

Area and Perimeter of Trapezoids

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Printed: September 6, 2013

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CONCEPT

1

Area and Perimeter of Trapezoids

Here you'll learn how to calculate the area and perimeter of a trapezoid.

What if you were given the dimensions of a trapezoid and asked to calculate its area? How does calculating the area of a trapezoid relate to calculating the area of a parallelogram? After completing this Concept, you'll be able to answer questions like these.

Watch This



MEDIA

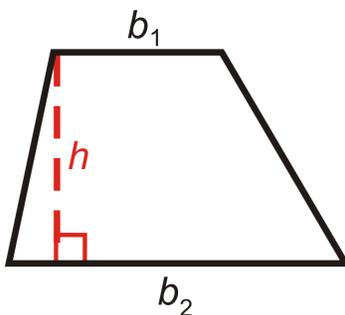
Click image to the left for more content.

[CK-12 Foundation: Chapter10AreaandPerimeterofTrapezoidsA](#)

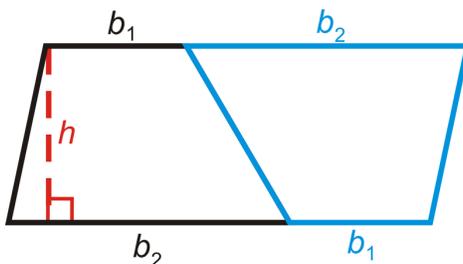
Learn more about the area of trapezoids by watching the video at this link.

Guidance

Recall that a trapezoid is a quadrilateral with one pair of parallel sides. The lengths of the parallel sides are the bases. The perpendicular distance between the parallel sides is the height, or altitude, of the trapezoid.



To find the area of the trapezoid, let's turn it into a parallelogram. To do this, make a copy of the trapezoid and then rotate the copy 180° . Now, this is a parallelogram with height h and base $b_1 + b_2$. Let's find the area of this shape.

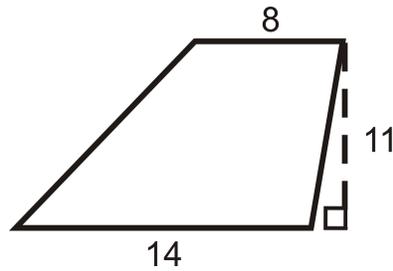


$$A = h(b_1 + b_2)$$

Because the area of this parallelogram is made up of two congruent trapezoids, the **area of one trapezoid** would be $A = \frac{1}{2}h(b_1 + b_2)$. The formula for the area of a trapezoid could also be written as *the average of the bases time the height*.

Example A

Find the area of the trapezoid below.



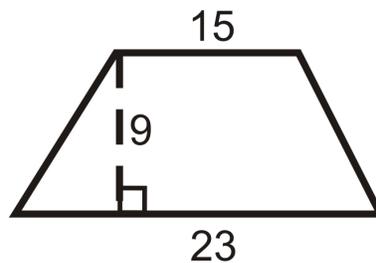
$$A = \frac{1}{2}(11)(14 + 8)$$

$$A = \frac{1}{2}(11)(22)$$

$$A = 121 \text{ units}^2$$

Example B

Find the area of the trapezoid below.



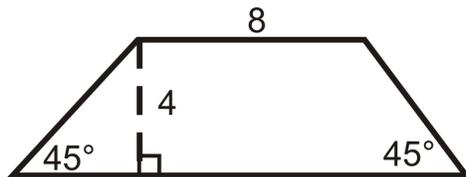
$$A = \frac{1}{2}(9)(15 + 23)$$

$$A = \frac{1}{2}(9)(38)$$

$$A = 171 \text{ units}^2$$

Example C

Find the perimeter and area of the trapezoid.



Even though we are not told the length of the second base, we can find it using special right triangles. Both triangles at the ends of this trapezoid are isosceles right triangles, so the hypotenuses are $4\sqrt{2}$ and the other legs are of length 4.

$$P = 8 + 4\sqrt{2} + 16 + 4\sqrt{2}$$

$$P = 24 + 8\sqrt{2} \approx 35.3 \text{ units}$$

$$A = \frac{1}{2}(4)(8 + 16)$$

$$A = 48 \text{ units}^2$$

Watch this video for help with the Examples above.



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Click image to the left for more content.

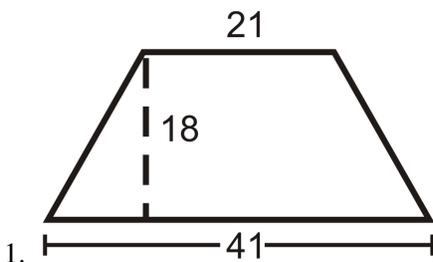
[CK-12 Foundation: Chapter10AreaandPerimeterofTrapezoidsB](#)

