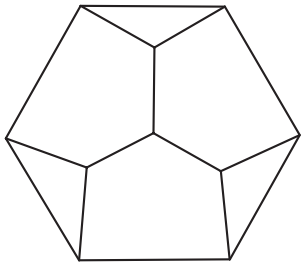
My Notes

Learning Targets:

- Model area formulas for parallelograms, trapezoids, and triangles.
- Write equations that represent problems related to the area of trapezoids and triangles.
- Solve problems involving the area of trapezoids and triangles.
- Find the area of triangles, special quadrilaterals, and polygons.
- Model area formulas by decomposing and rearranging parts.
- Find the area of special quadrilaterals and polygons.

SUGGESTED LEARNING STRATEGIES: Identify a Subtask, Look for a Pattern, Discussion Groups, Sharing and Responding, Interactive Word Wall

The diagram shows the aerial view of climbing bars to be included in the playground. To find the area of the figure, decompose the polygon into other shapes. One of these shapes is a triangle.



1. Use the congruent triangles on page 303.

- Cut out one of the triangles.
- Label one of its sides b.
- Draw the **altitude** of the triangle by drawing a line segment from a vertex perpendicular to side b. Label the segment h.
- Cut out the second triangle.
- Place the two triangles together to form a parallelogram whose base is the side labeled b.

2. How does the area of each triangle compare to the area of the parallelogram? Explain your thinking.

3. Using words, symbols, or both, describe a method for finding the area of a triangle.

MATH TERMS

The **altitude** of a triangle is a perpendicular line segment from a vertex to the line containing the opposite side. The measure of an altitude is the *height*.

My Notes

If you know the area of a triangle and the length of its base or its height, you can find the missing measure since the area, A, of a triangle is one-half the length of the base, b, times the height, h: $A = \frac{1}{2} \times b \times h$.

4. The area of a triangular garden near the playground is 12 square feet. The height of the garden is 4 feet. How long is the base of the garden? Explain your thinking.

5. Another shape seen in the aerial view of the playground looks like a trapezoid. The parallel sides of a trapezoid are called the **bases**. The two sides that are not parallel are called the **legs**. Label the bases and legs on the trapezoid shown.

READING MATH

Sometimes *subscripts* are used to label segments. b_1 is read as "*b* sub 1" and b_2 is read as "*b* sub 2."

6. Use the congruent trapezoids on page 303.

- Cut out both the trapezoids.
- On the inside of each figure, label the bases b_1 and b_2.
- Draw the height of each trapezoid and label it h.
- Form a parallelogram by turning one of the trapezoids so that its short base lines up with the long base of the other trapezoid. The long legs of the trapezoids will be adjacent.

7. How does the height of one of the trapezoids compare to the height of the parallelogram?

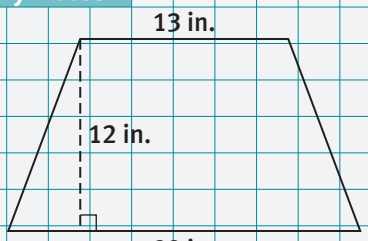
8. How does the base of one of the trapezoids compare to the base of the parallelogram?

9. What is the area of one of the trapezoids? Explain your thinking.

My Notes

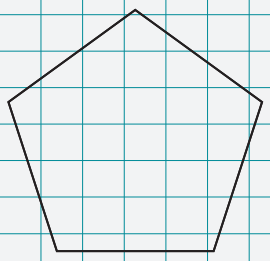
The area, A, of a trapezoid is equal to one-half the height, h, times the sum of the bases, b_1 and b_2: $A = \frac{1}{2} \times h \times (b_1 + b_2)$.

10. A planter near the playground has the dimensions shown in the diagram to the right. What is the area of the planter?

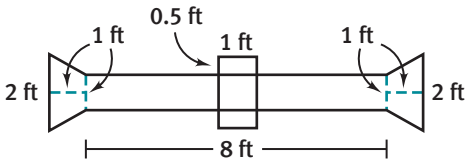


You can find the area of a composite figure that can be decomposed, or divided, into rectangles, parallelograms, triangles, and trapezoids.

