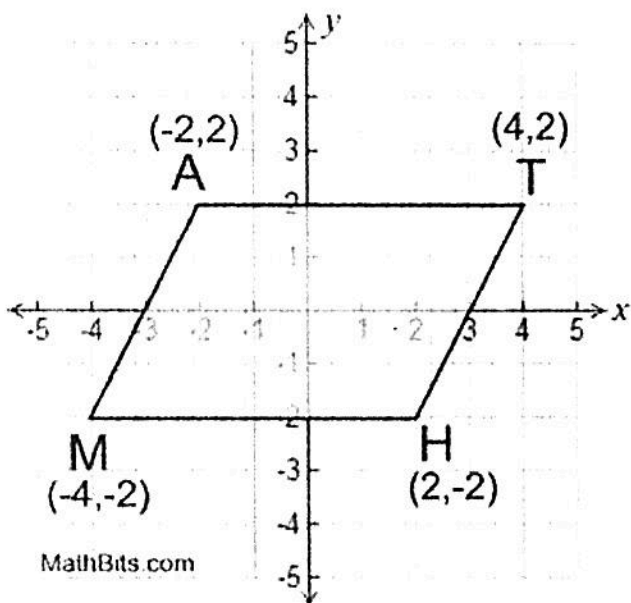


Now!

List the 5 properties of a parallelogram:

- consecutive \angle 's are supp
- opposite sides are \parallel
- opposite sides are \cong
- diagonals bisect each other
- opposite angles are \cong

Great! Now that we remember the 5 **unique** properties of a parallelogram, let's examine some qualities of a parallelogram on the **coordinate plane**:



1. What is the slope of:

- AT? $\frac{\Delta y}{\Delta x} = \frac{2-2}{4-2} = \frac{0}{2} = 0$

- MH? $\frac{\Delta y}{\Delta x} = \frac{-2-2}{2-4} = \frac{0}{-2} = 0$

- AM? $\frac{\Delta y}{\Delta x} = \frac{-2-2}{-4-2} = \frac{-4}{-6} = \frac{2}{3}$

- TH? $\frac{\Delta y}{\Delta x} = \frac{-2-2}{2-4} = \frac{-4}{-2} = 2$

Handwritten notes: "SAME" with arrows pointing to the slope calculations for AT and MH, and another "SAME" with arrows pointing to the slope calculations for AM and TH.

2. What is the distance between:

- AT? 6

- MH? 6

- AM? $d = \sqrt{(-4-2)^2 + (-2-2)^2}$
 $d = \sqrt{(-2)^2 + (-4)^2}$
 $d = \sqrt{4+16}$
 $d = \sqrt{20}$

- TH? $d = \sqrt{(2-4)^2 + (-2-2)^2}$
 $= \sqrt{(-2)^2 + (-4)^2}$
 $= \sqrt{4+16} = \sqrt{20}$

3. What is the midpoint of:

- MT? $(\frac{4-4}{2}, \frac{2-2}{2})$
 $(\frac{0}{2}, \frac{0}{2})$
 $(0, 0)$

- AH? $(\frac{-2+2}{2}, \frac{2-2}{2})$
 $(\frac{0}{2}, \frac{0}{2})$
 $(0, 0)$

Proving a Quadrilateral is a Parallelogram on the Coordinate Plane

Method 1:

Show both pairs of opposite sides are parallel by showing they have equal slopes.

Method 2:

Show both pairs of opposite sides are congruent by using the distance formula.

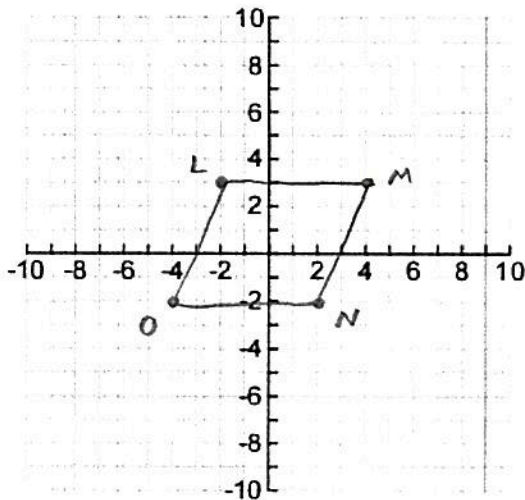
Method 3:

Show one pair of sides is both congruent and parallel.

Method 4:

Show that the diagonals bisect each other by showing the midpoint of the diagonals are the same.

1. Prove that the quadrilateral with the coordinates L(-2,3), M(4,3), N(2,-2) and O(-4,-2) is a parallelogram.



$$\text{slope } \overline{LM} = \frac{\Delta y}{\Delta x} = \frac{3-3}{4-2} = \frac{0}{2} = 0$$

$$\text{slope } \overline{ON} = \frac{\Delta y}{\Delta x} = \frac{-2-2}{-4-2} = \frac{-4}{-6} = \frac{2}{3}$$

$\overline{LM} \parallel \overline{ON}$ because the slopes are equal.

$$\text{slope } \overline{LO} = \frac{\Delta y}{\Delta x} = \frac{-2-3}{-4-2} = \frac{-5}{-6} = \frac{5}{6}$$

$$\text{slope } \overline{MN} = \frac{\Delta y}{\Delta x} = \frac{-2-3}{2-4} = \frac{-5}{-2} = \frac{5}{2}$$

$\overline{LO} \parallel \overline{MN}$ because the slopes are equal.

LMNO is a parallelogram because it is a quadrilateral with two sets of \parallel sides.