

1.1 Lines in the Plane

Day 2

I. Summary of Equations of Lines

1. **General Form:** $Ax + By + C = 0$
2. **Vertical line:** $x = a$
3. **Horizontal line:** $y = b$
4. **Slope-intercept:** $y = mx + b$
5. **Point-Slope Form:** $y - y_1 = m(x - x_1)$

II. Parallel and Perpendicular Lines

- A. Parallel lines have the same slope.
- B. Perpendicular lines have slope that are negative reciprocals of each other

$$m_1 = -1/m_2$$

Ex 1) Find the slope-intercept form of the equation that passes through the point (2, -1) and is parallel to the line $2x - 3y = 5$.

$$\begin{array}{l}
 2x - 3y = 5 \\
 \underline{-2x} \qquad \underline{-2x} \\
 -3y = -2x + 5 \\
 \underline{-3} \qquad \underline{-3} \qquad \underline{-3} \\
 y = \frac{2}{3}x - \frac{5}{3} \\
 m = \frac{2}{3}
 \end{array}$$

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

$$\begin{array}{l}
 y - (-1) = \frac{2}{3}(x - 2) \\
 y + 1 = \frac{2}{3}x - \frac{4}{3} \\
 \underline{-1} \qquad \underline{-1} \qquad \underline{-1} \\
 y = \frac{2}{3}x - \frac{7}{3}
 \end{array}$$

Ex 2) Now find an equation of a line that is perpendicular to $2x - 3y = 5$ and passes through (2, -1).

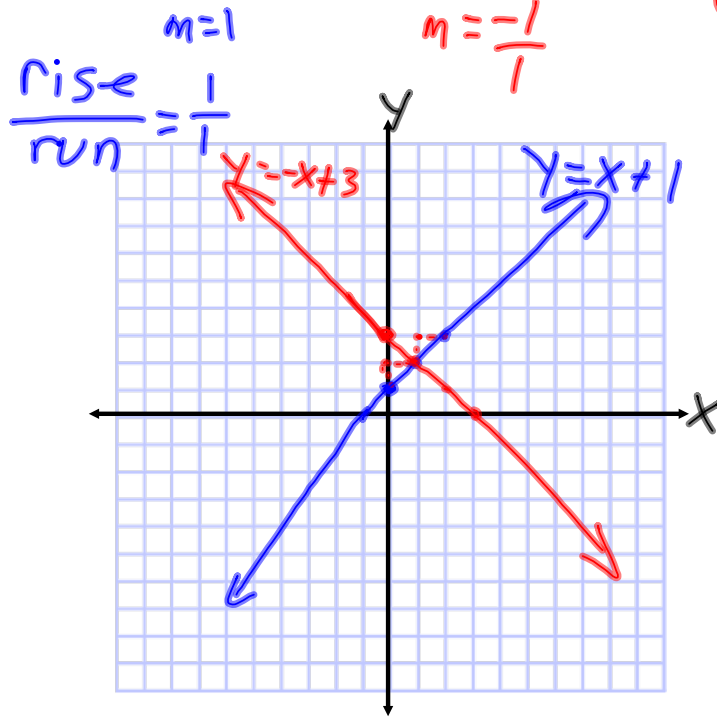
$$\begin{array}{l}
 m = -\frac{3}{2} \\
 y - (-1) = -\frac{3}{2}(x - 2) \\
 y + 1 = -\frac{3}{2}x + 3 \\
 \underline{-1} \qquad \underline{-1} \\
 y = -\frac{3}{2}x + 2
 \end{array}$$

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

Ex 3) Are L_1 and L_2 parallel, perpendicular, or neither?

$$\begin{array}{l}
 L_1: (3, 6) \text{ and } (-6, 0) \quad L_1 = \frac{0-6}{-6-3} = \frac{-6}{-9} = \frac{2}{3} \\
 L_2: (0, -1) \text{ and } (5, 7/3) \quad L_2 = \frac{(7/3)+1}{5-0} = \frac{3\frac{1}{3}}{5} = \frac{2}{3} \\
 \text{Parallel}
 \end{array}$$

Ex 4) Graph $y = x + 1$ and $y = -x + 3$. Are they parallel, perpendicular, or neither?



Ex 5) In 2000, Nike's net sales were 9 billion. In 2001, the sales were 9.5 billion. Write a linear equation giving the net sales y in terms of the year x . Then use the equation to predict the net sales in 2012?

$(0, 9)$ $(1, 9.5)$

$$\frac{\Delta y}{\Delta x} = \frac{9.5 - 9}{1 - 0} = \frac{0.5}{1} = \frac{1}{2}$$

$$y - 9 = \frac{1}{2}(x - 0)$$

$$y - 9 = \frac{1}{2}x$$

$$y = \frac{1}{2}x + 9$$

$x = 12$
 $y = \frac{1}{2}(12) + 9$
 $y = 6 + 9$
 $y = 15$ billion