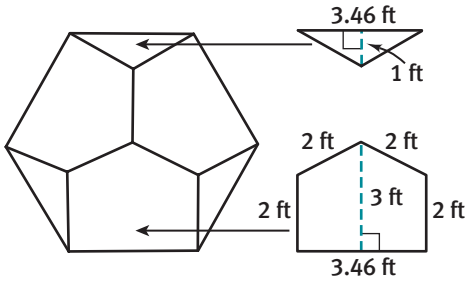
11. A pentagon is another polygon in the aerial view of the playground. Describe how to find the area of the pentagon using the figure shown.



12. The diagram shows the dimensions of Figure A in the aerial view of the playground. Find the area of Figure A using the formulas you have learned in this activity. Show your work in the My Notes column.



13. Attend to precision. The diagram shows the dimensions of Figure F from an aerial view. Find the area of Figure F. Explain your thinking.

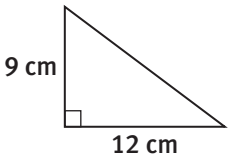


My Notes

Check Your Understanding

For Items 14 and 15, find the area of each figure.

14.



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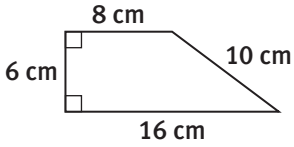
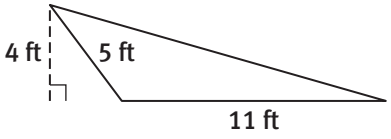


16. The area of a trapezoid is 40 square inches. The bases of the trapezoid are 9 inches and 11 inches long. Explain how to find the height of the trapezoid.

LESSON 23-3 PRACTICE

For Items 17–20, find the area of each figure.

17.



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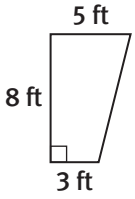

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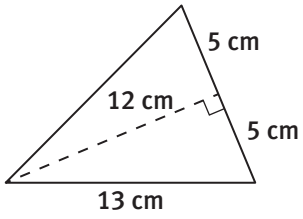
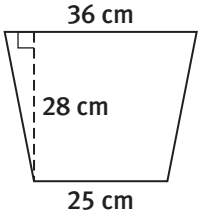


20.



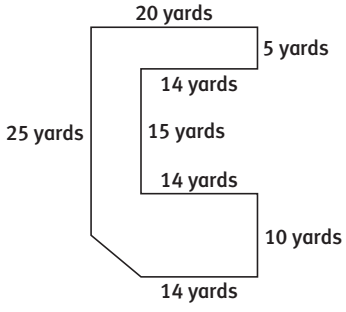
21. A triangular sail with a height of 6 feet has a base that is 9 feet long. What is the area of the sail?

22. A triangle with a height of 12 square inches has an area of 36 square inches. How long is the base of the triangle?

23. A trapezoidal window has a height of 18 centimeters. The bases of the window are 34 and 28 centimeters long. What is the area of the window?

24. Reason abstractly. A trapezoid with a height of 6 meters has an area of 36 square meters. One of the bases is twice as long as the other base. How long are the bases of the trapezoid?

25. Make sense of problems. The diagram shows an aerial view of a parking lot that needs new concrete. The concrete costs $75 per square yard. How much will the concrete for the parking lot cost? Explain your thinking.



