Lesson 24

Nets and Surface Area

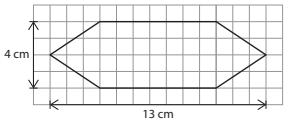
Name: _____

Prerequisite: Area of Polygons

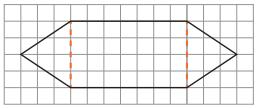
Study the example problem showing how to find the area of a polygon. Then solve problems 1–8.

Example

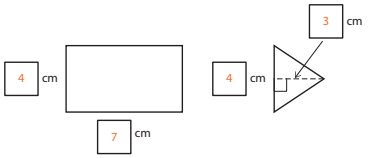
Gary drew a picture of a nameplate that he plans to make. He wants to find the area of the nameplate. How could Gary break apart the figure to find its area?



Gary separates the figure he drew into two triangles and a rectangle.



B 1 Label the dimensions of the rectangle and one of the triangles.



B 2 What is the area of the rectangle?

28 sq cm; Area of a rectangle = bh = (7)(4) = 28

B 3 What is the area of the triangle?

6 sq cm; Area of a triangle = $\frac{1}{2}bh = \frac{1}{2}(4)(3) = 6$

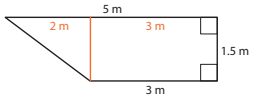
B 4 What is the area of the nameplate? Write an equation to show your solution.

40 sq cm; Total area = 2 × Area of the triangle + Area of the rectangle; 2(6) + 28 = 40

Solve.

Use the trapezoid to solve problems 5–6.

M 5 Separate the trapezoid into figures whose areas you can find. Label the dimensions.



M 6 What is the area of the trapezoid?

Show your work.

Possible work:

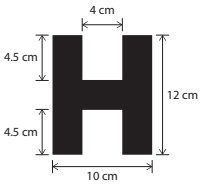
Area of the rectangle = bh = (3)(1.5) = 4.5

Area of the triangle = $\frac{1}{2}bh = \frac{1}{2}(2)(1.5) = 1.5$

4.5 + 1.5 = 6

Solution: **The area of the trapezoid is 6 square meters.**

M 7 Hector drew three rectangles to show the letter H on his notebook. Use the rectangles to find the area of the letter he drew.



Show your work.

Possible work:

Area of vertical rectangle = bh = (12)(3) = 36

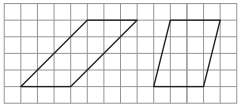
Area of 2 vertical rectangles = 2 × 36 = 72

Area of horizontal rectangle = bh = (3)(4) = 12

Total area of figure = 72 + 12 = 84

Solution: **The area of the letter H is 84 square centimeters.**

C 8 Pat says that the parallelograms below do not have the same area. Is she correct? Explain.



No; Possible explanation: The parallelograms have the same area because both the bases and heights of the parallelograms are the same.

Key		
B Basic	**M** Medium	**C** Challenge

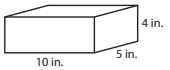
Name: _____

Surface Area of a Rectangular Prism

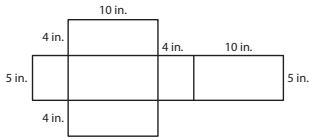
Study the example showing how to find the surface area of a rectangular prism. Then solve problems 1–8.

Example

Kanene wants to know how much wrapping paper she needs to cover this box. How much wrapping paper does she need?



You can use a net to help you solve the problem.



B 1 Complete the table to find the area of each face.

Face	Length (in.)	Width (in.)	Area (sq in.)
Top	10	5	50
Bottom	10	5	50
Front	10	4	40
Back	10	4	40
Right side	5	4	20
Left side	5	4	20

B 2 Which pairs of faces have the same areas?

top and bottom, front and back, right side and left side

B 3 What is the surface area of the box? Use your answer to problem 2 to write an equation.

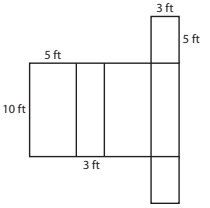
220 square inches; 2(50) + 2(40) + 2(20) = 100 + 80 + 40 = 220

B 4 What is the relationship between the surface area of a rectangular prism and the area of each face?

The surface area is the sum of the areas of the six faces.

Solve.

M 5 Carl drew this net for a wooden shed that he will build. He wants to protect the wood against the weather by using a sealant on all of the outside surfaces, including the bottom. Will a container of sealant that covers 200 square feet be enough to protect the outside surfaces?

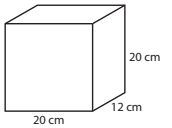


Show your work.

Possible work:
(10)(5) = 50
(10)(3) = 30
(3)(5) = 15
2(50) + 2(30) + 2(15) = 100 + 60 + 30 = 190
The surface area of the shed is 190 square feet, which is less than 200 square feet.

Solution: Yes, the container of sealant will be enough to protect the wood.

