Warm Up

Write the equation of the line through the points given:

a) (4, -6) and (5, -1)

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ m = \frac{-1 - (-6)}{5 - 4} \]
\[ m = \frac{5}{1} \]
\[ m = 5 \]
\[ y = mx + b \]
\[ y = 5x + b \]
\[ -1 = 5(5) + b \]
\[ -1 = 25 + b \]
\[ -1 - 25 = b \]
\[ -26 = b \]
\[ y = 5x - 26 \]

b) (4, 5) and (3, 9)

\[ m = \frac{9 - 5}{3 - 4} \]
\[ m = \frac{4}{-1} \]
\[ m = -4 \]
\[ y = mx + b \]
\[ y = -4x + b \]
\[ 5 = -4(4) + b \]
\[ 5 = -16 + b \]
\[ 5 + 16 = b \]
\[ 21 = b \]
\[ y = -4x + 21 \]
Parallel and Perpendicular Lines

- I know how to identify parallel lines.
- I know how to identify perpendicular lines.
- I know how to recognise a vertical line.
- I know how to recognise a horizontal line.
Complete: Investigating the Math on Pages 295 - 296

Using desmos.com complete #s 1 - 3 on page 105
Parallel Lines:
  Lines that never cross
  They have the same slope

Perpendicular Lines:
  Lines that cross at 90°
  They have slopes which are negative reciprocals

Negative Reciprocals:
  Numbers that have opposite signs and their denominators and numerators are switched

\[ m_1 = \frac{2}{3} \quad m_2 = -\frac{3}{2} \]

\[ m_1 = -\frac{4}{7} \quad m_2 = \frac{7}{4} \]

\[ m_1 = -\frac{3}{1} \quad m_2 = \frac{1}{3} \]
Example:

Which lines are parallel and which are perpendicular?

a) \( y = 3x + 1 \)  
  b) \( y = \frac{1}{3}x + 4 \)  
  c) \( y = -3x - 2 \)  

d) \( y = -\frac{1}{3}x - 1 \)  
  e) \( y = x + 3 \)  
  f) \( y = -x - 3 \)  

Parallel  \( \Rightarrow \) None

Perpendicular

(a) and (d)  
(b) and (c)  
(e) and (f)

\( m_1 = 1 \Rightarrow \frac{1}{1} \)  
\( m_2 = -1 \Rightarrow -\frac{1}{1} \)
Example

1. Find the equation of a line parallel to \( y = 3x + 4 \) with a y-intercept of 2

   \[ \text{Parallel} \rightarrow \text{Same slope} \]
   \[ y = 3x + 2 \]  \[ y \text{-intercept I want} \]

2. Find the equation of a line perpendicular to \( y = \frac{3}{4}x + 1 \) with a y-intercept of 5

   \[ \text{Perpendicular} \rightarrow \text{slope is negative reciprocal} \]
   \[ \frac{3}{4} \Rightarrow -\frac{4}{3} \]
   \[ y = -\frac{4}{3}x + 5 \]  \[ y \text{-intercept I want} \]
3. Find the equation of a line parallel to \( y = 2x - 1 \) through the point \((1, 5)\)

Parallel \(\rightarrow\) Same Slope

\[
y = mx + b
\]

Using \((1, 5)\)

\[
5 = 2(1) + b
\]

\[
5 = 2 + b
\]

\[
5 - 2 = b \quad \Rightarrow \quad y = 2x + 3
\]

\[
3 = b
\]
4. Find the equation of a line parallel to the x-axis through the point (3, 4)

Horizontal lines are \( y = \text{a #} \)

\[ \Rightarrow y = 4 \]
Vertical Lines:

A line that is straight up and down has no "run"
Since we can't divide by zero the slope is undefined
They have an equation of the form:
\[ x = a \]
where \( a \) is the \( x \)-value of any point on the line

Horizontal Lines:

A line that is straight across from left to right has no "rise"
Since the slope has no rise the slope is zero
They have an equation of the form:
\[ y = a \]
where \( a \) is the \( y \)-value of any point on the line
Homework

MHR HW Book Page 105 #s 4, 5, 6, 8 & 9

Page 302 #s 1, 2, 3, 5, 6, 7, 8 & 15