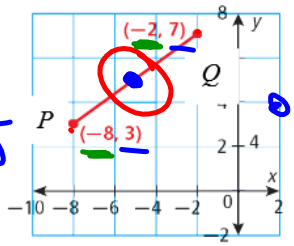
Notes 1-6: Midpoint and Distance in the Coordinate Plane Geometry - Ch. 1: *Foundations for Geometry*

Objectives: ***Develop*** *and apply the formula for midpoint.*
Use the distance formula and the Pythagorean Theorem to find the distance between two points.

Coordinate Plane: a plane split into 4 regions by the X -axis and the Y -axis. A pt. is denoted (X , Y).

EX 1: Discuss how to find the midpoint of $\overline{PQ}$ to develop a formula.



$x = \frac{-8+2}{2}$ $y = \frac{3+7}{2}$

$x = \frac{-6}{2} = -3$ $y = \frac{10}{2} = 5$

$M(\frac{-3}{x}, \frac{5}{y})$

EX 2: *M* is the midpoint of *XY*. *X* has coordinates (2, 7) and *M* has coordinates (6, 1). Find the coordinates of *Y*.

Method 1 (Algebra)

$6 = \frac{2+x}{2}$ $\times 2$ $12 = 2 + x$ $-2 \quad -2$ $10 = x$

$1 = \frac{7+y}{2}$ $\times 2$ $2 = 7 + y$ $-7 \quad -7$ $-5 = y$

Method 2 (Trick)

X (2, 7) +4 +4 M (6, 1) -5 -6 Y (10, -5)

$Y(\frac{10}{x}, \frac{-5}{y})$

Midpoint Formula: take the average of the *x*-coordinates & *y*-coordinates. $M(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2})$

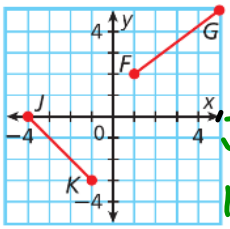
Distance Formula: the distance between (x_1, y_1) and (x_2, y_2) $D = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

EX 3: Find $\overline{FG}$ and $\overline{JK}$ using the distance formula. Is $\overline{FG} \cong \overline{JK}$?

$\overline{FG} = \sqrt{(5-1)^2+(5-2)^2}$

F(1, 2) G(5, 5) $\sqrt{(4)^2+(3)^2}$ $\sqrt{16+9}$ $\sqrt{25}$

$\overline{FG} = 5$



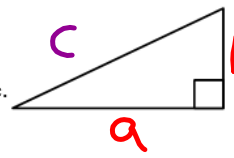
$\overline{JK} = \sqrt{(-1+4)^2+(-3-0)^2}$

J(−4, 0) K(−1, −3) $\sqrt{(3)^2+(-3)^2}$ $\sqrt{9+9}$ $\sqrt{18}$ 4.24

$\overline{JK} = 4.24$

$\overline{FG} \cong \overline{JK}$? NO

Right Triangles: the legs (a & b) **create** the rt. angle, and the hypotenuse (c) is **opposite** the rt. angle.



Pythagorean Theorem: $a^2+b^2=c^2$

hypotenuse IS ALWAYS THE LONGEST SIDE.

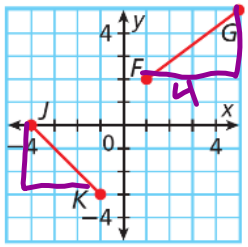
EX 4: Use the Pythagorean Theorem to find the lengths of $\overline{FG}$ and $\overline{JK}$ again.

$\overline{FG} = 4^2 + 3^2$ $c^2 = a^2 + b^2$ $\sqrt{25} = 16 + 9$

$\overline{FG} = 5$

$\overline{JK} = 3^2 + 3^2$ $\sqrt{c^2} = \sqrt{18}$ $c =$

$\overline{JK} = 4.24$



- The Pyth. Thm. and the distance formula are derived from each other. Which is easier to use?
- You MUST memorize both formulas!