

Day 4 – Basics of Geometry in the Coordinate Plane – Notes

Throughout this unit, you have learned /reviewed about three important formulas:

Distance Formula: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ **Midpoint Formula:** $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

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

In an earlier unit, you learned about slopes of lines:

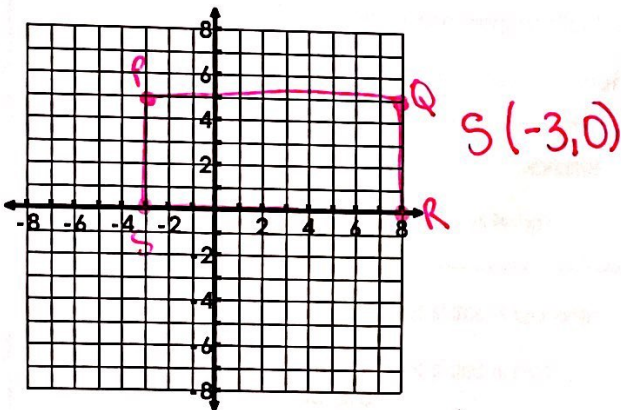
Parallel Lines – same slope, never intersect

Perpendicular – negative reciprocal slopes, intersect at 90degrees

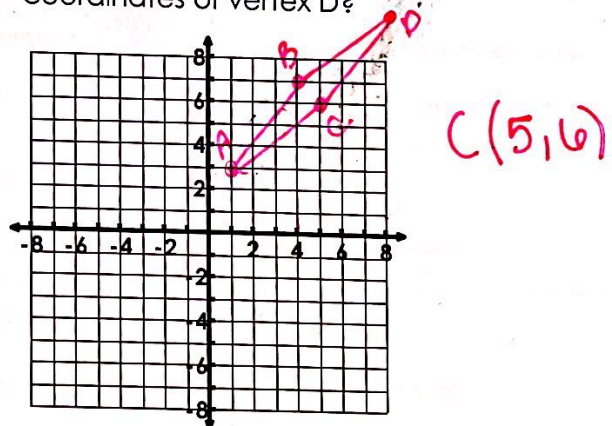
Neither – intersect, but not at 90 degrees, no relationship with slopes

Now are we going to use the coordinate plane to put together all of this information!

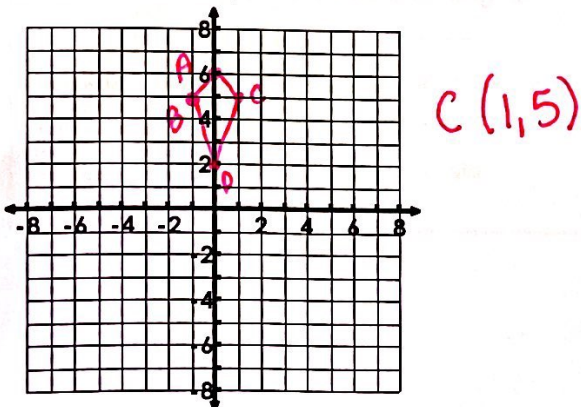
Example 1: Rectangle PQRS has vertices at P(-3, 5), Q(8, 5), R(8, 0), and S. Find the coordinates of point S.



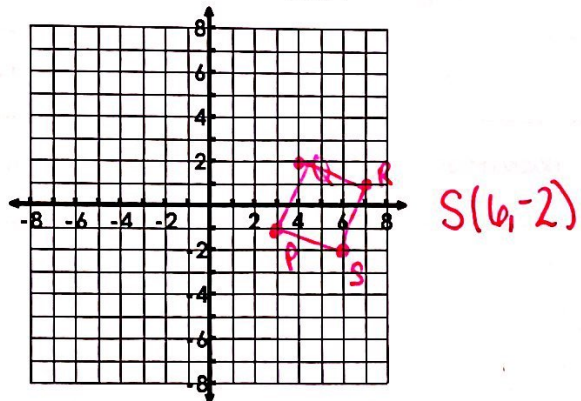
Example 2: If the points A(1, 3), B(4, 7), & C(8, 10) are the vertices of rhombus ABCD, what are the coordinates of vertex D?



Example 3: Kite ABCD has vertices at A(-1, 5), B(0, 6), D(0, 2), and C. Find the coordinates of point C.



Example 4: If the points P(3, -1), Q(4, 2), & R(7, 1) are the vertices of square PQRS, what the coordinates of vertex S?