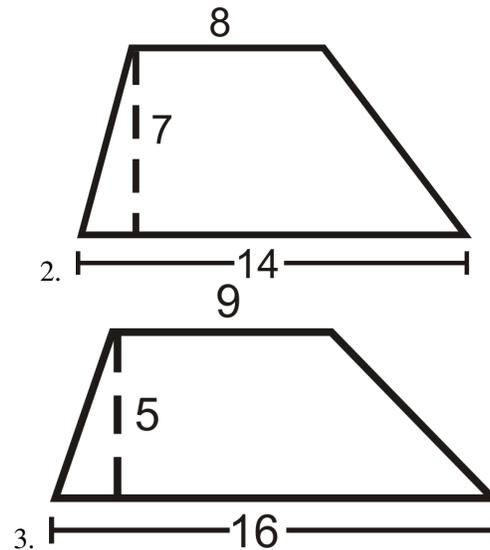
Vocabulary

Perimeter is the distance around a shape. The perimeter of any figure must have a unit of measurement attached to it. If no specific units are given (feet, inches, centimeters, etc), write “units.” **Area** is the amount of space inside a figure. Area is measured in square units. A **trapezoid** is a quadrilateral with one pair of parallel sides.

Guided Practice

Find the area of the following shapes. Round your answers to the nearest hundredth.





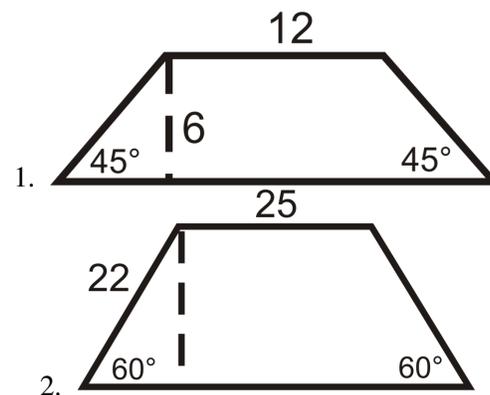
Answers

Use the formula for the area of a trapezoid.

- $\frac{1}{2}(18)(41 + 21) = 558 \text{ units}^2$.
- $\frac{1}{2}(7)(14 + 8) = 77 \text{ units}^2$.
- $\frac{1}{2}(5)(16 + 9) = 62.5 \text{ units}^2$.

Practice

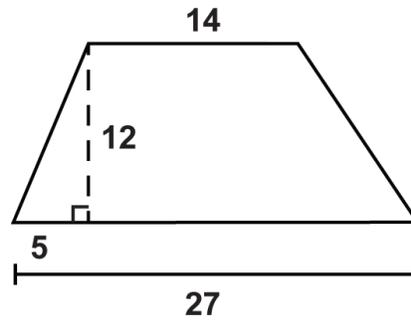
Find the area and perimeter of the following shapes. Round your answers to the nearest hundredth.



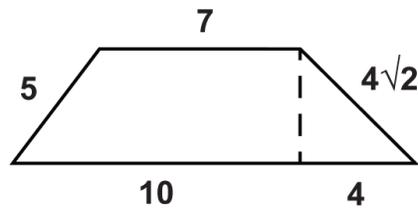
Find the area of the following trapezoids.

- Trapezoid with bases 3 in and 7 in and height of 3 in.
- Trapezoid with bases 6 in and 8 in and height of 5 in.
- Trapezoid with bases 10 in and 26 in and height of 2 in.
- Trapezoid with bases 15 in and 12 in and height of 10 in.
- Trapezoid with bases 4 in and 23 in and height of 21 in.
- Trapezoid with bases 9 in and 4 in and height of 1 in.
- Trapezoid with bases 12 in and 8 in and height of 16 in.
- Trapezoid with bases 26 in and 14 in and height of 19 in.

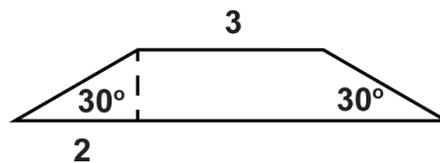
Use the given figures to answer the questions.



11. What is the perimeter of the trapezoid?
12. What is the area of the trapezoid?

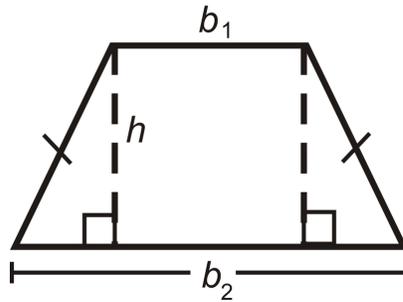


13. What is the perimeter of the trapezoid?
14. What is the area of the trapezoid?



15. What is the perimeter of the trapezoid?
16. What is the area of the trapezoid?

17. Use the isosceles trapezoid to show that the area of this trapezoid can also be written as the sum of the area of the two triangles and the rectangle in the middle. Write the formula and then reduce it to equal $\frac{1}{2}h(b_1 + b_2)$ or $\frac{h}{2}(b_1 + b_2)$.



18. Quadrilateral $ABCD$ has vertices $A(-2,0)$, $B(0,2)$, $C(4,2)$, and $D(0,-2)$. Show that $ABCD$ is a trapezoid and find its area. *Leave your answer in simplest radical form.*