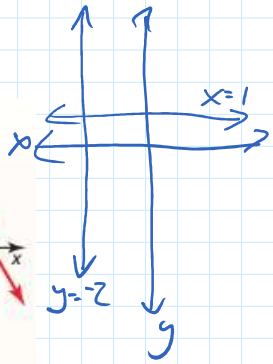
What You Will Learn

- Identify parallel and perpendicular lines.
- Write equations of parallel and perpendicular lines.

Identifying Parallel and Perpendicular Lines

In the coordinate plane, the x-axis and the y-axis are perpendicular. Horizontal lines are parallel to the x-axis, and vertical lines are parallel to the y-axis.

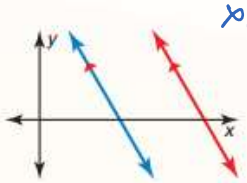


Theorem 3.13 Slopes of Parallel Lines

In a coordinate plane, two distinct nonvertical lines are parallel if and only if they have the same slope.

Any two vertical lines are parallel.

Proof p. 439; Ex. 41, p. 444

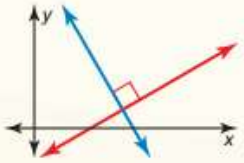


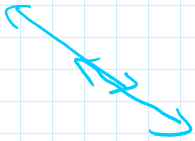
$m_1 = m_2$

Theorem 3.14 Slopes of Perpendicular Lines

In a coordinate plane, two nonvertical lines are perpendicular if and only if the product of their slopes is -1.

Horizontal lines are perpendicular to vertical lines.





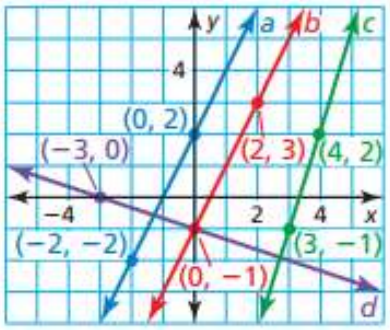
Slope-intercept form $y = mx + b$

Point-slope form $y - y_1 = m(x - x_1)$

Slope $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x}$

$m = \frac{y_2 - y_1}{x_2 - x_1}$

3. Determine which of the lines are parallel and which of the lines are perpendicular.



a) $\frac{2+2}{0+2} = \frac{4}{2} = 2$

b) $\frac{3+1}{2-0} = \frac{4}{2} = 2$

c) $\frac{2+1}{4-3} = \frac{3}{1} = 3$

d) $\frac{0+1}{-3-0} = \frac{1}{-3} = -\frac{1}{3}$

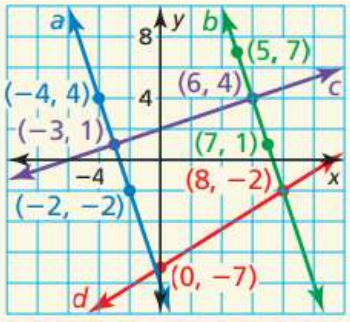
a ∥ b

c ⊥ d

$m = 5$

$\perp m = -\frac{1}{5}$

Determine which of the lines are parallel and which of the lines are perpendicular.



a) $\frac{4+2}{-4+2} = \frac{6}{-2} = -3$

b) $\frac{7-1}{5-7} = \frac{6}{-2} = -3$

c) $\frac{4-1}{6+3} = \frac{3}{9} = \frac{1}{3}$

d) $\frac{-2+7}{8-0} = \frac{5}{8}$

a ⊥ c

a ∥ b

b ⊥ c

Write an equation of the line passing through the point (−4, 6) that is parallel to the line $y = 3x - 4$.

$m = 3$

Write an equation of the line passing through the point (−12, 6) that is perpendicular to the line $y = \frac{2}{3}x - 10$.

$m = \frac{2}{3}$ $\perp m = -\frac{3}{2}$

$y - y_1 = m(x - x_1)$

to the line $y = 3x - 4$.

$y = mx + b \quad m = 3$

$y - y_1 = m(x - x_1) \quad (x_1, y_1)$

$y - 6 = 3(x + 4)$

$y - 6 = 3x + 12$

$+6 \quad +6$

$\boxed{y = 3x + 18}$

perpendicular to the line $y = \frac{2}{3}x - 10$.

$y - 6 = \frac{2}{3}(x + 12)$

$y - 6 = \frac{2}{3}x + 8$

$+6 \quad +6$

$y = \frac{2}{3}x + 14$

$y - y_1 = m(x - x_1)$

$y - 6 = \frac{-3}{2}(x - {}^{-}12)$

$y - 6 = \frac{-3}{2}(x + 12)$

$y - 6 = \frac{-3}{2}x + \frac{-3}{2} \cdot \frac{12}{1}$

$y - 6 = \frac{-3}{2}x - 18$

$+6 \quad +6$

$\boxed{y = \frac{-3}{2}x - 12}$

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4. Write an equation of the line that passes through the point (1, 5) and is (a) parallel to the line $y = 3x - 5$ and (b) perpendicular to the line $y = 3x - 5$.

a) // lines: $m = 3$

$y - 5 = 3(x - 1)$

$y - 5 = 3x - 3$

$+5 \quad +5$

$\boxed{y = 3x + 2}$

b) $\perp$ lines $m = 3$ $\perp m = -\frac{1}{3}$

$y - 5 = -\frac{1}{3}(x - 1)$

$y - 5 = -\frac{1}{3}x + \frac{1}{3}$

$+5 \quad +5$

$\boxed{y = -\frac{1}{3}x + \frac{16}{3}}$

$y = -\frac{1}{3}x + 5\frac{1}{3}$

$8\frac{1}{4} = \frac{33}{4}$

Practice sec 3.5 pg.
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