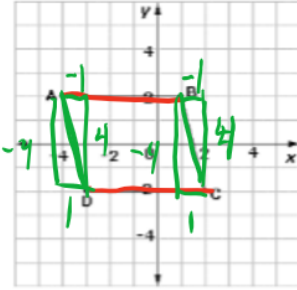


Goals for today

Proving shapes using Slopes

Proving shapes using the distance formula

Prove that the following shape is a parallelogram.



What are the properties of parallelograms?

Opp sides have to be parallel

\overline{AD}

$$m = \frac{4}{-1} = -4$$

Same slope
parallel

\overline{BC}

$$m = \frac{4}{-1} = -4$$

\overline{AB}

$$m = \frac{0}{5} = 0$$

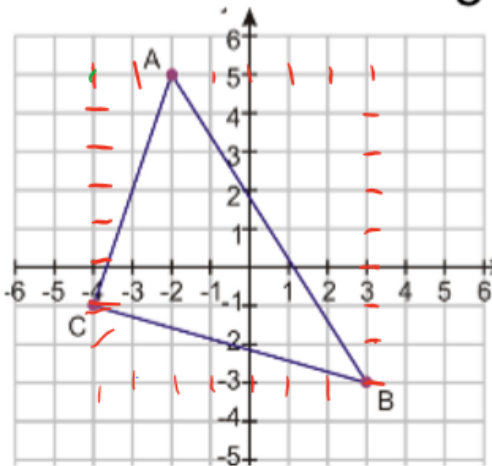
Same slope
parallel.

\overline{DC}

$$m = \frac{0}{5} = 0$$

\overline{AD} and \overline{BC} have the same slope and \overline{AB} and \overline{DC} have the same slope. This means that opp. sides are parallel, thus proving that ABCD is a parallelogram.

Prove that the triangle shown is a right triangle.



What do you know about right triangles?

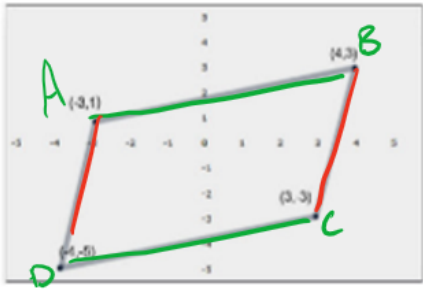
They have to have 1 right angle.

$$\overline{AB}: m = -\frac{8}{5} \quad \overline{AC}: m = \frac{6}{2} \quad \overline{BC}: m = -\frac{2}{7}$$

The slopes of each side of the triangle are not opp. reciprocals of each other. Therefore there are no perp. sides in the triangle. Thus ABC is not a right triangle.

You try! Pick one!

Prove it is a parallelogram



$$\overline{AB}: m = \frac{2}{7} \rightarrow \text{same slope}$$

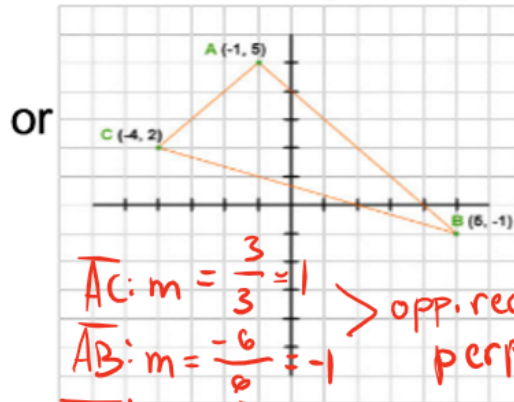
$$\overline{DC}: m = \frac{2}{7} \rightarrow \text{parallel}$$

$$\overline{AD}: m = \frac{6}{1} \rightarrow \text{same slope}$$

$$\overline{BC}: m = \frac{6}{1} \rightarrow \text{parallel}$$

$\overline{AB} \parallel \overline{DC}$ and $\overline{AD} \parallel \overline{BC}$ because each pair has the same slope. The opposite sides are parallel, so ABCD is a Parallelogram.

