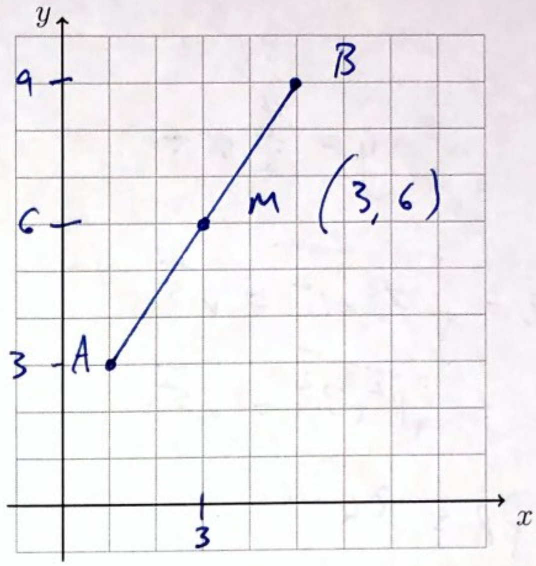
Unit 9: Algebra Name:
28 March 2022

9.6 Distance formula, perpendicular and parallel slopes

1. Do Now: Graph and label the line segment $\overline{AB}$, $A(1,3)$ and $B(5,9)$.

   (a) Mark the midpoint M of $\overline{AB}$. Label it as an ordered pair.



   (b) Find the slope of $\overline{AB}$

   $m_{\overline{AB}} = \frac{9-3}{5-1} = \frac{6}{4}$

   $= \frac{3}{2}$

2. Write down the slope perpendicular to the given slope.

   (a) $m = \frac{1}{2}$ $\quad m_\perp = -2$

   (b) $m = -\frac{3}{5}$ $\quad m_\perp = +\frac{5}{3}$

   (c) $m = -2$ $\quad m_\perp = \frac{1}{2}$

   (d) $m = 0.75 = \frac{3}{4}$ $\quad m_\perp = -\frac{4}{3}$

3. The line l has the equation $y = -\frac{1}{2}x + 3$. $\quad m = -\frac{1}{2}$

   (a) What is the slope of the line k, given $k \parallel l$?

   $-\frac{1}{2}$

   (b) What is the slope of the line j, given $j \perp l$?

   $+2$

4. Find the slope m of the line $x - 2y = 1$. Write down $m_\perp$.

   $y = \frac{1}{2}x - \frac{1}{2}$

   $m = \frac{1}{2}$ $\quad m_\perp = -2$

$m_{\overline{PQ}} = \frac{2-8}{7-(-1)} = -\frac{6}{8} = -\frac{3}{4}$

5. Plot and label the line segment $\overline{PQ}$, $P(-1, 8)$ and $Q(7, 2)$.

   (a) Graph the perpendicular bisector of $\overline{PQ}$ and label it with its equation in the form $y = mx + b$.

