**Calculus I Worksheet 1 - Lines**
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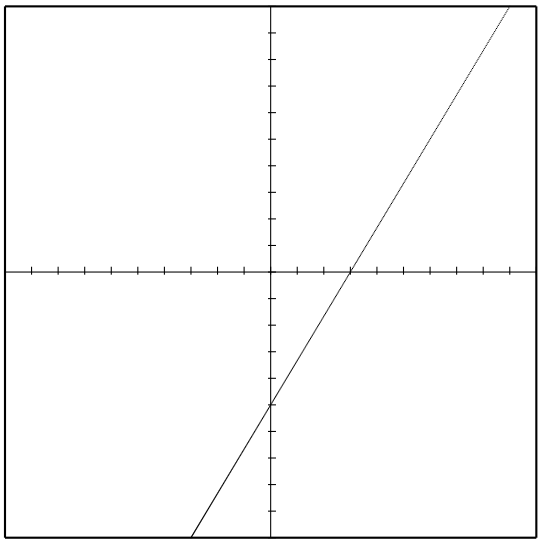
Every vertical line can be expressed by a unique equation of the form $x = c$, where $c$ is a constant. Such lines have undefined slope (or, one may say that the slope is $\infty$).

Every other line has can be expressed by a unique equation of the form $y = mx + b$. This is called *slope-intercept form*, where $m$ is the slope and $b$ is the $y$-value of the $y$ intercept.

**Example 1.** Consider the graph of a line. Find the standard form ($y = mx + b$) of the line, and identify the numbers $m$ and $b$. Find the slope, the $y$-intercept, and the $x$-intercept (if any) of the line.

*Solution.* By examining the graph, we see that the $y$-intercept of the line is $(0, -5)$ and that the $x$-intercept is $(3, 0)$. The slope is the change in $y$ divided by the change in $x$, which is $\frac{5}{3}$. Thus $m = \frac{5}{3}$ and $b = -5$. □



**Standard Form:** $y = \frac{5}{3}x - 5$

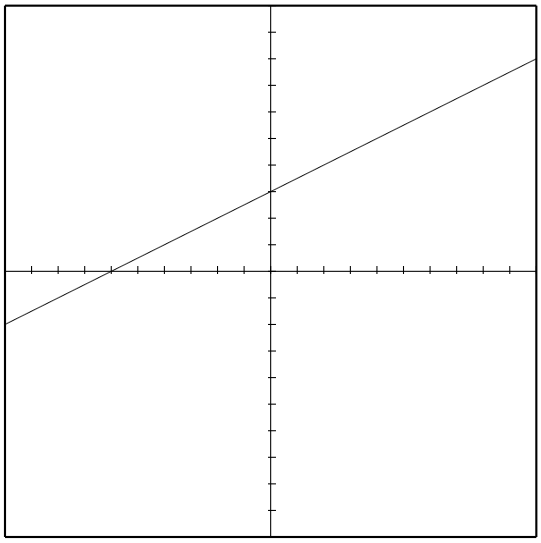
**m:** $\frac{5}{3}$ **b:** $-5$

**Slope:** $\frac{5}{3}$

**$y$-intercept:** $(0, -5)$

**$x$-intercept:** $(3, 0)$

**Exercise 1.** Consider the graph of a line. Find the standard form ($y = mx + b$) of the line, and identify the numbers $m$ and $b$. Find the slope, the $y$-intercept, and the $x$-intercept (if any) of the line.



**Standard Form:**

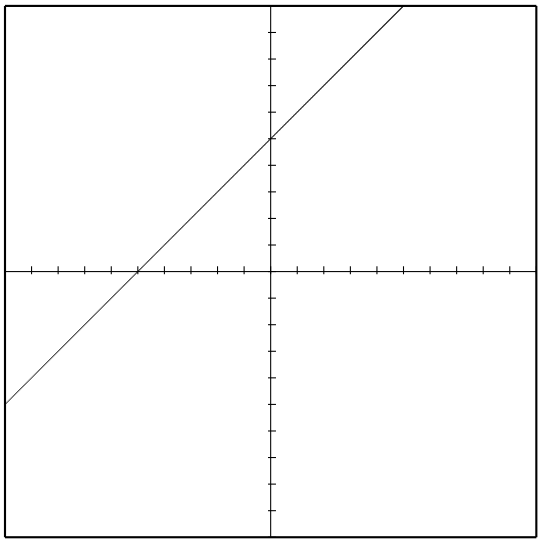
**m:** **b:**

**Slope:**

**$y$-intercept:**

**$x$-intercept:**

**Exercise 2.** Consider the graph of a line. Find the standard form ($y = mx + b$) of the line, and identify the numbers $m$ and $b$. Find the slope, the $y$-intercept, and the $x$-intercept (if any) of the line.