Polygons on the Coordinate Plane

Wall Art

Lesson 24-1 Defining Polygons on the Coordinate Plane

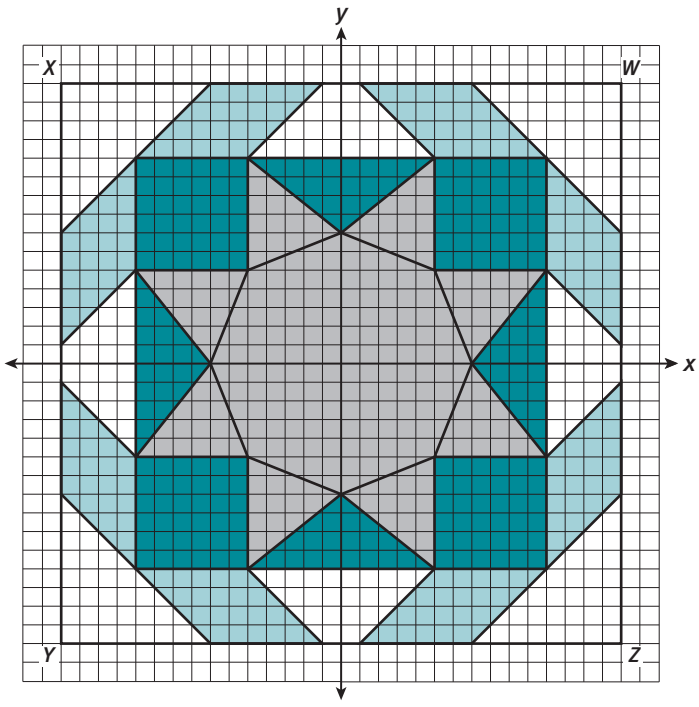
My Notes

Learning Targets:

- Draw polygons in the coordinate plane given vertex coordinates.
- Find the length of a segment joining points with the same first coordinate or the same second coordinate.
- Use coordinate geometry to identify locations on a plane.
- Graph points in all four quadrants.
- Solve problems involving the area on the coordinate plane.

SUGGESTED LEARNING STRATEGIES: Visualization, Think-Pair-Share, Create Representations, Identify a Subtask

Zena is hired to paint a mural on the side of a large building. She creates a scale drawing of her mural, shown on the coordinate grid. She will use the model to plan the painting. Each block on the grid represents 1 foot by 1 foot.



CONNECT TO ART

A mural is a painting or enlarged artwork applied directly to a wall or ceiling.

1. The border of Zena's design forms quadrilateral *WXYZ*.

a. What are the coordinates of point *W* and point *X*?

b. What do these coordinates have in common?

My Notes

c. What is the length of side $\overline{XW}$ of quadrilateral *WXYZ*? Explain your answer.

d. What are the coordinates of point *Z*?

e. What do the coordinates of points *W* and *Z* have in common?

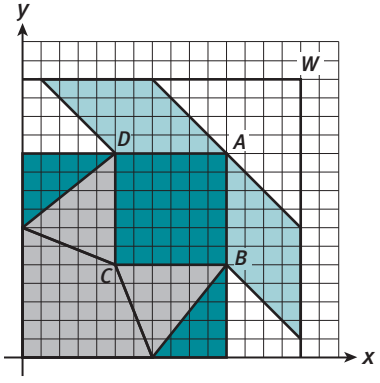
f. What is the length of side $\overline{WZ}$ of quadrilateral *WXYZ*? Explain your answer.

g. What is the best name for quadrilateral *WXYZ*? Explain your reasoning.

MATH TIP

The first quadrant has only positive *x*- and positive *y*-coordinates.

2. Consider only the portion of Zena's design in the first quadrant. The **vertices** of the inner square are labeled *A*, *B*, *C*, and *D*.



a. The coordinates of point *B* are (11, 5). What are the coordinates of point *A*?

b. What is the length of $\overline{AB}$?

c. What is the area of square *ABCD*?

3. a. Make use of structure. Explain how to find the length of a vertical line segment using the coordinates of the endpoints. Include an example in your explanation.

b. Explain how to find the length of a horizontal line segment using the coordinates of the endpoints. Include an example in your explanation.

