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Lesson 5: Definitions of Quadrilaterals

Date _____ Block _____

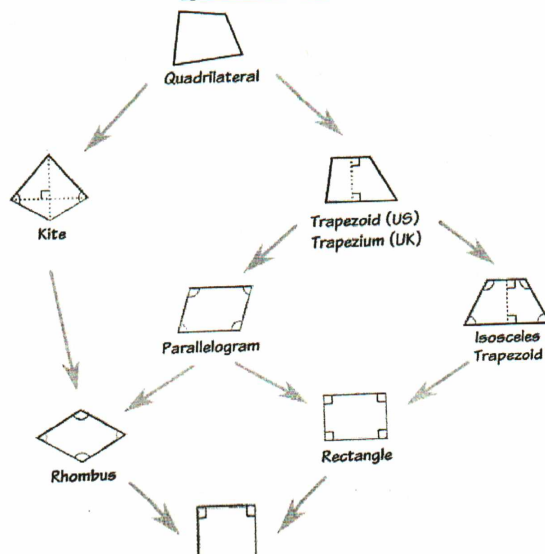
**** These terms and definitions should be memorized! ****

Polygon - a closed figure whose sides are line segments

Quadrilateral - a polygon with four sides

- o **Kite** - a quadrilateral with two pairs of congruent adjacent sides
- o **Trapezoid** - a quadrilateral with at least one pair of parallel sides
 - o **Isosceles Trapezoid** - a trapezoid with one pair of congruent sides (not the bases)
- o **Parallelogram** - a trapezoid with two pairs of parallel sides
 - o **Rhombus** - a parallelogram with all sides congruent
 - o **Rectangle** - a parallelogram with at least one right angle (why do we only need one?)
 - o **Square** - a rectangle with all sides congruent

Quadrilateral Chart



Reference your hierarchy on page 1 as you work through these exercises in #4.

- 3) Determine if each statement is Always, Sometimes, or Never True and explain how you know.
- a) A rhombus is a parallelogram.
 - b) A square is a trapezoid.
 - c) A kite is a quadrilateral.
 - d) A parallelogram is a rectangle.
 - e) A square is a rectangle.
 - f) An isosceles trapezoid is a trapezoid.
 - g) A rectangle is a parallelogram.
 - h) A square is a rhombus.

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These terms and definitions should be memorized.

Polygon – a closed figure whose sides are line segments.

Triangles

Triangle – a polygon with three sides

Scalene Triangle – a triangle with no congruent sides

Isosceles Triangle – a triangle with at least two congruent sides

Equilateral Triangle – a triangle with exactly three congruent sides

Right Triangle – a triangle with a right angle

Obtuse Triangle – a triangle with an obtuse angle (greater than 90 degrees and less than 180 degrees)

Acute Triangle – a triangle with all acute angles (less than 90 degrees)

Quadrilaterals

Quadrilateral – a polygon with four sides

Trapezoid – a quadrilateral with at least two parallel sides

Isosceles Trapezoid – a trapezoid with pairs of congruent base angles

Kite – a quadrilateral with two pairs of congruent adjacent sides

Parallelogram – a trapezoid with two pairs of parallel sides

Rhombus – a parallelogram with all sides congruent

Rectangle – a parallelogram with at least one right angle (why do we only need one?)

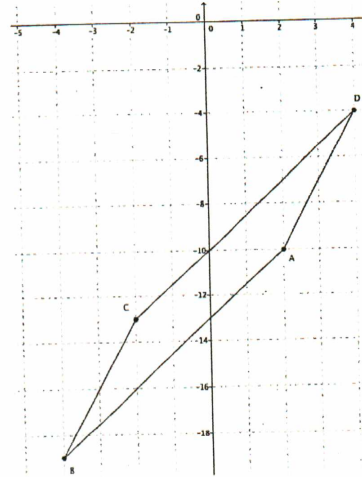
Square – a rectangle with all sides congruent

Class Examples

- Given a figure with coordinates $A(2, -10)$, $B(-4, -19)$, $C(-2, -13)$, $D(4, -4)$.
Prove that the figure defined is a parallelogram.

Strategy:

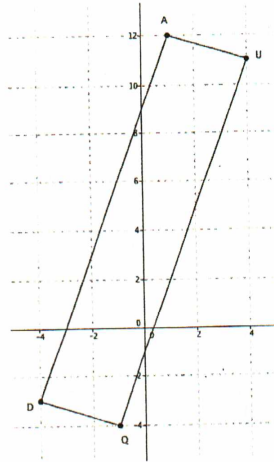
- Recall the definition of the figure.
- Use the definition to detect the identifying features/requirements of the figure.
- Algebraically show the requirements are satisfied.
- Write a concluding statement that uses your algebra to justify the specific quadrilateral in the figure.



2. Given a quadrilateral with vertices $Q(-1, -4)$, $U(4, 11)$, $A(1, 12)$ and $D(-4, -3)$, Determine the most specific name for the figure.