**Standard Form:**

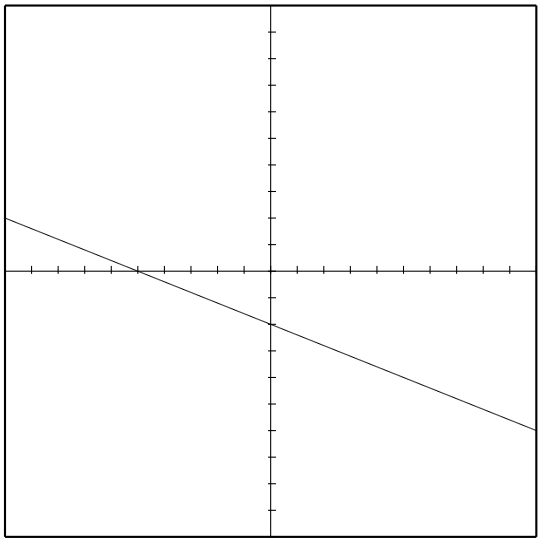
**m:** **b:**

**Slope:**

**$y$-intercept:**

**$x$-intercept:**

**Exercise 3.** Consider the graph of a line. Find the standard form ($y = mx + b$) of the line, and identify the numbers $m$ and $b$. Find the slope, the $y$-intercept, and the $x$-intercept (if any) of the line.



**Standard Form:**

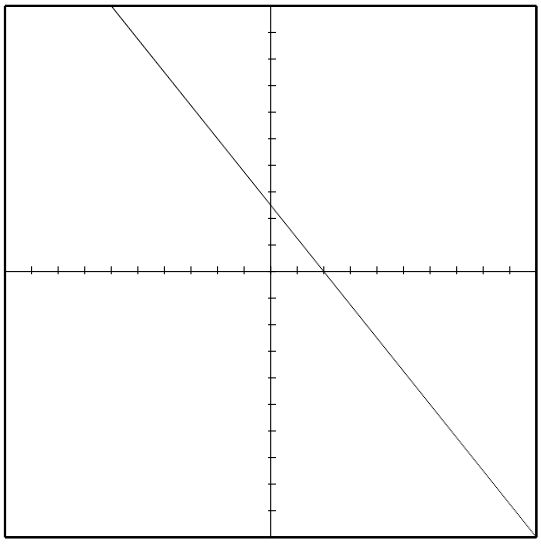
**m:** **b:**

**Slope:**

**$y$-intercept:**

**$x$-intercept:**

**Exercise 4.** Consider the graph of a line. Find the standard form ($y = mx + b$) of the line, and identify the numbers $m$ and $b$. Find the slope, the $y$-intercept, and the $x$-intercept (if any) of the line.



**Standard Form:**

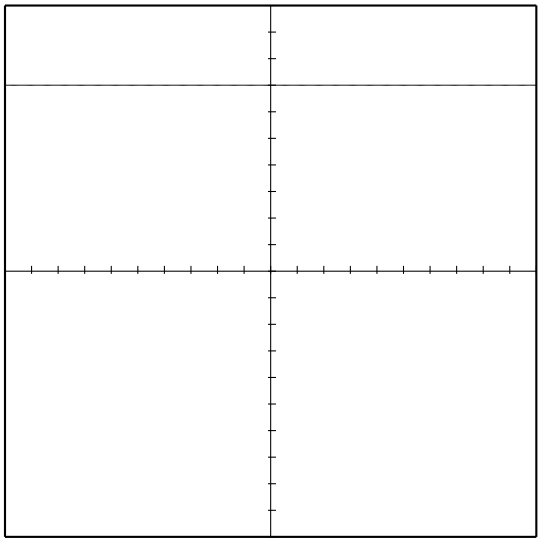
**m:** **b:**

**Slope:**

**$y$-intercept:**

**$x$-intercept:**

**Exercise 5.** Consider the graph of a line. Find the standard form ($y = mx + b$) of the line, and identify the numbers $m$ and $b$. Find the slope, the $y$-intercept, and the $x$-intercept (if any) of the line.



**Standard Form:**

**m:** **b:**

**Slope:**

**$y$-intercept:**

**$x$-intercept:**

**Example 2.** Consider the linear equation $3x + 6y = 9$. Find the standard form $y = mx + b$ of the line, and identify the numbers $m$ and $b$. Find the slope, the $y$-intercept, and the $x$-intercept (if any) of the line. Graph the line and label these points.

