Find the slope of the line passing through the points:

80. (2,1) and (6,6)
\[ m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6-1}{6-2} = \frac{5}{4} \]

81. (−5,2) and (4,2)
\[ m = \frac{2-2}{4-(-5)} = \frac{0}{9} = 0 \]

82. (−3,0) and (3,−4)
\[ m = \frac{-4-0}{3-(-3)} = \frac{-4}{6} = \frac{-2}{3} \]

### Challenge #5:
Show that (7, -1) is on the line \( y = 2x - 15 \)

Algebraically:
\[ y = 2x - 15 \]
\[ -1 = 2(7) - 15 \]
\[ -1 = 14 - 15 \]
\[ -1 = -1 \]

Yes!

\[ \therefore (7, -1) \text{ is on the line } y = 2x - 15. \]
The Equation of a Line

As you have seen, equations such as $2x + 3y = 12$ or $3y = x + 9$ or $y = \frac{5}{6}x - 4$ produce straight lines when graphed. They are linear equations.

Linear Equations may be written in several forms:

- **Slope-Intercept Form:** $y = mx + b$  
  
- **Point-Slope Form:** $y_2 - y_1 = m(x_2 - x_1)$

- **General Form:** $Ax + By + C = 0$

**y-intercept**

Recall the Equation of a Line Property:

The coordinates of every point on the line will satisfy the equation of the line.

Eg.1. Show that $(7, -1)$ is on the line $y = 2x - 15$

- $y = 2x - 15$
- $(-1) = 2(7) - 15$
- $-1 = 14 - 15$
- $-1 = -1$

If $(7, -1)$ is on the line, it will satisfy the equation.
Substitute the ordered pair into the equation.
Does the left side = right side?
Yes. The point IS on the line.

---

2 ways to solve:
- **Graphically** - Create a table of values
- **Algebraically** - Use substitution and check.

Determine if the following points lie on the line $y = 2x + 4$ (HINT: substitution!)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>86. (-10, 24)</td>
<td>87. (14, 14)</td>
</tr>
<tr>
<td>$y = 2(x) + 4$</td>
<td>$14 = 2(14) + 4$</td>
</tr>
<tr>
<td>$24 = 2(-10) + 4$</td>
<td>$14 = 10 + 4$</td>
</tr>
<tr>
<td>$24 = -20 + 4$</td>
<td>$14 = 14$</td>
</tr>
<tr>
<td>$24 = -16$</td>
<td>$y = 2x + 4$</td>
</tr>
</tbody>
</table>

Determine if the following points lie on the line $3x - 2y + 6 = 0$

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>89. (10, 18)</td>
<td>90. (0, -3)</td>
</tr>
<tr>
<td>$3x - 2y + 6 = 0$</td>
<td>$3(0) - 2(-3) + 6 = 0$</td>
</tr>
<tr>
<td>$3(10) - 2(18) + 6 = 0$</td>
<td>$0 - (-6) + 6 = 0$</td>
</tr>
<tr>
<td>$30 - 30 + 6 = 0$</td>
<td>$0 = 0$</td>
</tr>
<tr>
<td>$0 = 0$</td>
<td>$12 = 0$</td>
</tr>
</tbody>
</table>

**yes, (10, 18) is on the line.**

**no, not on the line.**

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92. Determine if the point \((2, -3)\) is on the line \(y = 3x - 9\).

\[-3 = 3(2) - 9\]
\[-3 = 6 - 9\]
\[-3 = -3\]

Explain why or why not:
Yes, it is on the line because when the coordinates \(2, -3\) are substituted into the equation, left side and right side are equal.

93. Determine if the point \((-1, -4)\) is on the line \(3x - 2y - 11 = 0\).

\[3(-1) - 2(-4) - 11 = 0\]
\[-3 + 8 - 11 = 0\]
\[-6 \neq 0\]

Explain why or why not:
No, the coordinates \(-1, -4\) are not on the line \(3x - 2y = 0\) because when substituted \(-6 \neq 0\), i.e., sides are not equal.

94. Determine if the point \((2, -3)\) is on the line \(y + 1 = \frac{3x}{2}\).

\[(-3) + 1 = \frac{3(2)}{2}\]
\[-2 = \frac{6}{2}\]
\[-2 \neq 3\]

Explain why or why not:
No, \((2, -3)\) is not on the line \(y + 1 = \frac{3x}{2}\) because \(-2 \neq 3\).

95. Determine if the set of ordered pairs represents a linear relation. \((x, y)\):

\[x, y\]
\[(2,3), (3,4), (4,5), (5,6)\]

Explain why or why not:
Yes, it is a linear relation because the rate of change (slope) is constant (inc. by +1).

96. Determine if the set of ordered pairs represents a linear relation.

Explain why or why not:
all $x$ values are equal while $y$ changes. This represents a vertical line.

97. Determine if the set of ordered pairs represents a linear relation.

$((2,1), (3,0), (4,-1), (5,-2))$

Yes, there is a constant rate of change.

