Coordinate Algebra Agenda:

Go over quizzes

Talk about project grades

Section 12.4
1. \((3, 1) \quad (6, 5)\)

\[ d = \sqrt{(6-3)^2 + (5-1)^2} \]

\[ d = \sqrt{3^2 + 4^2} = \sqrt{9+16} = \sqrt{25} = 5 \]

2. \((7, 3) \quad (2, 8)\)

\[ \sqrt{(2-7)^2 + (8-3)^2} \]

\[ \sqrt{(5)^2 + (5)^2} = \sqrt{50} = 5\sqrt{2} \approx 7.1 \]
Mid Point

\[
\begin{align*}
\text{③ } (x_1, y_1) & \quad (x_2, y_2) \\
(8, 0) & \quad (4, 6) \\
\left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) & \quad \left( \frac{12}{2}, \frac{16}{2} \right) \\
& \quad (6, 3)
\end{align*}
\]

\[
\begin{align*}
\text{④ } (x_1, y_1) & \quad (x_2, y_2) \\
(-2, 7) & \quad (-8, -9) \\
\left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) & \quad \left( \frac{-10}{2}, \frac{-2}{2} \right) \\
& \quad (-5, -1)
\end{align*}
\]
Ch 8 Projects

Starting grade: Project

- 5 if couldn't answer #3.
- 5: ·················· #4
Did You Find a Parking Space?
Parallel and Perpendicular Lines on the Coordinate Plane

**LEARNING GOALS**

In this lesson, you will:
- Determine whether lines are parallel.
- Identify and write the equations of lines parallel to given lines.
- Determine whether lines are perpendicular.
- Identify and write the equations of lines perpendicular to given lines.
- Identify and write the equations of horizontal and vertical lines.
- Calculate the distance between a line and a point not on the line.

**KEY TERM**

- point-slope form

They seem simple enough, but parking lots require a great deal of planning. Parking lots are designed by transportation engineers who use technology and science to plan, design, operate, and manage facilities for any mode of transportation. During the planning stage of a parking lot, these engineers must keep in mind the needs of the facility that will use the parking lot as well as the needs of the drivers. They must think about the entrances and exits as well as the surrounding streets and their traffic flow. Even the weather must be taken into account if the lot is being built somewhere with heavy rain or snow!

Only thinking about the cars and their drivers, what needs might affect an engineer's plans? What would make a parking lot "good" or "bad"? Can you think of anything else that might affect the planning of a parking lot other than the things mentioned above?
PROBLEM 1 Parking Spaces

Large parking lots have line segments painted to mark the locations where vehicles are supposed to park. The layout of these line segments must be considered carefully so that there is enough room for the vehicles to move and park in the lot without other vehicles being damaged.

The line segments shown model parking spaces in a parking lot. One grid square represents one square meter.

1. What do you notice about the line segments that form the parking spaces?

They are parallel. 10 meters between segments

2. What is the vertical distance between AB and CD and between CD and EF?

6 meters

3. Carefully extend AB to create line p, extend CD to create line q, and extend EF to create line r.

4. Use the graph to identify the slope of each line. What do you notice?

All the lines have a slope of $\frac{3}{2}$.

The point-slope form of the equation of the line that passes through $(x_1, y_1)$ and has slope $m$ is $y - y_1 = m(x - x_1)$.

5. Use the point-slope form to write the equations of lines p, q, and r. Then write the equations in slope-intercept form.
The point-slope form of the equation of the line that passes through \((x_1, y_1)\) and has slope \(m\) is \(y - y_1 = m(x - x_1)\).

5. Use the point-slope form to write the equations of lines \(p\), \(q\), and \(r\). Then write the equations in slope-intercept form.

\textbf{Line } p: \quad \textbf{Point:} (0,0) \quad \textbf{Point:} (2,3) \quad m = \frac{3}{2} \quad y - 0 = \frac{3}{2} (x - 0) \quad y = \frac{3}{2} x

\textbf{Line } q: \quad \textbf{Point:} (0,4) \quad \textbf{Point:} (2,9) \quad m = \frac{3}{2} \quad y - 4 = \frac{3}{2} (x - 0) \quad y - 4 = \frac{3}{2} x \quad \rightarrow \quad y = \frac{3}{2} x + 6

\textbf{Line } r: \quad \textbf{Point:} (0,12) \quad \textbf{Point:} (2,15) \quad m = \frac{3}{2} \quad y - 12 = \frac{3}{2} (x - 0) \quad y - 12 = \frac{3}{2} x \quad \rightarrow \quad y = \frac{3}{2} x + 12
6. What do the y-intercepts tell you about the relationship between these lines in the problem situation?

\[(0,0), (0,4), (0,12)\]

**Spots are 6 meters apart**

7. If you were to draw \(GH\) above \(EF\) to form another parking space, predict what the slope and equation of the line will be without graphing the new line. How did you come to this conclusion?

\[m = \frac{3}{2}, (0, 18)\]

\[y = \frac{3}{2}x + 18\]  **It is parallel \( \perp \) 6 m up**

8. In the Parking Spaces problem, all the slopes were equal and the y-intercepts were all multiples of the same number.

a. Are the slopes of parallel lines on a coordinate plane always equal? Explain your reasoning.

**Yes, slopes of \( \parallel \) lines are always same**

**They have same rise \& run**

b. Are the y-intercepts of parallel lines on a coordinate plane always a multiple of the same number? Explain your reasoning.

9. Write equations for three lines that are parallel to the line given by \(y = -2x + 4\).

Explain how you determined your answers.

10. Write an equation for the line that is parallel to the line given by \(y = 5x + 3\) and passes through the point \((4, 0)\). Explain how you determined your answer.
9. Write equations for three lines that are parallel to the line given by \( y = -2x + 4 \).
   Explain how you determined your answers.
   
   \[
   \begin{align*}
   y &= -2x + 3 \\
   y &= -2x + 2 \\
   y &= -2x + 5
   \end{align*}
   \]
   \( m = -2 \)

10. Write an equation for the line that is parallel to the line given by \( y = 5x + 3 \) and passes through the point \((4, 0)\). Explain how you determined your answer.

   \[
   \begin{align*}
   m &= 5 \\
   \text{point} &\ (4, 0) \\
   y - y_1 &= m(x - x_1) \\
   y - 0 &= 5(x - 4) \\
   y &= 5x - 20
   \end{align*}
   \]
11. Without graphing the equations, predict whether the lines given by \( y - 2x = 5 \) and \( 2x - y = 4 \) are parallel.

\[
\begin{align*}
y &= mx + b \\
y &= 2x + 5 \\
m &= 2
\end{align*}
\]

\[
\begin{align*}
+2x - y &= 4 \\
-2x \\
-y &= -2x + 4 \\
-1 \\
y &= 2x - 4
\end{align*}
\]

They are parallel. \( m = 2 \)

d. Use the slope formula to calculate the slope of the image.

e. How does the slope of the image compare to the slope of the pre-image?

f. How would you describe the relationship between the graph of the image and the graph of the pre-image?
HW1
(2, 4) \( m = 5 \)

HW2
(-1, 3) \( m = -3 \)

Write the equations

\[ y = mx + b \]