My Notes

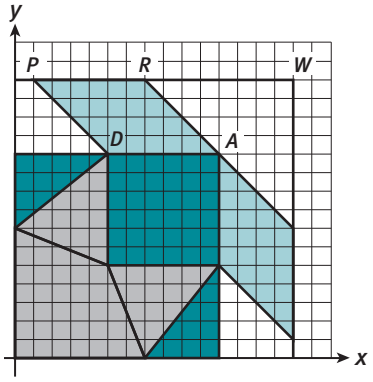
4. The endpoints of a line segment are (−4.5, 6) and (−4.5, −2).

a. Use the My Notes section to create a coordinate grid. Draw the line segment on the coordinate grid.

b. What is the length of the line segment? Explain how you determined this length.

5. Look at parallelogram *ADPR* in Zena's first quadrant design.

a. What is the length of the base of the parallelogram, $\overline{AD}$?



b. What is the height of the parallelogram? Explain how you determined this.

c. What is the area of parallelogram *ADPR*? Explain your reasoning.

6. a. What is the total area of the parallelograms in Zena's first quadrant design? Explain your reasoning.

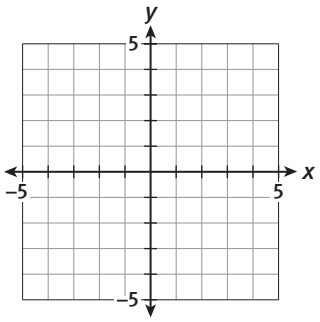
b. Each of the four quadrants has two of the light blue parallelograms in the mural design. What is the total area of the light blue parallelograms in the mural design?

c. Make sense of problems. Each gallon of light blue paint costs $45 and will cover 75 square feet. How much will the light blue paint cost that is needed to paint the light blue parallelograms in all four quadrants of the mural design? Explain your reasoning.

My Notes

Check Your Understanding

Use the coordinate grid for Items 7–10.



7. The vertices of rectangle *JKLM* are represented by these coordinates: $J(-2.5, 3)$, $K(2, 3)$, $L(2, -1)$, and $M(-2.5, -1)$. Draw rectangle *JKLM*.

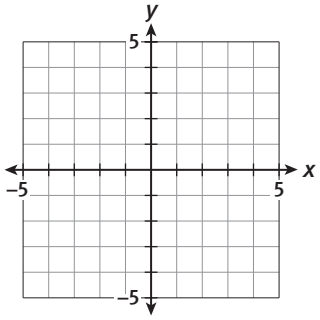
8. What is the length of side *JK*?

9. What is the length of side *JM*?

10. What is the area of rectangle *JKLM*?

LESSON 24-1 PRACTICE

Use the coordinate grid for Items 11–14.



11. The coordinates $Q(2, 2)$, $R(-1, -3)$, $S(-2, -3)$, and $T(-1, 2)$ represent the vertices of parallelogram *QRST*. Draw parallelogram *QRST*.

12. What is the length of the base of parallelogram *QRST*?

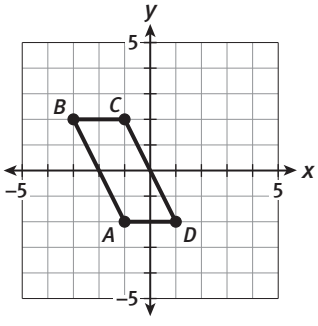
13. What is the height of parallelogram *QRST*?

14. What is the area of parallelogram *QRST*?

15. What is the distance between the points (1, 3) and (1, 7)? Explain your reasoning.

16. A line segment has the endpoints (2.25, 5.75) and (−1, 5.75). What is the length of the line segment?

Use parallelogram *ABCD* for Items 17 and 18.



17. What are the coordinates of the vertices of the parallelogram?

18. A stained-glass designer will align eight different colored parallelograms of this same size to create a pattern. What is the total area of the designer's pattern if each square on the grid represents 1 square centimeter?

19. **Reason abstractly.** A square has vertices (1, 7), (1, 2), (6, 7), and (6, 2). What is the area of the square? How can you find the area of the square without drawing the square in a coordinate plane? Explain.