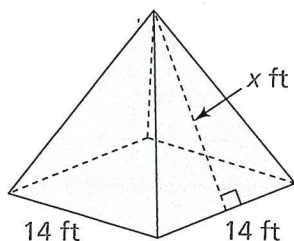
In 11 and 12, use the pyramid and net shown.

11. **Model with Math** Ken drew a square pyramid and its net to represent a doghouse that he is building. Complete the net by filling in the missing measures.



12. Use the net to find the amount of wood Ken needs to make the doghouse.

13. The surface area of this square pyramid is 644 ft^2 . Can the value of x be 20? Explain.



14. **Construct Arguments** Which of these pyramids do you think has the greater surface area? Explain.

- Square pyramid: The base is 10 cm by 10 cm and the triangular faces have a height of 8.66 cm.
- Triangular pyramid: All the faces are equilateral triangles with a base of 10 cm and a height of 8.66 cm.

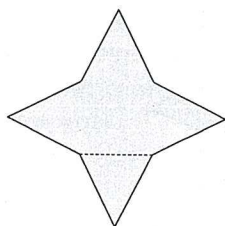
15. **Higher Order Thinking** The base of a pyramid can be any polygon. How many faces does a pentagonal pyramid have? Describe the shapes of the faces.

16. **Vocabulary** What is the term used to describe a point where three or more edges of a solid figure meet?

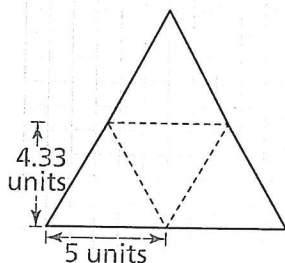
Assessment Practice

17. Which net represents the pyramid with the greatest surface area? 6.G.1.4

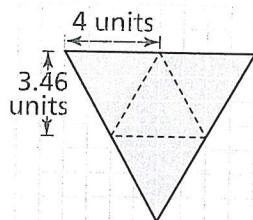
(A)



(B)



(C)



(D)