M 6 Susana is making a small box. The 20-cm by 20-cm front of the box will be glass. The other faces will be wood. How much wood does Susana need to make the box?



Show your work.

Possible work:
(20)(20) = 400
(12)(20) = 240
400 + 4(240) = 1,360

Solution: Susana needs 1,360 square centimeters of wood.

M 7 The surface area of a cube is 216 square meters. What is the height of the cube? Explain.

6 meters; Possible explanation: The area of each face is 216 ÷ 6 = 36 sq m. Each face is a square, so its side lengths are equal. The height of the cube is 6 m because 6(6) = 36.

C 8 Mike says that if he doubles each dimension of any rectangular prism, the surface area also doubles. Is Mike correct? Give an example to support your answer.

No; Possible explanation: The surface area of a 2-ft by 3-ft by 4-ft rectangular prism is 52 sq ft. The surface area of a 4-ft by 6-ft by 8-ft rectangular prism is 208 sq ft. When you multiply 52 by 2, you get 104, which is half of 208. So doubling the dimensions of a rectangular prism will not double its surface area. It will quadruple it.

Name: _____

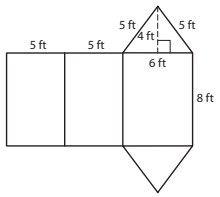
Surface Area of a Triangular Prism

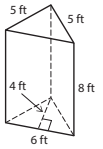
Study the example showing how to find the surface area of a triangular prism. Then solve problems 1–7.

Example

What is the surface area of the triangular prism shown?

You can draw and label a net of the prism to help you.





B 1 Complete the table to find the area of each face.

Face	Base (ft)	Height (ft)	Area (sq ft)
Triangle	6	4	12
Triangle	6	4	12
Rectangle	6	8	48
Rectangle	5	8	40
Rectangle	5	8	40

B 2 Why do the rectangular faces have different areas?

Possible explanation: Because the side lengths of the triangle are different. Two of the side lengths are 5 feet and one is 6 feet, so two of the rectangles will have a base length of 5 and one will have a base length of 6. All three rectangles have a height of 8.

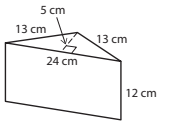
B 3 What is the surface area of the triangular prism? Write two equations to represent the surface area.

152 square feet; 2(12) + 2(40) + 48 = 152; 12 + 12 + 40 + 40 + 48 = 152

Solve.

Use the following situation to solve problems 4–6.

Jane is decorating a paperweight in the shape of a triangular prism. The diagram shows its dimensions.



M 4 Label the net of the triangular prism to show the dimensions of the faces.

M 5 What is the surface area of the paperweight?

Show your work.

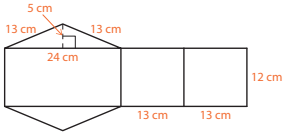
Possible work:

$\frac{1}{2}(24)(5) = 60$

(13)(12) = 156

(24)(12) = 288

2(60) + 2(156) + 288 = 120 + 312 + 288 = 720

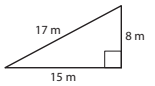


Solution: The surface area is 720 square centimeters.

M 6 Amad used the expression $2\left(\frac{1}{2} \cdot 24 \cdot 5\right) + 3(13 \cdot 12)$ to find the surface area of the paperweight. What is wrong with his expression? Correct Amad's mistake.

Possible explanation: Only two rectangular faces have a base length of 13 cm. The base of the other rectangular face is 24 cm. A correct expression is $2\left(\frac{1}{2} \cdot 24 \cdot 5\right) + 2(13 \cdot 12) + (24 \cdot 12)$.

C 7 The picture shows the dimensions of one base of a triangular prism. The height of the prism is 2 meters. What is the surface area of the triangular prism? Explain how to find the answer.



200 square meters; Possible explanation: The picture of the triangular base shows that the bases of the three rectangular faces are 17 meters, 15 meters, and 8 meters. Use the height of the prism and the formula for the area of a rectangle to find the area of each rectangular face. Use the formula for area of a triangle to find the area of one triangular face, and then double it for the area of both triangular faces. Add all of the areas together.

Lesson 24

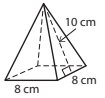
Name: _____

Surface Area of a Pyramid

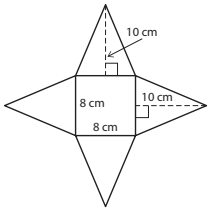
Study the example problem showing how to find the surface area of a pyramid. Then solve problems 1–8.

Example

What is the surface area of the pyramid?



You can draw and label a net to help you.



B 1 Complete the table to find the area of each face.

Face	Base (cm)	Height (cm)	Area (sq cm)
Triangle	8	10	40
Triangle	8	10	40
Triangle	8	10	40
Triangle	8	10	40
Square	8	8	64

B 2 Describe the number of faces and their shapes.