   $m_{\perp} = \frac{4}{3}$

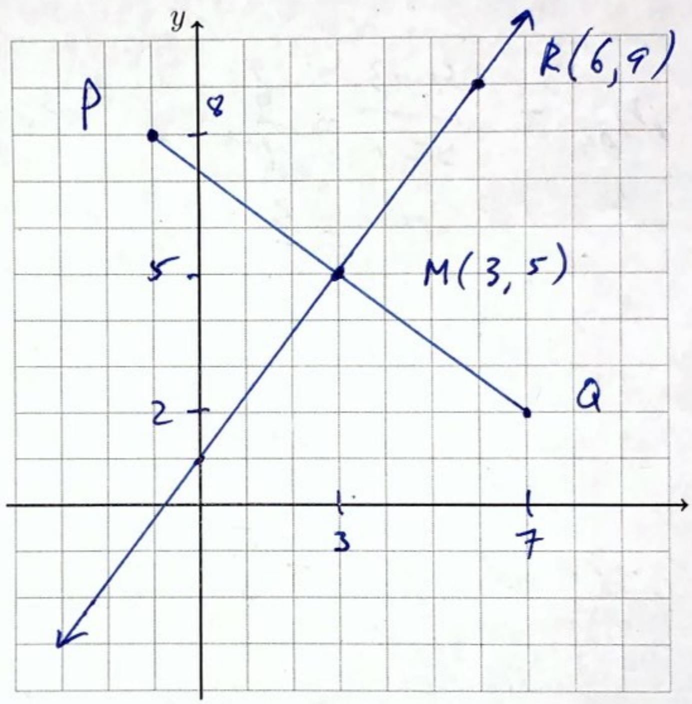
   $y = \frac{4}{3}x + 1$

   (b) Plot and label $R(6, 9)$. Compare the distances PR and PQ.

$PR = \sqrt{7^2 + 1^2} = \sqrt{50}$

$RQ = \sqrt{1^2 + 7^2} = \sqrt{50}$

$PR = RQ$



6. Solve each system of equations. Check your answer.

   (a) $4x + 8y = 20$
   $-4x + 2y = -30$

   $10y = -10$
   $y = -1$
   $4x + 8(-1) = 20$
   $x = 7$

   check: $-4(7) + 2(-1) = -30$?
   $-28 - 2 = -30$ ✓

   (b) $8x + y = -16$
   $-3x + y = -5$

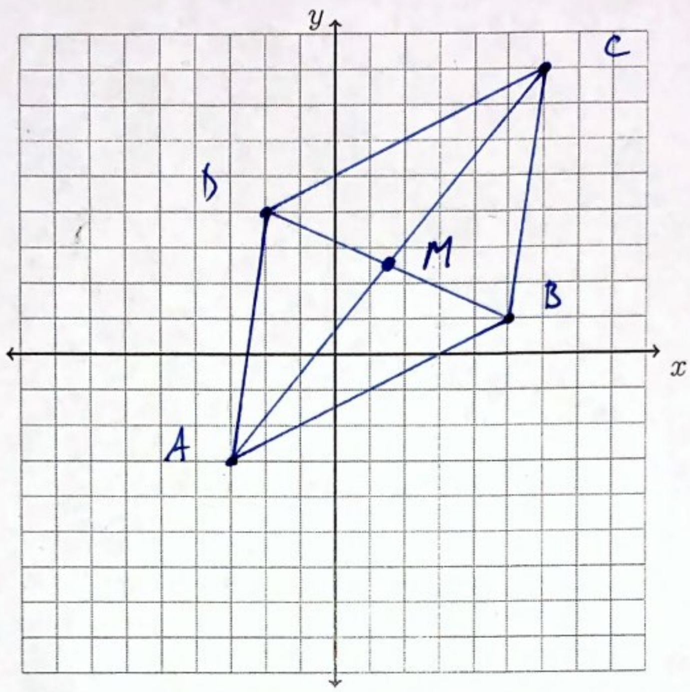
   Subtract

   $11x = -11$
   $x = -1$
   $8(-1) + y = -16$
   $y = -8$

   Check: $-3(-1) + -8 = -5$?
   $-5 = -5$ ✓

Name: Solutions

6. Spicy: On the set of axes below, graph the quadrilateral $ABCD$ having coordinates $A(-3,-3)$, $B(5,1)$, $C(6,8)$, and $D(-2,4)$.



Show that the midpoints of the two diagonals, $\overline{AC}$ and $\overline{BD}$, are the same point.

$$M_{AC} = \left(\frac{-3+6}{2}, \frac{-3+8}{2}\right) = \left(+\frac{3}{2}, \frac{5}{2}\right)$$

$$M_{BD} = \left(\frac{5+-2}{2}, \frac{1+4}{2}\right) = \left(\frac{3}{2}, \frac{5}{2}\right)$$

$$M_{AC} = M_{BD}$$

Prove $ABCD$ is a parallelogram. Use the following theorem: A quadrilateral is a parallelogram if and only if its diagonals bisect each other.

Given $ABCD$

Be sure to state the conclusion in your proof.

Intersection M bisects $\overline{AC}$ and $\overline{BD}$ because M is their mid points

$\Rightarrow$ $ABCD$ is a parallelogram because its diagonals bisect each other