11.2 Areas of Trapezoids, Rhombuses, and Kites

Goal • Find areas of other types of quadrilaterals.

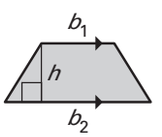
Your Notes

VOCABULARY

Height of a trapezoid The height of a trapezoid is the perpendicular distance between its bases.

THEOREM 11.4: AREA OF A TRAPEZOID

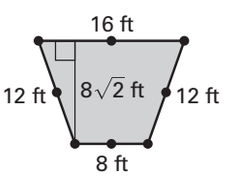
The area of a trapezoid is one half the product of the height and the sum of the lengths of the bases.



$A = \frac{1}{2}$ *h* (b_1 + b_2)

Example 1 *Find the area of a trapezoid*

Beavers To prevent beavers from damming a drainage pipe, the trapezoid-shaped fence shown is placed at the pipe. Approximate the area enclosed by the fence.



Solution

The height of the trapezoid is $8\sqrt{2}$ feet. The lengths of the bases are 16 feet and 8 feet.

$A = \frac{1}{2}h(b_1 + b_2)$ **Formula for area of a trapezoid**

$= \frac{1}{2}(8\sqrt{2})(16 + 8)$ **Substitute.**

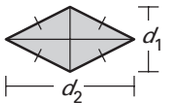
≈ 136 **Approximate.**

The area enclosed by the fence is about 136 square feet.

Your Notes

THEOREM 11.5: AREA OF A RHOMBUS

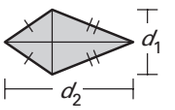
The area of a rhombus is one half the product of the lengths of its diagonals.



$A = \frac{1}{2}$ $d_1 d_2$

THEOREM 11.6: AREA OF A KITE

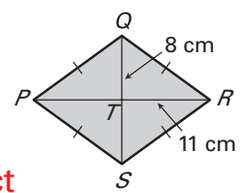
The area of a kite is one half the product of the lengths of its diagonals.



$A = \frac{1}{2}$ $d_1 d_2$

Example 2 ***Find the area of a rhombus***

Find the area of the rhombus.



Solution

Step 1 **Find** the length of each diagonal. The diagonals of a rhombus bisect each other, so $QT =$ *TS* and $PT =$ *TR*.

$QS = QT +$ *TS* $= 8 +$ 8 $=$ 16 cm

$PR =$ *PT* $+ TR =$ 11 $+ 11 =$ 22 cm

Step 2 **Find** the area of the rhombus. Let d_1 represent *QS* and d_2 represent *PR*.

$A = \frac{1}{2} d_1 d_2$ **Formula for area of a rhombus**

$= \frac{1}{2}($ 16 $)($ 22 $)$ **Substitute.**

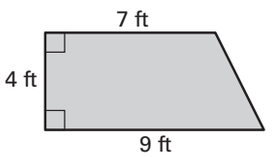
$=$ 176 **Simplify.**

The area of the rhombus is 176 square centimeters.

Your Notes

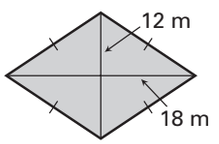
Checkpoint **Find the area of the figure.**

1.



32 ft^2

2.



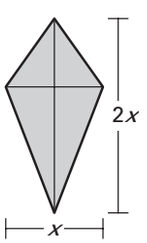
432 m^2

Example 3 ***Solve for unknown measures***

One diagonal of a kite is two times as long as the other diagonal. The area of the kite is 56.25 square inches. What are the lengths of the diagonals?

Solution

Draw and label a diagram. Let x be the length of one diagonal. The other diagonal is twice as long, so label it $2x$. Use the formula for the area of a kite to find the value of x.



$A = \frac{1}{2}d_1d_2$ **Formula for area of a kite**

$56.25 = \frac{1}{2}(x)(2x)$ **Substitute.**

$56.25 = x^2$ **Simplify.**

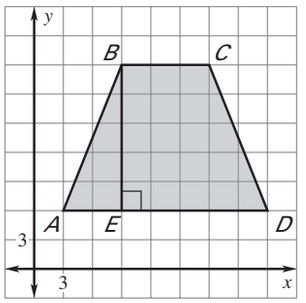
$7.5 = x$ **Find positive square root of each side.**

The lengths of the diagonals are 7.5 inches and $2(7.5) = 15$ inches.

Your Notes

Example 4 ***Find an area in the coordinate plane***

Yard You have a diagram of your backyard. Each square represents a 3 meter by 3 meter square. Find the area of your backyard.



Solution

Step 1 **Find** the lengths of the bases and the height of trapezoid *ABCD*.

$b_1 = BC = |\ 18 - 9\ | = 9$ m

$b_2 = AD = |\ 24 - 3\ | = 21$ m

$h = BE = |\ 21 - 6\ | = 15$ m

Step 2 **Find** the area of *ABCD*.

$A = \frac{1}{2}h(b_1 + b_2) = \frac{1}{2}(15)(9 + 21) = 225$

The area of your backyard is 225 square meters.

Checkpoint **Complete the following exercises.**

3. One diagonal of a kite is three times as long as the other diagonal. The area of the kite is 73.5 square yards. What are the lengths of the diagonals?

7 yards and 21 yards

4. Find the area of a rhombus with vertices $M(2, 4)$, $N(5, 6)$, $P(8, 4)$, and $Q(5, 2)$.

12 square units

Homework