There is one square face and four triangular faces.

B 3 Use formulas to explain how to find the area of each face.

Use the formula $A = \frac{1}{2}bh$ to find the area of the triangular faces. Use the formula

$A = bh$ to find the area of the square base.

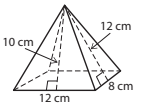
B 4 What is the surface area of the pyramid? Write an equation to represent the surface area.

224 sq cm; Possible equation: $4(\frac{1}{2} \cdot 8 \cdot 10) + (8 \cdot 8) = 224$

Solve.

Use the following situation to solve problems 5–7.

Marcos is making a pyramid in his wood shop class. The base of the pyramid is a rectangle.



M 5 Label the net of the pyramid with the dimensions of the faces.

M 6 What is the surface area of the pyramid?

Show your work.

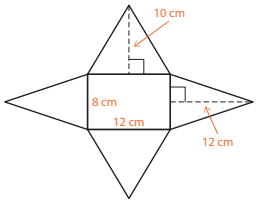
Possible work:

$\frac{1}{2}(12)(10) = 60$

$\frac{1}{2}(8)(12) = 48$

$(12)(8) = 96$

$2(60) + 2(48) + 96 = 120 + 96 + 96 = 312$



Solution: The surface area of the pyramid is 312 square centimeters.

M 7 Yolanda used the expression $\left(\frac{1}{2} \cdot 12 \cdot 10\right) + \left(\frac{1}{2} \cdot 8 \cdot 12\right) + (12 \cdot 8)$ to find the surface area of the pyramid. What is wrong with the expression? Correct Yolanda's mistake.

Possible explanation: The expression only includes two of the triangular faces.

A correct expression is $2\left(\frac{1}{2} \cdot 12 \cdot 10\right) + 2\left(\frac{1}{2} \cdot 8 \cdot 12\right) + (12 \cdot 8)$.

C 8 The surface area of a pyramid is 540 square inches. Its base is a square with a side length of 10 inches. What is the height of one of the triangular faces of the pyramid? Explain how to find the answer.

22 inches; Possible explanation: Subtract the area of the base from 540:

540 − 100 = 440. Divide 440 by 4 to find the area of each triangular face:

440 ÷ 4 = 110. Use the formula for area of a triangle to find the height:

$A = \frac{1}{2}bh$: $110 = \frac{1}{2} \cdot 10 \cdot h$; $110 = 5h$; $h = 22$.

Name: _____

Nets and Surface Area

Solve the problems.

M

1 Rita keeps her craft supplies in a container without a top. The container is a triangular prism. Rita plans to cover the outside of the container with decorative paper. How much paper does she need?

How many faces should you include in your calculations?

Show your work.

Possible work:

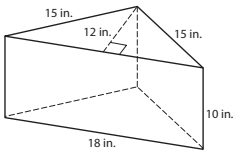
$A = \frac{1}{2}(18)(12) = 108$

$(15)(10) = 150$

$(18)(10) = 180$

$108 + 2(150) + 180 = 108 + 300 + 180$

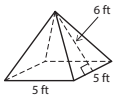
$= 588$



Solution: **Rita needs 588 square inches of paper.**

M

2 Look at the pyramid below.



What do you need to know to find the surface area of a pyramid?

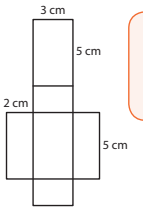
Tell whether each statement about the pyramid is *True* or *False*.

a.	The area of each triangular face is 30 square feet.	☐ True	☒ False
b.	The surface area of the pyramid is 85 square feet.	☒ True	☐ False
c.	A net of the pyramid would have three triangular faces.	☐ True	☒ False
d.	The area of the base is 25 square feet.	☒ True	☐ False

Solve.

M

3 The net represents a rectangular prism. Which expression represents the surface area? Select all that apply.



How do you find the surface area of a rectangular prism?

A $(3 \cdot 5) + (5 \cdot 2) + (2 \cdot 3)$

B $15 + 15 + 6 + 6 + 10$

C $2(3 \cdot 5) + 2(3 \cdot 2) + 2(2 \cdot 5)$

D $2(10) + 2(6) + 2(15)$

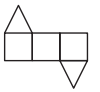
Horus chose **A** as the correct answer. How did he get that answer?

Possible explanation: He only included 3 of the faces.

M

4 Does the diagram represent the net of a triangular prism? Choose *Yes* or *No*.

How many faces on a triangular prism are triangles?

a.  ☒ Yes ☐ No

b.  ☐ Yes ☒ No

c.  ☒ Yes ☐ No

C

5 Design your own pyramid. Describe your pyramid, and then choose its dimensions and find its surface area.

Possible answer: The pyramid has a square base with a side length of 16 cm.

The height of each triangular face is 20 cm. The surface area is 896 sq cm.