

# Area and Perimeter of Triangles

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## CONCEPT

## 1

# Area and Perimeter of Triangles

Here you'll learn how to find the area and perimeter of a triangle given its base and height.

What if you were given a triangle and the size of its base and height? How could you find the total distance around the triangle and the amount of space it takes up? After completing this Concept, you'll be able to use the formulas for the perimeter and area of a triangle to solve problems like this.

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Multimedia

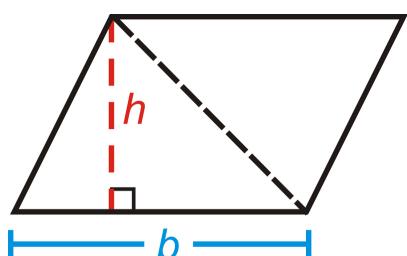
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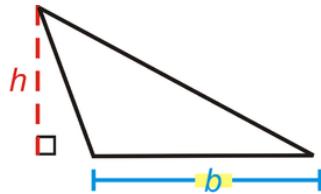
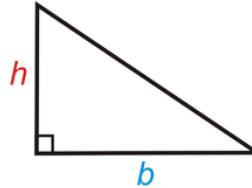
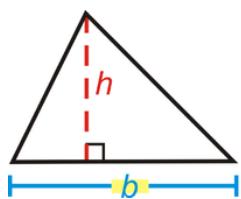
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## Guidance

The formula for the area of a triangle is half the area of a parallelogram.

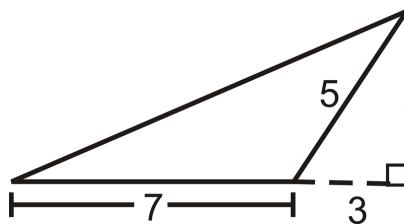


**Area of a Triangle:**  $A = \frac{1}{2} bh$  or  $A = \frac{bh}{2}$ .



## Example A

Find the area of the triangle.

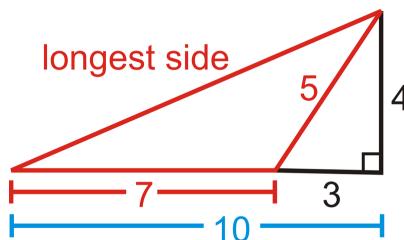


To find the area, we need to find the height of the triangle. We are given two sides of the small right triangle, where the hypotenuse is also the short side of the obtuse triangle.

$$\begin{aligned}
 3^2 + h^2 &= 5^2 \\
 9 + h^2 &= 25 \\
 h^2 &= 16 \\
 h &= 4 \\
 A &= \frac{1}{2}(4)(7) = 14 \text{ units}^2
 \end{aligned}$$

### Example B

Find the perimeter of the triangle in Example A.



To find the perimeter, we need to find the longest side of the obtuse triangle. If we used the black lines in the picture, we would see that the longest side is also the hypotenuse of the right triangle with legs 4 and 10.

$$\begin{aligned}
 4^2 + 10^2 &= c^2 \\
 16 + 100 &= c^2 \\
 c &= \sqrt{116} \approx 10.77
 \end{aligned}$$

The perimeter is  $7 + 5 + 10.77 \approx 22.77 \text{ units}$

### Example C

Find the area of a triangle with base of length 28 cm and height of 15 cm.

The area is  $\frac{1}{2}(28)(15) = 210 \text{ cm}^2$ .



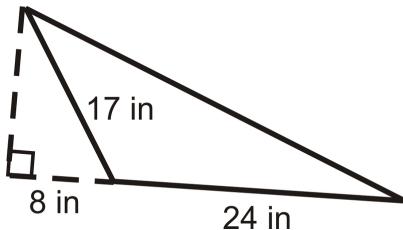
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### Guided Practice

Use the triangle to answer the following questions.



- Find the height of the triangle.
- Find the perimeter.
- Find the area.

#### Answers:

- Use the Pythagorean Theorem to find the height.

$$\begin{aligned} 8^2 + h^2 &= 17^2 \\ h^2 &= 225 \\ h &= 15 \text{ in} \end{aligned}$$

- We need to find the hypotenuse. Use the Pythagorean Theorem again.

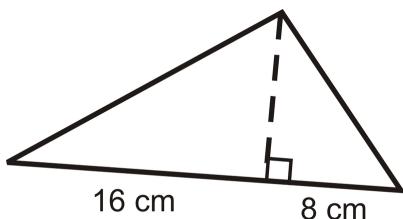
$$\begin{aligned} (8+24)^2 + 15^2 &= h^2 \\ h^2 &= 1249 \\ h &\approx 35.3 \text{ in} \end{aligned}$$

The perimeter is  $24 + 35.3 + 17 \approx 76.3 \text{ in}$ .

- The area is  $\frac{1}{2}(24)(15) = 180 \text{ in}^2$ .

### Practice

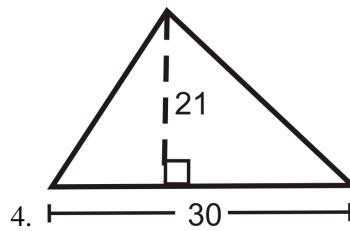
Use the triangle to answer the following questions.



- Find the height of the triangle by using the geometric mean.

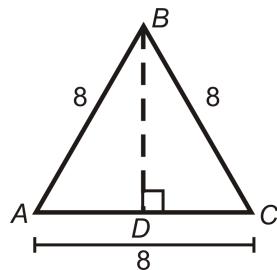
2. Find the perimeter.
3. Find the area.

Find the area of the following shape.



4. What is the height of a triangle with area  $144 \text{ m}^2$  and a base of 24 m?

In questions 6-11 we are going to derive a formula for the area of an equilateral triangle.



6. What kind of triangle is  $\triangle ABD$ ? Find  $AD$  and  $BD$ .
7. Find the area of  $\triangle ABC$ .
8. If each side is  $x$ , what is  $AD$  and  $BD$ ?
9. If each side is  $x$ , find the area of  $\triangle ABC$ .
10. Using your formula from #9, find the area of an equilateral triangle with 12 inch sides.
11. Using your formula from #9, find the area of an equilateral triangle with 5 inch sides.