*Solution.* First we must solve for $y$. Subtract $3x$ from both sides to get $6y = -3x + 9$. Divide by 6 to get

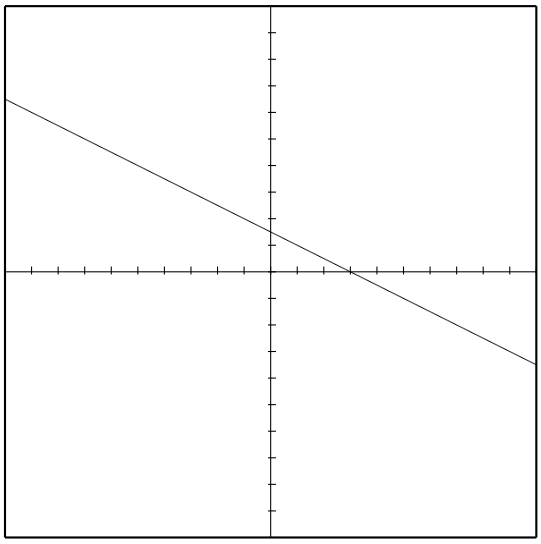
$$\boxed{y = -\frac{1}{2}x + \frac{3}{2}}.$$

Thus $m = -\frac{1}{2}$ and $b = \frac{3}{2}$.

The slope is the number in front of the $x$ when the equation is in slope-intercept form (that is, the slope is $m$). In this case, the slope is $-\frac{1}{2}$. This is negative, so the graph goes down.

The $y$-intercept is the point where the line intersects the $y$-axis. This is obtained by plugging in 0 for $x$, and solving for $y$. In this case, we obtain $y = \frac{3}{2}$. The the $y$-intercept is the point $(0, \frac{3}{2})$.

The $x$-intercept is the point where the line intersects the $x$-axis. This is obtained by plugging in 0 for $y$ and solving for $x$. In this case, we obtain $x = 3$. Thus the $x$-intercept is the point $(3, 0)$. □



**Equation:** $3x + 6y = 9$

**Standard Form:** $y = -\frac{1}{2}x + \frac{3}{2}$

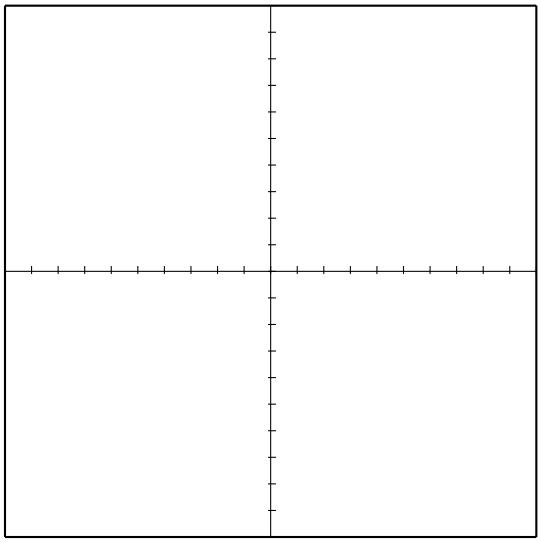
**m:** $-\frac{1}{2}$ **b:** $\frac{3}{2}$

**Slope:** $-\frac{1}{2}$

**$y$-intercept:** $(0, \frac{3}{2})$

**$x$-intercept:** $(3, 0)$

**Exercise 6.** Consider the linear equation $y = 3x - 6$. Find the standard form $y = mx + b$ of the line, and identify the numbers $m$ and $b$. Find the slope, the $y$-intercept, and the $x$-intercept (if any) of the line. Graph the line and label these points.



**Equation:** $y = 3x - 6$

**Standard Form:**

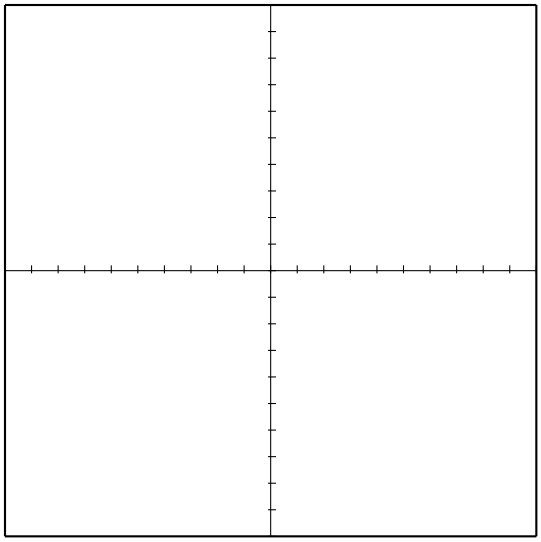
**m:** **b:**

**Slope:**

**$y$-intercept:**

**$x$-intercept:**

**Exercise 7.** Consider the linear equation $3x - 5y = 15$. Find the standard form $y = mx + b$ of the line, and identify the numbers $m$ and $b$. Find the slope, the $y$-intercept, and the $x$-intercept (if any) of the line. Graph the line and label these points.



