Graphing Functions

- Graphing is easiest when you have ordered pairs to plot on the coordinate plane.
- Be able to graph with and without a calculator.
- Extend your lines/curves to outside of the graph when you are graphing.

Graphing Linear Functions

2 Ways to Graph Linear Functions:
1. Using y-intercept and slope
2. Finding ordered pairs

- Use domain (x-values) that are on the graph
- If a slope is a fraction, use x-values that are multiples of the denominator
Graph using y-intercept and slope.

\[ f(x) = 2x + 1 \]

- **y-intercept**: \( (0, 1) \)
- **Slope**: \( \frac{\text{rise}}{\text{run}} = \frac{2}{1} \) or \( -\frac{2}{-1} \)

Graph using y-intercept and slope.

\[ f(x) = -3x + 4 \]

- **y-intercept**: \( (0, 4) \)
- **Slope**: \( \frac{\text{rise}}{\text{run}} = -\frac{3}{1} \) or \( \frac{3}{-1} \)
Graph using y-intercept and slope.

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

**y-intercept:** \((0, -2)\)

**Slope:** \(\frac{\text{rise}}{\text{run}} = \frac{1}{2} \text{ or } \frac{-1}{-2}\)

**What if...** \(y = -\frac{1}{2}x - 2\)

**Slope:** \(\frac{-1}{2} \text{ or } \frac{1}{-2}\)

Graph by finding the ordered pairs.

\[ f(x) = 5x - 3 \]

**Choose inputs:** \((-2, 1, 0, 1, 2)\)

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>5(-2)</td>
<td>-13</td>
</tr>
<tr>
<td>5(-1)</td>
<td>-8</td>
</tr>
<tr>
<td>5(0)</td>
<td>-3</td>
</tr>
<tr>
<td>5(1)</td>
<td>2</td>
</tr>
<tr>
<td>5(2)</td>
<td>7</td>
</tr>
</tbody>
</table>

\((-2, -13), (-1, -8), (0, -3), (1, 2), (2, 7)\)
Graph by finding the ordered pairs.

1. **$y = -\frac{3}{4}x$**
   - Inputs: (-8, -4, 0, 4, 8)
   - Because I multiply the denominator (4) by the inputs (-2, 1, 0, 1, 2)
   - $-\frac{3}{4}(-8) = 6 \quad (-8, 6)$
   - $-\frac{3}{4}(-4) = 3 \quad (-4, 3)$
   - $-\frac{3}{4}(0) = 0 \quad (0, 0)$
   - $-\frac{3}{4}(4) = -3 \quad (4, -3)$
   - $-\frac{3}{4}(8) = -6 \quad (8, -6)$

2. **$y = -\frac{5}{2}x + 5$**
   - $-\frac{5}{2}(-4) + 5 = 15 \quad (-4, 15)$
   - $-\frac{5}{2}(-2) + 5 = 10 \quad (-2, 10)$
   - $-\frac{5}{2}(0) + 5 = 5 \quad (0, 5)$
   - $-\frac{5}{2}(2) + 5 = 0 \quad (2, 0)$
   - $-\frac{5}{2}(4) + 5 = -5 \quad (4, -5)$
   - $-\frac{5}{2}(6) + 5 = -10 \quad (6, -10)$
Graphing Non-Linear Functions

- Best way (especially without a calculator) to graph would be to find the ordered pairs
- Use domain (x-values) that are on the graph

Graph by finding the ordered pairs.

\[ f(x) = x^2 + 1 \]

\( (-2)^2 + 1 = 5 \quad \rightarrow \quad (-2, 5) \)
\( (-1)^2 + 1 = 2 \quad \rightarrow \quad (-1, 2) \)
\( (0)^2 + 1 = 1 \quad \rightarrow \quad (0, 1) \)
\( (1)^2 + 1 = 2 \quad \rightarrow \quad (1, 2) \)
\( (2)^2 + 1 = 5 \quad \rightarrow \quad (2, 5) \)
Graph by finding the ordered pairs.

\[ f(x) = |x| - 3 \]

- \(|-2| - 3 = -1\)\((-2, -1)\)
- \(|-1| - 3 = -2\)\((-1, -2)\)
- \(|0| - 3 = -3\)\((0, -3)\)
- \(|1| - 3 = -2\)\((1, -2)\)
- \(|2| - 3 = -1\)\((2, -1)\)

Graph by finding the ordered pairs.

\[ f(x) = -3x^2 + 8 \]

- \(-3(-2)^2 + 8 = -4\)\((-2, -4)\)
- \(-3(-1)^2 + 8 = 5\)\((-1, 5)\)
- \(-3(0)^2 + 8 = 8\)\((0, 8)\)
- \(-3(1)^2 + 8 = 5\)\((1, 5)\)
- \(-3(2)^2 + 8 = -4\)\((2, -4)\)
Graph by finding the ordered pairs.

\[ f(x) = |x + 1| \]

\[
\begin{align*}
|(-2) + 1| &= 1 & (-2, 1) \\
|(-1) + 1| &= 0 & (-1, 0) \\
|(0) + 1| &= 1 & (0, 1) \\
|(1) + 1| &= 2 & (1, 2) \\
|(2) + 1| &= 3 & (2, 3)
\end{align*}
\]

Graph the following functions:

1. \( f(x) = 5x - 7 \)  
2. \( f(x) = 2 |x| - 3 \)  
3. \( f(x) = -\frac{5}{2} x + 2 \)  
4. \( f(x) = x^2 + 2x - 3 \)