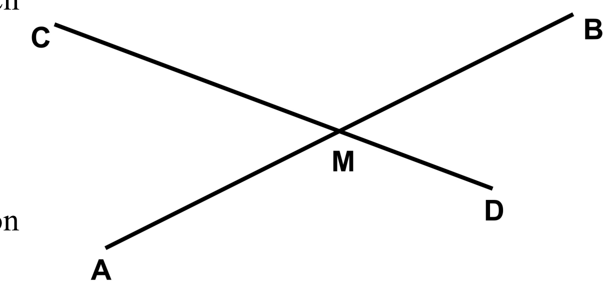
Name: ____________________________________ Date: _________________

THE MIDPOINT FORMULA
COMMON CORE GEOMETRY

Midpoints will be important as we move forward in geometry. The first exercise reviews some of the basics about midpoints.

***Exercise* #1:** In the diagram below segment $\overline{CD}$ bisects $\overline{AB}$ at point M.



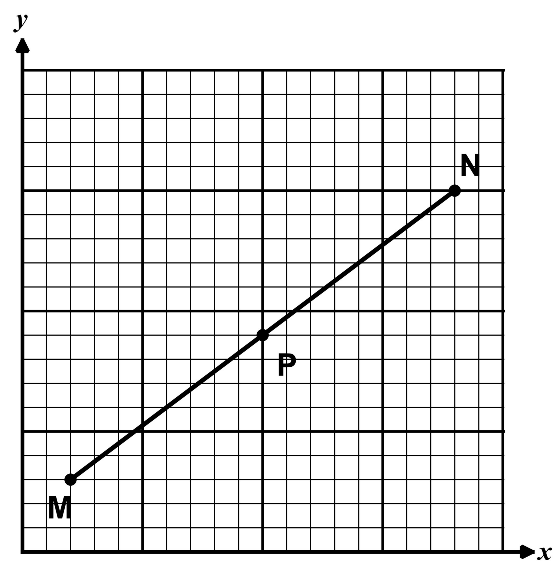
(a) Based on the information given, M is the midpoint of which of the two segments? Explain.

(b) Which two segments must have the same length based on the givens? Make a formal statement of congruence.

Midpoints have a special place in coordinate geometry as well as Euclidean geometry.

***Exercise* #2:** In the diagram shown, $\overline{MN}$ contains point P. Use the distance formula to prove that P is the midpoint of $\overline{MN}$.

$$M(2,3),\ P(10,9),\ N(18,15)$$



***Exercise* #3:** Given $M(2,3)$ and $N(18,15)$ from *Exercise* #2, find the average of their x-coordinates and the average of their y-coordinates. What do you notice about these averages?

THE MIDPOINT FORMULA

If (x_1, y_1) and (x_2, y_2) are the endpoints of a line segment, then the midpoint of that line segment is at:

$$\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) \text{ (the average)}$$

***Exercise* #4:** For each set of coordinates, find the coordinates of the midpoint of the segment joining the two.

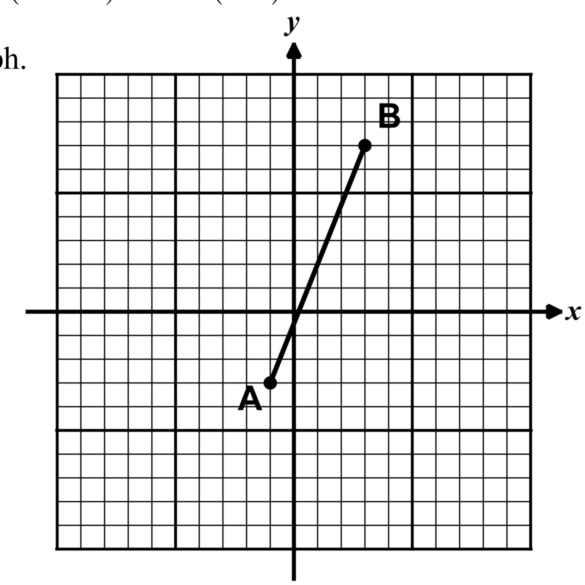
(a) $(-5, 7)$ and $(9, 15)$

(b) $(-8, 12)$ and $(5, 4)$

The midpoint formula is easy enough to use and should be understood from the perspective of averages. It can be helpful in many different contexts.