**Equation:** $3x - 5y = 15$

**Standard Form:**

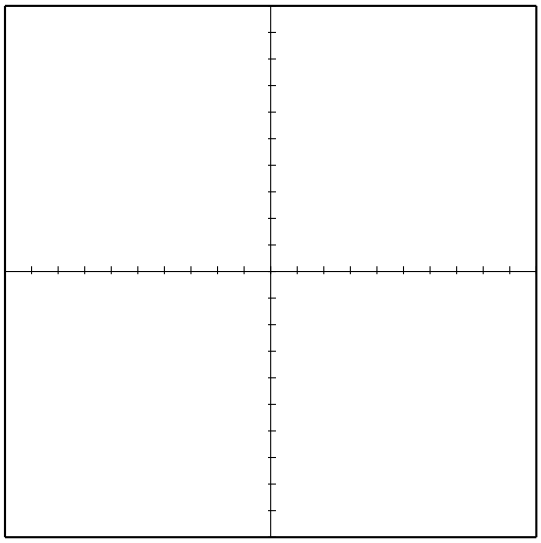
**m:** **b:**

**Slope:**

**$y$-intercept:**

**$x$-intercept:**

**Exercise 8.** Consider the linear equation $y = -3$. Find the standard form $y = mx + b$ of the line, and identify the numbers $m$ and $b$. Find the slope, the $y$-intercept, and the $x$-intercept (if any) of the line. Graph the line and label these points.



**Equation:** $y = -3$

**Standard Form:**

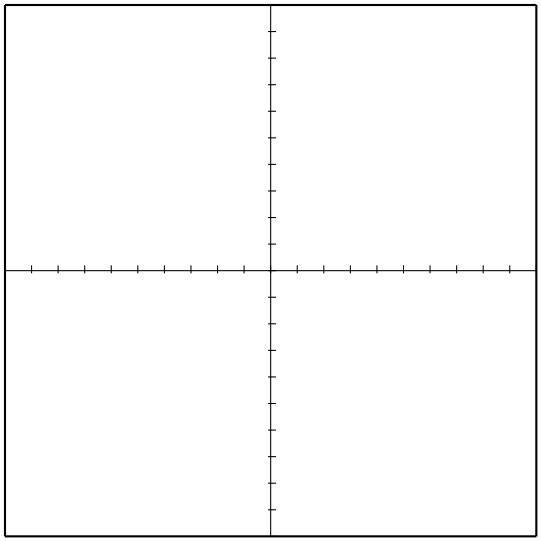
**m:** **b:**

**Slope:**

**$y$-intercept:**

**$x$-intercept:**

**Exercise 9.** Consider the linear equation $-7y = 49 - 14x$. Find the standard form $y = mx + b$ of the line, and identify the numbers $m$ and $b$. Find the slope, the $y$-intercept, and the $x$-intercept (if any) of the line. Graph the line and label these points.



**Equation:** $-7y = 49 - 14x$

**Standard Form:**

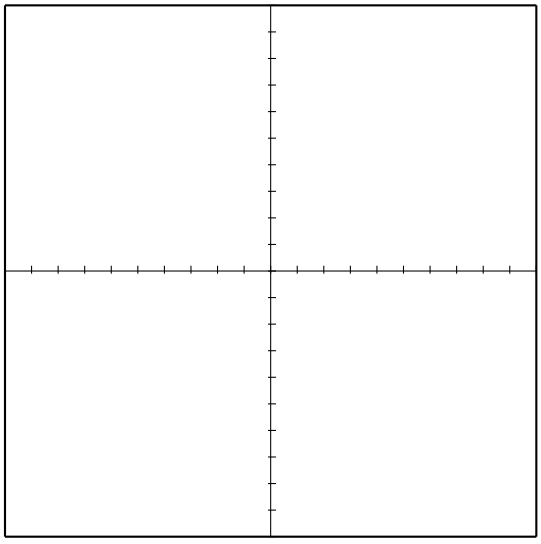
**m:** **b:**

**Slope:**

**$y$-intercept:**

**$x$-intercept:**

**Exercise 10.** Consider the linear equation $\frac{2x}{y} = 5$. Find the standard form $y = mx + b$ of the line, and identify the numbers $m$ and $b$. Find the slope, the $y$-intercept, and the $x$-intercept (if any) of the line. Graph the line and label these points.



**Equation:** $\frac{2x}{y} = 5$

**Standard Form:**

**m:** **b:**

**Slope:**

**$y$-intercept:**

**$x$-intercept:**