(i.e. as $x \uparrow +1$, $y \downarrow -1$)
Equation of a Line: Slope-Intercept Form

98. Graph the line \( y = \frac{2}{3} x - 5 \) using a table of values.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-\frac{11}{3}</td>
</tr>
<tr>
<td>0</td>
<td>-5</td>
</tr>
<tr>
<td>3</td>
<td>-\frac{17}{3}</td>
</tr>
</tbody>
</table>

99. Graph the line \( y = -3x + 5 \) using a table of values.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>-11</td>
</tr>
<tr>
<td>-1</td>
<td>-8</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>-1</td>
</tr>
</tbody>
</table>

100. What is the slope of the line above?
\[ m = \frac{2}{3} \] (note: uphill)

101. What is the slope of the line above?
\[ m = -3 \] (note: negative slope)

102. What is the y-intercept of the line above?
\[ y = \frac{2}{3} x - 5 \]
\[ y_{\text{int}} = -5 \]

103. What is the y-intercept of the line above?
\[ y_{\text{int}} = 5 \] (where \( x = 0 \))

104. Compare these values to the equation.
What do you notice?
\[ y = \frac{2}{3} x - 5 \]

105. Compare these values to the equation.
What do you notice?
\[ y = mx + b \text{ or } y = -3x + 5 \]

We say the equations above are written in **slope-intercept form**. A general formula for an equation in slope intercept form is \( y = mx + b \).

The slope is the coefficient of \( x \).
The y-intercept. (Make note of the sign)

Remember, \( x \) and \( y \) are the coordinates of ANY point on the line. When substituted, they will satisfy the equation. See your work on the previous page!

\[ \text{ie: you can choose ANY numbers for your table of values. \{-2,-1,0,1,2\} are just a suggestion.} \]
State the slope and y-intercept for the line represented by each equation.

106. \( y = -\frac{3}{5}x + 2 \)
   \( m = -\frac{3}{5} \)
   \( y\)-int = 2

107. \( y = -\frac{3}{5}x - 7 \)
   \( m = -\frac{3}{5} \)
   \( y\)-int = -7

108. \( y = \frac{2}{3}x - \frac{5}{2} \)
   \( m = \frac{2}{3} \)
   \( y\)-int = -\frac{5}{2}

Write the equation of each line given the slope and y-intercept.

109. \( m = 2 \), \( b = -5 \)
    \( y = mx + b \)
    \( y = 2x - 5 \) *note \pm sign

110. \( m = \frac{2}{3} \), \( b = \frac{2}{3} \)
    \( y = \frac{2}{3}x + \frac{2}{3} \)

111. \( m = -3 \), \( b = -2 \)
    \( y = -3x - 2 \)

For each line below, state the slope, y-intercept, and equation.

112.
   "uphill" = \( m \) slope
   y-intercept = 3
   equation: \( y = \frac{2}{3}x + 3 \)

113.
   slope = \( \frac{-3}{4} \)
   y-intercept = -2
   equation: \( y = -\frac{3}{4}x - 2 \)

114.
   slope = \( \frac{4}{1} = -4 \)
   y-intercept = 0
   equation: \( y = -4x + 0 \)
   \( \therefore y = -4x \)
For each line below, state the slope, y-intercept, and equation.

115. slope: $-\frac{1}{3}$  
y-intercept: $-3$  
equation: $y = -\frac{1}{3}x - 3$

116. slope: $\frac{3}{2}$  
y-intercept: $-4$  
equation: $y = \frac{3}{2}x - 4$

117. slope: $\frac{3}{1}$  
y-intercept: $0$  
equation: $y = 3x$

118. What do you notice about the equation of the lines passing through the origin?
There is no constant term (y-int).  
\[ y = mx \]

119. When is b positive? When the line crosses the y-axis above the x-axis.

120. When is b negative? When the line crosses the y-axis below the x-axis.

Graph the equations below by finding the slope and y-intercept from the equation.

121. $y = -3x$

122. $y = \frac{5}{2}x$

\[ y = \text{int} = 0 \]
Graph the equations below by finding the slope and y-intercept from the equation.

123. \( y = -x + 3 \)
   \[ m = -1 \]
   \[ y\text{-int} = 3 \]

124. \( \frac{3y}{4} = -10x + 12 \)
   \[ y = -5 + b \]
   \[ m = -5 \]
   \[ y\text{-int} = b \]

125. \( y - \frac{1}{3}x = 3 + 5 \)
   \[ y = \frac{1}{3}x + 2 \]
   \[ m = \frac{1}{3} \]
   \[ y\text{-int} = 2 \]

126. \( 2x - 5y + 20 = 0 \)
   \[ +5y \]
   \[ +5y \]
   \[ 2x + 20 = 5y \]
   \[ \frac{2x}{5} + 4 = y \]
   \[ m = \frac{2}{5} \]
   \[ y\text{-int} = 4 \]

127. \( \begin{align*}
12x &= (x - y) + 1 \\
\frac{12x}{2} &= 12 \\
6x &= 12 \\
6x - 3y &= 12 \\
\frac{4x - 12}{3} &= \frac{3y}{3} \\
\frac{4}{3}x - 4 &= y \\
m &= \frac{4}{3} \\
y\text{-int} &= -4
\end{align*} \)

128. \( \begin{align*}
(12x + 3) &= 8 \\
\frac{2x}{3} + \frac{3y}{4} &= -6 \\
8x + 9y &= -72 \\
\frac{12(12x + 3)}{4} &= 8 \\
\frac{2x + 3y}{3} &= -6 \\
8x + 9y &= -72 \\
\frac{y}{9} &= -8x - 72 \\
y &= \frac{-8}{9}x - 8 \\
x &= \frac{-8}{9} \\
y\text{-int} &= -8