3.1 Graphing Linear Equalities

**Definition 1: Two Forms of a Linear Equation**

\[ ax + by = c \]
\[ y = mx + b \]

**Definition 2: Linear Inequalities**

\[ ax + by \leq c \]
\[ ax + by \geq c \]

**Definition 3: Boundary and Solution Set**

[Diagram showing a linear inequality with boundary line and solution set]
**Steps 1**

1. Draw the line by replacing the inequality with an equals
2. Pick a test point on one side of the line
3. If the inequality is satisfied, shade that side
4. If the inequality is not satisfied, shade the other side

**Example 1**

Graph $2x - 3y \geq 6$

\[2x-3y = 6\]

**Example 2**

Graph $x \geq -1$ and $0 \leq y \leq 2$
### Steps 2: Graphing a System of Linear Inequalities

1. Graph the two linear inequalities
2. The solution set, $S$, is the region where the inequalities are both TRUE.

### Example 3

Graph the solution set for

\[ x - 2y \leq 1 \]
\[ 3x + 2y \geq 6 \]
Example 4

Graph the solution set for

\[ x + y \leq 4 \]
\[ 2x + y \leq 6 \]
\[ 2x - y \geq -1 \]
\[ x \geq 0 , \ y \geq 0 \]  

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Definition 4

1. Bounded: BOUNDED IF IT CAN BE ENCLOSED BY A CIRCLE
2. Unbounded: IF IT CANNOT BE ENCLOSED
Describe the shaded region

Either

\[
\begin{align*}
    y \geq 2x \\
    2 \geq 2(0) \\
    2 \geq 0
\end{align*}
\]

or

\[
\begin{align*}
    y \leq 2x \\
    2 \leq 2(0) \\
    2 \leq 0
\end{align*}
\]