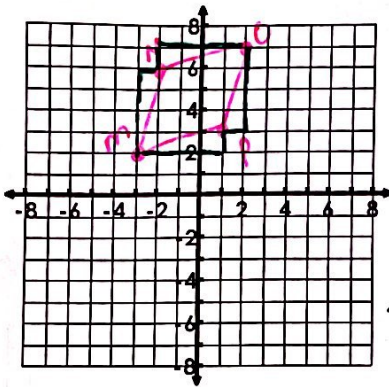
Proofs with Quadrilaterals and Triangles in a Coordinate Plane

If the object is a ...	Prove....	By using....	To Show...
Parallelogram	Opp sides are \cong Opposite Sides are parallel	Distance Formula Slope Formula	Sides are \cong Slopes are equal
	Diagonal bisect each other	Midpoint Formula	Midpoints are the same point
Rectangle	4 Right Angles	Slope Formula	Slopes are negative reciprocals
	Diagonals are congruent	Distance Formula	Diagonals are same lengths
	Diagonal bisect each other	Midpoint Formula	Midpoints are the same point
Rhombus	All sides congruent	Distance Formula	Sides are same lengths
	Diagonals are perpendicular	Slope Formula	Slopes are negative reciprocals
	Diagonals bisect each other	Midpoint Formula	Midpoints are the same point
Square	All sides are congruent	Distance Formula	Sides are same lengths
	4 Right Angles	Slope Formula	Slopes are negative reciprocals
	Diagonals are congruent	Distance Formula	Diagonals are same lengths
	Diagonals are perpendicular	Slope Formula	Slopes are negative reciprocals
	Diagonals bisect each other	Midpoint Formula	Midpoints are the same point
Trapezoid	One pair of sides is parallel	Slope Formula	Slopes are equal
	One pair of sides is not parallel	Slope Formula	Slopes are not equal
Isosceles Trapezoid	One pair of sides is parallel	Slope Formula	Slopes are equal
	One pair of sides is not parallel	Slope Formula	Slopes are not equal
	Non parallel sides are congruent	Distance Formula	Sides are same lengths
Equilateral Triangle	All sides are congruent	Distance Formula	Sides are same lengths
Isosceles Triangle	Two sides are congruent	Distance Formula	Sides are same lengths
Right Triangle	One Right Angle	Slope Formula	Slopes are negative reciprocals

Example 5: What kind of quadrilateral is MNOP? How do you know?

M(-3, 2), N(-2, 6), O(2, 7), & P(1, 3)?

Looks like a rhombus



All sides =
 $1^2 + 4^2 = c^2$
 $17 = c^2$
 $\sqrt{17} = c$

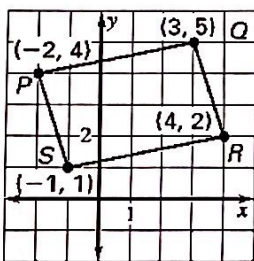
Right angles?

Slope of MP: $1/4 \rightarrow$ Not Right Angles
 Slope of PO: 4

Definitely a rhombus, so could it be a square too?

It is just a Rhombus!

Example 6: What kind of quadrilateral is PQRS? Justify your answer.



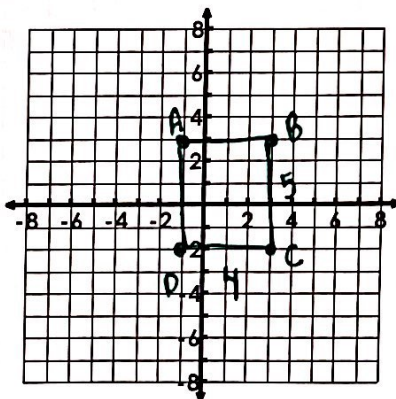
Looks like a rectangle or parallelogram

Slopes of:
 SR: $1/5$ PQ: $1/5$
 QR: -3 PS: -3
 not right angles

But the opposite sides are parallel because the slopes are the same, so its a **parallelogram**

Example 7: Prove that the points A(-1, 3), B(3, 3), C(3, -2), and D(-1, -2) form a square or not.

↓
 Prove 4 right angles
 4 \cong sides



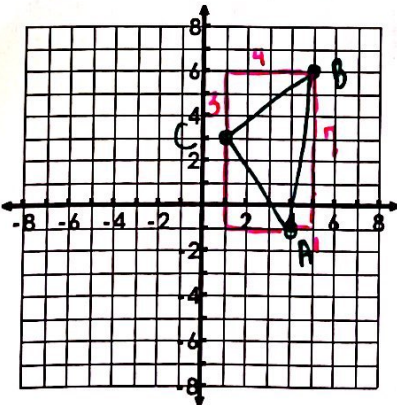
This is not a square because not all the sides are congruent.

Example 8: What type of triangle is formed by the coordinates? Justify your answer.

A(4, -1), B(5, 6), and C(1, 3)?

Isosceles, Scalene, Equilateral?
 Right, Acute, Obtuse?

This is an isosceles right triangle.



Sides
 BC: $3^2 + 4^2 = c^2$
 $25 = c^2$
 $5 = c$
 AC: $3^2 + 4^2 = c^2$
 $5 = c$
 BA: $1^2 + 7^2 = c^2$
 $50 = c^2$
 $5\sqrt{2} = c$

Slopes
 BC: $3/4$
 AC: $-4/3$

negative reciprocals so $BC \perp AC$, thus making it a right Δ .

Two sides are \cong , so Isosceles.