Prove it is a right triangle.



$$\overline{AC}: m = \frac{3}{3} = 1 \rightarrow \text{opp. recip. slopes}$$

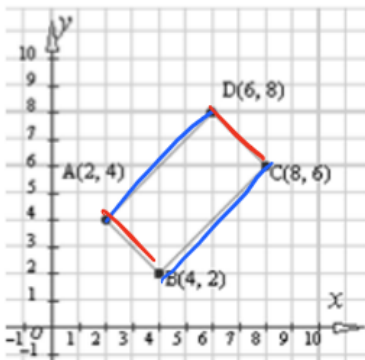
$$\overline{AB}: m = \frac{-6}{6} = -1 \rightarrow \text{perp.}$$

$$\overline{CB}: m = \frac{-3}{9} = -\frac{1}{3}$$

$\triangle ABC$ is a right triangle because \overline{AC} and \overline{AB} have opp. reciprocal slopes which makes them perpendicular.

Lets get a little more specific...

Prove the following is a Rectangle.



How could you guarantee that the shape is a

Rectangle? 1. Prove opp. sides are parallel

2. Prove that at least 1 angle is a right angle (perp. lines)

$$\overline{AD}: m = \frac{4}{4} = 1 \rightarrow \text{same slope}$$

$$\overline{BC}: m = \frac{4}{4} = 1 \rightarrow \text{parallel}$$

$$\overline{AB}: m = \frac{-2}{2} = -1 \rightarrow \text{opp. recip. slope}$$

$$\overline{DC}: m = \frac{-2}{2} = -1 \rightarrow \text{perp.}$$

$$\overline{AB}: m = \frac{-2}{2} = -1 \rightarrow \text{same slope}$$

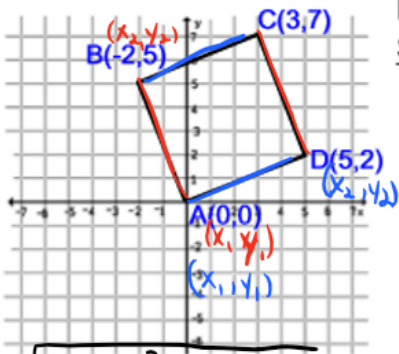
$$\overline{DC}: m = \frac{-2}{2} = -1 \rightarrow \text{parallel}$$

$\overline{AD} \parallel \overline{BC}$ and $\overline{AB} \parallel \overline{DC}$ because they have the same slopes.

$\overline{BC} \perp \overline{AB}$ because they have opp. reciprocal slopes.

Thus, ABCD is a rectangle.

Even more specific...
 Prove the following shape is a Square.



How could you guarantee that the shape is a Square?

1. 2 pairs of opp. parallel sides
2. 1 pair of perp. sides
3. 1 pair of consecutive congruent sides (distance formula)

$$\begin{aligned} \overline{AB}: m &= -\frac{5}{2} &> \text{same slope parallel} \\ \overline{CD}: m &= -\frac{5}{2} &> \text{opp. rec. slope perp.} \\ \overline{BC}: m &= \frac{2}{5} &> \text{same slope parallel} \\ \overline{AD}: m &= \frac{2}{5} &> \text{same slope parallel} \end{aligned}$$

$$\begin{aligned} d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ m \overline{AB} &= \sqrt{(-2-0)^2 + (5-0)^2} \\ &= \sqrt{(-2)^2 + (5)^2} \\ &= \sqrt{4+25} \\ m \overline{AB} &= \sqrt{29} \\ m \overline{AD} &= \sqrt{(5-0)^2 + (2-0)^2} \\ &= \sqrt{25+4} \\ m \overline{AD} &= \sqrt{29} \end{aligned}$$

Congruent consecutive sides

ABCD is a square because it has 2 pairs of parallel sides, a pair of perp. sides and a pair of consecutive congruent sides as shown in the work provided.

Recap of what we learned so far.

1. What do you need to know to prove a quadrilateral is a:
 - a: Parallelogram - 2 pairs of parallel sides.
 - b: Rectangle - 2 pairs of parallel sides and 1 pair of perp. sides.
 - c: Square - 2 pairs of parallel sides, 1 pair of perp. sides, 1 pair of consecutive congruent sides.
2. How could you prove a given triangle is a right triangle?

show that 1 pair of sides is perpendicular.