

Objective: Determine the area of a quadrilateral or triangle given coordinates.

Warm Up:

1. What is the distance formula?

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

2. Define "area".

The amount of space inside a polygon

3. How do we calculate slope?

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

4. What do we know about the slopes of parallel lines? Perpendicular lines?

parallel lines: same slope

perpendicular lines: opposite reciprocal slopes

Formulas:

Area of a Triangle: $A = \frac{1}{2} \cdot b \cdot h$

Area of a Rectangle/Square: $A = b \cdot h$

Area of a Parallelogram: $A = b \cdot h$

Area of a Rhombus: $A = b \cdot h$ or $A = \frac{1}{2} \cdot d_1 \cdot d_2$

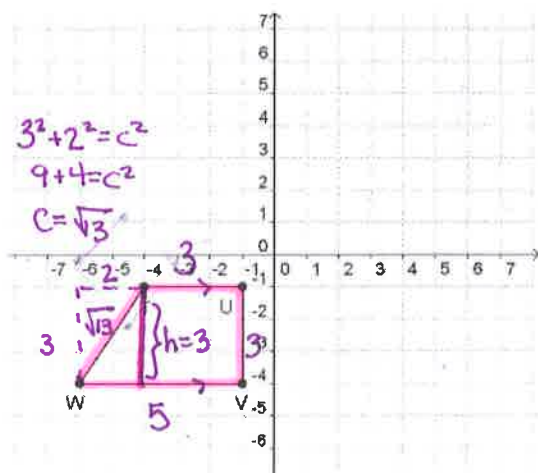
Area of a Kite: $A = \frac{1}{2} \cdot d_1 \cdot d_2$

Area of a Trapezoid: $A = \frac{1}{2} \cdot h(b_1 + b_2)$

CAUTION: "d" stands for diagonal, not distance!

Examples: the base and the height must be perpendicular

1. Find the area and perimeter of the given polygon.



→ Trapezoid → two parallel sides (\overline{TU} and \overline{WV})

$$\text{Perimeter} = 3 + 3 + 5 + \sqrt{13}$$

$$= 11 + \sqrt{13} \text{ units}$$

$$\text{Area} = \frac{1}{2} \cdot h(b_1 + b_2) = \frac{1}{2} \cdot 3(3 + 5)$$

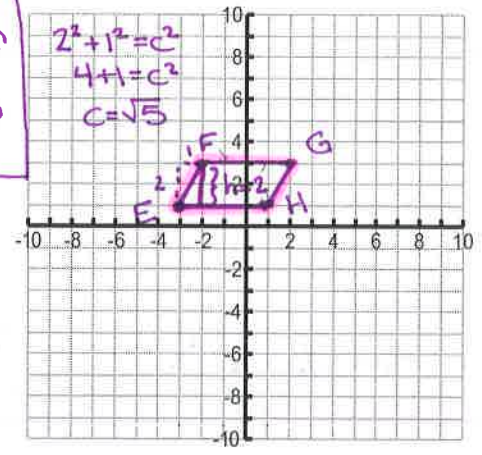
$$= \frac{1}{2} \cdot 3(8) = 12 \text{ units}^2$$

2. Classify the polygon and determine its area.

a. $E(-3, 1), F(-2, 3), G(2, 3),$ and $H(1, 1)$

$$\begin{aligned} \overline{EF} &= \sqrt{5} & m &= 2 & \overline{FG} &= 4 & m &= 0 \\ \overline{GH} &= \sqrt{5} & m &= 2 & \overline{EH} &= 4 & m &= 0 \end{aligned}$$

Parallelogram
Two sets of congruent and parallel sides



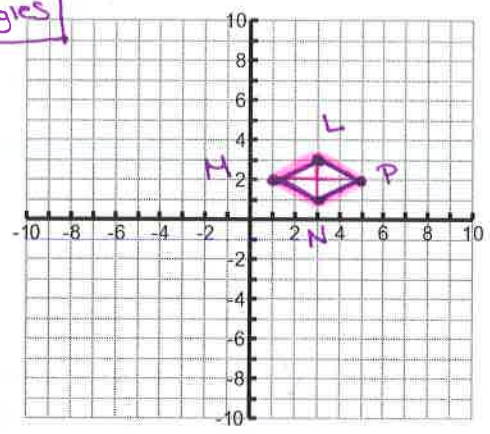
$$\text{Area} = b \cdot h = 4 \cdot 2$$

$$= 8 \text{ units}^2$$

b. $L(3, 3), M(1, 2), N(3, 1),$ and $P(5, 2)$

$$\begin{aligned} \overline{ML} &= \sqrt{5} & m &= \frac{1}{2} & \overline{LP} &= \sqrt{5} & m &= -\frac{1}{2} \\ \overline{NP} &= \sqrt{5} & m &= \frac{1}{2} & \overline{MN} &= \sqrt{5} & m &= -\frac{1}{2} \end{aligned}$$

Rhombus
Four congruent sides and no right angles



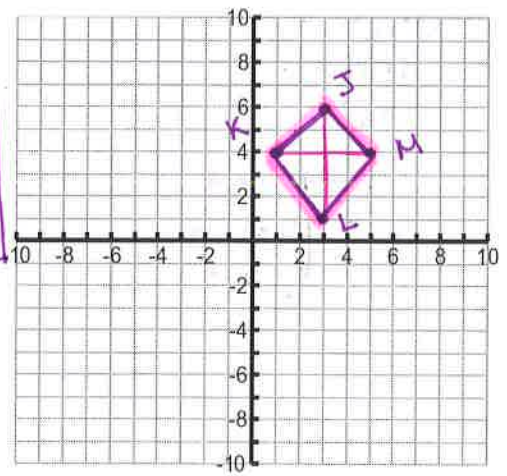
$$\text{Area} = \frac{1}{2} \cdot d_1 \cdot d_2 = \frac{1}{2} \cdot 4 \cdot 2$$

$$= 4 \text{ units}^2$$

3. Given quadrilateral KJML with $K(1, 4), J(3, 6), L(3, 1)$ and $M(5, 4)$, determine the type of quadrilateral and justify your choice. Then, find the area.

$$\begin{aligned} \overline{KJ} &= \sqrt{8} = 2\sqrt{2} & m &= 1 \\ \overline{ML} &= \sqrt{3} & m &= \frac{3}{2} \\ \overline{JM} &= \sqrt{8} = 2\sqrt{2} & m &= -1 \\ \overline{KL} &= \sqrt{3} & m &= -\frac{3}{2} \end{aligned}$$

Kite
• No parallel sides (same slope)
• Adjacent sides are congruent



$$\text{Area} = \frac{1}{2} \cdot d_1 \cdot d_2 = \frac{1}{2} \cdot 5 \cdot 4$$

$$= 10 \text{ units}^2$$