***Exercise* #5:** In the graph below, $\overline{AB}$ is drawn with endpoints at $A(-1, -3)$ and $B(3, 7)$.

(a) Find the coordinates of its midpoint, *M*, and mark it on the graph.



(b) What is the slope of $\overline{AB}$? State in simplest form.

(c) Draw the perpendicular bisector of $\overline{AB}$ and state its equation.

(d) State one point, other than *M*, that the perpendicular bisector passes through. Mark this point as *D* on the graph. Draw $\overline{AD}$ and $\overline{BD}$ and find their lengths using the distance formula. What do you observe?

Coordinates of *D*: ________________

Length of $\overline{AD}$:

Length of $\overline{BD}$:

Observation: ____

Name: ________________________________ Date: ________________

THE MIDPOINT FORMULA
COMMON CORE GEOMETRY HOMEWORK

PROBLEM SOLVING

1. For each pair of points below, find three quantities: the slope between the points, the midpoint between the points and the distance between the points. Show all calculations. Simplify all answers.

(a) $A(-4,-10)$ and $B(8,6)$

Slope:

Midpoint:

Distance:

(b) $F(-1,3)$ and $G(9,-3)$

Slope:

Midpoint:

Distance:

2. If two points, *R* and *T*, have coordinates of $R(-5,8)$ and $T(3,14)$, then which of the following points lies at the midpoint of $\overline{RT}$?

(1) $(-2,22)$ (3) $(-1,11)$

(2) $(-5,14)$ (4) $(2,11)$

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3. Which of the following would be true about the perpendicular bisector of the line segment whose endpoints are $E(-3,2)$ and $F(9,10)$?

(1) It would have a slope of $\frac{2}{3}$ and pass through the point $(3,6)$.

(2) It would have a slope of $\frac{2}{3}$ and pass through the point $(6,12)$.

(3) It would have a slope of $-\frac{3}{2}$ and pass through the point $(6,12)$.

(4) It would have a slope of $-\frac{3}{2}$ and pass through the point $(3,6)$.

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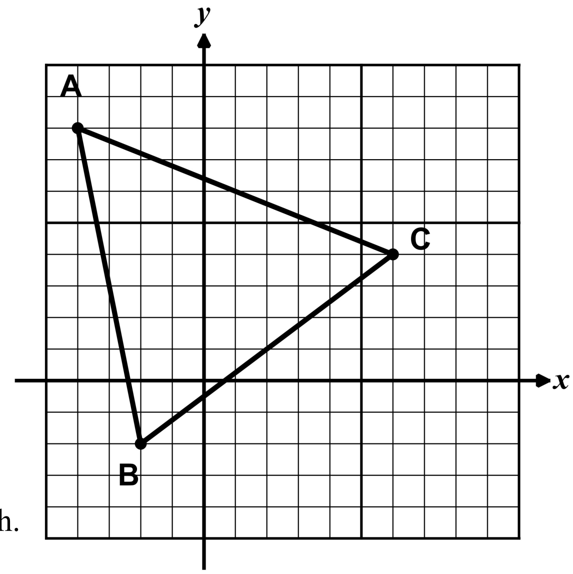
4. In the following diagram, ΔABC is drawn with coordinates at $A(-4,8)$, $B(-2,-2)$ and $C(6,4)$.



(a) Find the midpoints of $\overline{AB}$ and $\overline{AC}$ and label them D and E respectively.

Midpoint of $\overline{AB}$:
(point D)

Midpoint of $\overline{AC}$:
(point E)

(b) Draw segment $\overline{DE}$ on the graph and find its slope and length. Show your calculations below.

Slope of $\overline{DE}$:

Length of $\overline{DE}$:

(c) Find the slope and the length of line segment $\overline{BC}$. Show your calculations below.

Slope of $\overline{BC}$:

Length of $\overline{BC}$:

(d) Give at least two observations you can make based on your answers to (b) and (c).

5. Determine the equation of the perpendicular bisector $\overline{JK}$ whose endpoints are $J(-4,9)$ and $K(6,1)$. Show all your work below. (Use of the grid is optional.)