BIOSPHERE The structure of the different sections in the Biosphere 2 complex in Tucson, Arizona, are made of interlocking triangles that are all the same size.

1. Compare the two outlined triangles.
2. What figure is formed by the two triangles?
3. MAKE A CONJECTURE Describe the relationship that exists between the area of one triangle and the area of the parallelogram.

A parallelogram can be formed by two congruent triangles. Since congruent triangles have the same area, the area of a triangle is one half the area of the parallelogram.

Area of a Triangle

Words The area $A$ of a triangle is one half the product of the base $b$ and its height $h$.

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

Find the Area of a Triangle

Find the area of each triangle.

By counting, you find that the measure of the base is 6 units and the height is 4 units.
### Example 2

**Problem:** The front of a two-person camping tent has the dimensions shown. How much material was used to make the front of the tent?

**Solution:**

The area of a triangle is given by the formula $A = \frac{1}{2} bh$.

1. **Figure:**
   - Base $b = 12.1$ m
   - Height $h = 6.4$ m

2. **Calculations:**
   - $A = \frac{1}{2} (12.1)(6.4)$
   - $A = \frac{1}{2} (77.44)$
   - $A = 38.72$ square meters

The area of the front of the tent is 38.72 square meters.

### Example 3

**Problem:** A triangular cracker has a height of 4 centimeters and a base of 5 centimeters. Find the area of the cracker.

**Solution:**

The area of a triangle is given by the formula $A = \frac{1}{2} bh$.

1. **Figure:**
   - Base $b = 5$ cm
   - Height $h = 4$ cm

2. **Calculations:**
   - $A = \frac{1}{2} (5)(4)$
   - $A = 10$ square centimeters

The area of the triangular cracker is 10 square centimeters.
Check Your Understanding

Examples 1, 2 (pp. 540–541)
Find the area of each triangle.

1. 

2. 

3. 

4. **CRAFTS** Consuela made a triangular paper box as shown. What is the area of the top of the box?

Example 3 (p. 541)

Practice and Problem Solving

Find the area of each triangle.

5. 

6. 

7. 

8. 

9. 

10. 

11. height: 14 in., base: 35 in.

12. height: 27 cm, base: 19 cm

13. **ROOFING** Ansley is going to help his father shingle the roof of their house. What is the area of the triangular portion of one end of the roof to be shingled?

14. **ARCHITECTURE** An architect plans on designing a building on a triangular plot of land. If the base of the triangle is 100.8 feet and the height is 96.3 feet, find the available floor area the architect has to design the building.

15. **FLOWER BEDS** A flower bed in a parking lot is shaped like a triangle as shown. Find the area of the flower bed in square feet. If one bag of topsoil covers 10 square feet, how many bags are needed to cover this flower bed?
16. **ALGEBRA** The table at the right shows the areas of a triangle where the base of the triangle stays the same but the height changes. Write an algebraic expression that can be used to find the area of a triangle that has a base of 5 units and a height of \( n \) units.

17. **REASONING** Which is smaller, a triangle with an area of 1 square foot or a triangle with an area of 64 square inches?

18. **FLAGS** What is the area of the triangle on the flag of the Philippines at the right?

19. **COMPOSITE FIGURES** Find the perimeter and area of each figure.

20. **H.O.T. Problems** Dolores and Demetrius are finding the base of the triangle shown. Its area is 148.5 square meters. Who is correct? Explain.

21. **CHALLENGE** For Exercises 22–25, use the information below. All the triangles and squares in the quilt pattern shown are congruent.

22. Find the measure of the base and height of one of the triangles.

23. Calculate the area of one triangle and then find the area of all the triangles.

24. Calculate the area of one of the smaller squares and then find the area of all of the smaller squares.

25. What is the total area of the figure? Is your answer reasonable?
26. **REASONING** If two triangles have an area of 24 square feet, do they always have the same base and height? Use a model to explain your answer.

27. **WRITING IN> MATH** Draw a triangle and label its base and height. Draw another triangle that has the same base, but a height twice that of the first triangle. Find the area of each triangle. Then write a ratio that expresses the area of the first triangle to the area of the second triangle.

28. The table below shows the areas of a triangle where the height of the triangle stays the same but the base changes.

<table>
<thead>
<tr>
<th>Height (units)</th>
<th>Base (units)</th>
<th>Area (square units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>10 ( \frac{1}{2} )</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>17 ( \frac{1}{2} )</td>
</tr>
<tr>
<td>7</td>
<td>x</td>
<td>?</td>
</tr>
</tbody>
</table>

Which expression can be used to find the area of a triangle that has a height of 7 units and a base of \( x \) units?

- **A** \( 7x \)
- **B** \( \frac{7x}{2} \)
- **C** \( \frac{7}{2} \)
- **D** \( \frac{x}{2} \)

28. Norma cut a triangle out of construction paper for an art project.

![Diagram of triangle with height labeled as \( h \) cm and base labeled as 13 cm.]

The area of the triangle is 84.5 square centimeters. What is the height of the triangle?

- **F** 6.5 cm
- **G** 13 cm
- **H** 26 cm
- **J** 169 cm

30. Find the area of a parallelogram with base 15 inches and height 10 inches.  **(Lesson 10-3)**

31. Find the circumference of a circle with a radius of 5 meters. Round to the nearest tenth.  **(Lesson 10-2)**

32. **IDENTIFICATION** Measure the length and width of a student ID card or library card to the nearest eighth inch. Then find the perimeter of the card.  **(Lessons 1-9 and 10-1)**

33. **PREREQUISITE SKILL** A bookstore arranges its best-seller books in the front window. In how many ways can four best-seller books be arranged in a row? Use the act it out strategy.  **(Lesson 5-3)**

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