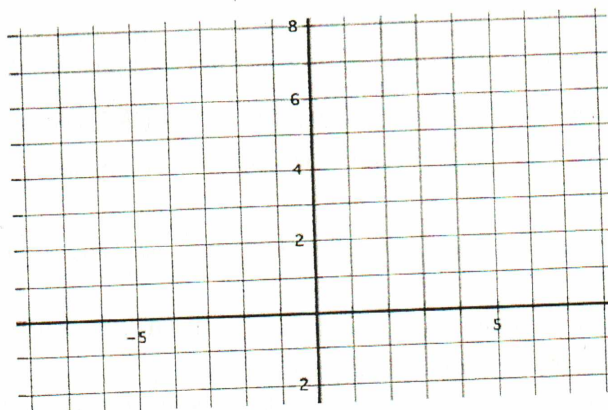
Strategy:

- Algebraically, gather as much information as your can about the figure using your knowledge of slopes (and distances).
- Analyze the information. Detect identifying features/requirements of the figure.
- Write a concluding statement that uses your algebra to justify the specific quadrilateral in the figure.



3. Imagine quadrilateral ABCD on the coordinate plane below. Three out of the four coordinates for the figure have been provided. $A(-3, 5)$, $B(-5, 1)$, and $C(-1, 1)$.
- Plot the given vertices.

- If quadrilateral ABCD is meant to be a trapezoid, determine three possible locations for D. (Note: How many possible locations for D are there?)



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Practice Problems and Problem Set

Complete these problems on a separate sheet of paper. All solutions need appropriate justification using distance, slopes, etc. – a graph is not sufficient justification.

1. Prove that the shape with vertices $A(4, 7)$, $B(8, 5)$ and $C(10, 10)$ is a scalene triangle.
2. Prove that the shape with vertices $A(14, 11)$, $B(24, 9)$, $C(26, 3)$ and $D(16, 5)$ is a parallelogram.
3. Prove that the shape with vertices $A(1, 4)$, $B(3, 0)$, $C(1, -4)$, and $D(-1, 0)$ is a rhombus.
4. Prove that the shape with vertices $A(8, 9)$, $B(13, 10)$, $C(14, 5)$ and $D(9, 4)$ is a square.
5. Prove that the shape with vertices $A(6, 4)$, $B(12, 7)$, $C(14, 3)$, and $D(8, 0)$ is a rectangle.
6. Prove that the shape with vertices $A(10, 8)$, $B(13, 5)$ and $C(17, 12)$ is an isosceles triangle.
7. Prove that the shape with vertices $A(-6, 4)$, $B(0, -1)$, $C(0, -2)$, and $D(-6, -8)$ is a trapezoid.
8. Do the coordinates $(-11, -5)$, $(-15, -3)$, $(-15, -13)$, and $(-19, -11)$ form a rectangle?
9. Do the points $(-11, -15)$, $(4, -3)$, and $(-27, 5)$ form a right triangle?
10. Do the points $W(-3, -4)$, $A(5, 2)$, $R(10, 0)$, $T(8, -6)$ form a parallelogram?
11. Do the points $C(8, 2)$, $A(11, -1)$, $R(7, -5)$, $P(4, -2)$ form a rectangle?

For 12-19, sketch a graph and determine the MOST SPECIFIC name for the figure using slopes and distances to justify your answer.

12. $W(-1, 1)$, $X(0, 2)$, $Y(1, 1)$, and $Z(0, -2)$
13. $A(3, 5)$, $B(7, 6)$, $C(6, 2)$, $D(2, 1)$
14. $V(2, 1)$, $W(5, 4)$, $X(7, 2)$, $M(2, 2)$

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16. $N(0, 6)$, $P(-3, 1)$, $Q(0, 2)$, $R(-3, 5)$
17. $E(-3, 1)$, $F(-7, -3)$, $G(6, -3)$, $H(2, 1)$
18. $B(-8, 3)$, $O(-6, -2)$, $N(-8, -6)$, and $D(-10, -2)$
19. $H(3, 2)$, $A(6, 6)$, $R(11, 6)$, and $P(8, 2)$

For 20-23, determine the location of vertex D to form the figure described. You may want to create a graph to assist you.

20. Square: $A(2, 4)$, $B(8, 0)$, $C(4, -6)$, $D(?, ?)$
21. Parallelogram: $A(-2, 2)$, $B(0, 6)$, $C(8, 4)$, $D(?, ?)$
22. Trapezoid: $A(6, 2)$, $B(2, -4)$, $C(-4, 0)$, $D(?, ?)$
23. Trapezoid: $A(-4, -1)$, $B(0, 0)$, $C(1, 5)$, $D(?, ?)$

For problems 30-35, sketch a picture on a coordinate plane satisfying the conditions given. If it is not possible, then explain why not.

24. a parallelogram that is neither a rectangle nor a rhombus
25. an isosceles trapezoid with vertical and horizontal congruent sides
26. a trapezoid with only one right angle
27. a trapezoid with two right angles that is not a rectangle
28. a rhombus that is not a square
29. a kite with exactly two right angles