

11.1

Areas of Triangles and Parallelograms

Goal • Find areas of triangles and parallelograms.

Your Notes

VOCABULARY

Bases of a parallelogram Either pair of parallel sides of a parallelogram are bases.

Height of a parallelogram The shortest distance between bases of a parallelogram is the height.

POSTULATE 24: AREA OF A SQUARE POSTULATE

The area of a square is the square of the length of its side.

POSTULATE 25: AREA CONGRUENCE POSTULATE

If two polygons are congruent, then they have the same area.

POSTULATE 26: AREA ADDITION POSTULATE

The area of a region is the sum of the areas of its nonoverlapping parts.

THEOREM 11.1: AREA OF A RECTANGLE

The area of a rectangle is the product of its base and height.

THEOREM 11.2: AREA OF A PARALLELOGRAM

The area of a parallelogram is the product of a base and its corresponding height.

THEOREM 11.3: AREA OF A TRIANGLE

The area of a triangle is one half the product of a base and its corresponding height.

Your Notes

Example 1 Use a formula to find area

Find the area of $\square ABCD$.

Solution

Method 1 Use \overline{AD} as the base.

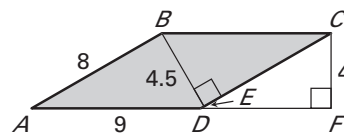
The base is extended to measure the height \overline{CF} . So, $b = 9$ and $h = 4$.

$$\text{Area} = bh = 9(4) = 36 \text{ square units}$$

Method 2 Use \overline{AB} as the base.

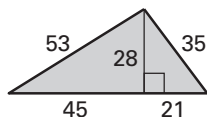
Then the height is \overline{BE} . So, $b = 8$ and $h = 4.5$.

$$\text{Area} = bh = 8(4.5) = 36 \text{ square units}$$



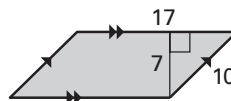
✓ Checkpoint Find the area of the polygon.

1.



924 square units

2.



119 square units

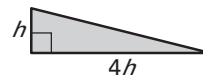
Example 2 Solve for unknown measures

The base of a triangle is four times its height. The area of the triangle is 50 square inches. Find the base and height.

Solution

Let h represent the height of the triangle.

Then the base is $4h$.



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

Write formula.

$$50 = \frac{1}{2}(4h)(h)$$

Substitute 50 for A and $4h$ for b .

$$50 = 2h^2$$

Simplify.

$$25 = h^2$$

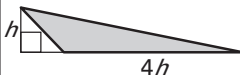
Divide each side by 2.

$$5 = h$$

Find positive square root of each side.

The height of the triangle is 5 inches, and the base is $4 \cdot 5 = 20$ inches.

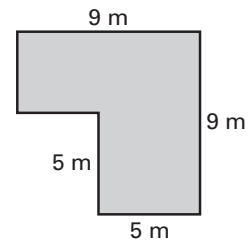
Note that there are other ways you can draw the triangle in Example 2.



Your Notes

Example 3 Solve a multi-step problem

Vacuum A robotic vacuum cleaner can clean 2 square meters of carpet in 8 minutes. About how long does it take for it to clean a carpet covering a room with the dimensions shown at the right?



Solution

Step 1 Find the area of the carpet.

$$\begin{aligned}\text{Area} &= \text{Area of rectangle} + \text{Area of square} \\ &= 4(\underline{9}) + 5(\underline{5}) = \underline{61} \text{ m}^2\end{aligned}$$

Step 2 Determine how long it takes the robotic vacuum to clean the carpet.

$$\underline{61} \text{ m}^2 \cdot \frac{\boxed{8} \text{ min}}{\boxed{2} \text{ m}^2} = \underline{244} \text{ minutes} \quad \text{Use unit analysis.}$$

It takes 244 minutes, or about 4 hours for the robotic vacuum to clean the carpet.

✓ Checkpoint Complete the following exercises.

3. A parallelogram has an area of 133 square feet and a height of 19 feet. What is the length of the base?

7 feet

4. In Example 3, suppose there are 4 sections of carpet measuring 1 meter by 2 meters that are covered and cannot be swept. About how many hours does it take for the robotic vacuum to clean the carpet?

about 3.5 hours

Homework