9.6 OBJECTIVES

a. Determine whether the graphs of two linear equations are parallel.

b. Determine whether the graphs of two linear equations are perpendicular.

Parallel and Perpendicular Lines

\[ y = 3x + 1 \]
\[ y = 2x + 2 \]
\[ y = 3x + 2 \]

Parallel lines have the same slope.

9.7 OBJECTIVES

a. Determine whether an ordered pair of numbers is a solution of an inequality in two variables.

b. Graph linear inequalities.
perpendicular lines

\[ y = \frac{1}{2} x + 1 \]
\[ y = -2x + 2 \]

\[
\frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x}
\]

perpendicular lines have slopes that multiply to -1.

Summary:

\[ y = mx + b \]
\[ y = nx + c \]

parallel \( \Rightarrow m = n \); perpendicular \( \Rightarrow m \cdot n = -1 \)

ex:

Find the equation of the line that is perpendicular to \( y = \frac{2}{3}x + 1 \) and goes through \((1,1)\).

\[ m = -\frac{3}{2} \quad (\text{negative reciprocal of } \frac{2}{3}) \]

Point-slope: \( y = m(x - x_1) + y_1 \)
\[ y = -\frac{3}{2}(x - 1) + 1 \]
\[ y = -\frac{3}{2}x + \frac{3}{2} + \frac{2}{2} \]
\[ y = -\frac{3}{2}x + \frac{5}{2} \]
\[
\text{alternate method}
\]
perp to \( y = \frac{2}{3} x + 1 \), throgh \((1,1)\)
\[
m = -\frac{3}{2}
\]
will look like \( y = -\frac{3}{2} x + b \)
\[
1 = -\frac{3}{2} \cdot 1 + b
\]
\[
1 = -\frac{3}{2} b + b
\]
\[
1 = -\frac{3}{2} b
\]
\[
\frac{3}{2} b = 1
\]
\[
b = \frac{2}{3}
\]
\[
y = -\frac{3}{2} x + \frac{5}{2}
\]

### 9.7 Graphing Inequalities in Two Variables

#### Objectives

- Determine whether an ordered pair of numbers is a solution of an inequality in two variables.
- Graph linear inequalities.

#### Solutions of Inequalities in Two Variables

The solutions of inequalities in two variables are ordered pairs.

**Example 1**

Determine whether \((-3, 2)\) is a solution of \(5x + 4y < 13\).

Solutions to inequalities in two variables:

\[
x + y < 7.
\]

| Solutions | \( (3,3) \) | \( (-4,5) \) | \( (1, 5.999) \) |
$y \geq 3x - 1$

solutions:

$(2, 7) \rightarrow 7 \geq 3(2) - 1$

$(3, 9) \rightarrow 9 \geq 3(3) - 1$

Graphing:

$x + y < 7$.

1. Solve for $y$.

\[
\begin{align*}
  x + y &< 7 \\
  -x & \quad -x \\
  y &< -x + 7.
\end{align*}
\]

2. Treat it like an equation and graph $y = -x + 7$.

graph: $y \geq 3x - 1$

$(0 \geq 3(0) - 1 \checkmark$

$(0, -1)$

$(1, 2)$