Q: Does every line have a midpoint?

A: NO

Because lines have infinite lengths
But every line segment has a midpoint.

Suppose a line segment has endpoints \((x_1, y_1)\) and \((x_2, y_2)\)
Then the midpoint of this line segment is

\[
\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)
\]

Hawkes Practice:

Fill in the table blank with the following equation: \(10x - 8y = 16\).

\[
\begin{array}{c|cccc}
X & 8/5 & 0 & 2 & 28/5 \\
-8y & 0 & -2 & 1/2 & 5 \\
\end{array}
\]

(1) \(10x - 8(0) = 16\).
\[
10x = 16
\]
\[
x = \frac{16}{10} = \frac{8}{5}
\]

(2) \(10(0) - 8y = 16\).
\[
-8y = 16
\]
\[
y = -2
\]

(3) \(10(2) - 8y = 16\).
\[
20 - 8y = 16
\]
\[
-8y = -4
\]
\[
y = \frac{1}{2}
\]

(4) \(10x - 8(5) = 16\).
\[
10x - 40 = 16
\]
\[
10x = 56
\]
\[
x = \frac{56}{10} = \frac{28}{5}
\]
3.2 Linear Equations in 2 Variables.

Definition: Only has \( x \)'s or \( y \)'s and \( \# \), but no product of \( x \) or \( y \).

Standard Form: \( \) has to be the lowest (simplified) form.

(1) Hawkes Practice:

\[-3x + (y + x) = 3.\]

Simplify: \(-3x + y + x = 3\)

\[-2x + y = 3\] linear standard form.

(2) Hawkes Practice:

\[12x + 6x = 9y.\]

Not linear because \(6xy\) is not a linear term.

(3) Hawkes Practice:

\[-4y = 4\]

Simplify: \(-4y = 4\)

\[y = 1\]

\((0, x + 1, y = 1)\]

There is no \( x \)-intercept. But \( y \)-intercept is \((0, 1)\).

- **Horizontal Line**: equation only has \( y \)'s.
  
  Example: \((0, 3), (3, 3)\) → equation of this line is \( y = 2 \).
  
  Every point on this line has \( y \)-coordinate of 2.
  
  Other examples: \(3y = 17\), \(2y = -19\) etc.

- **Vertical Line**: equation only has \( x \)'s.
  
  Example: \((x, 1), (x, 1)\) → equation of this line is \( x = 7 \).
  
  Every point on this line has \( x \)-coordinate of 7.
  
  Other examples: \((x, 11), (17, -9)\) etc.
Slanted line: equation has both x's and y's. 2/3/20 Monday.

- Example:

Given equation: $2x + 3y = 6$

Plot this line:

1. Let $y = 0$ & solve → $2x + 3(0) = 6$ → $2x = 6$ → $x = 3$ \( (3,0) \)

2. Let $x = 0$ & solve → $2(0) + 3y = 6$ → $3y = 6$ → $y = 2$ \( (0,2) \)

Notice any slanted line will eventually intersect with both x- and y-axis.

- Is the point $(-3,4)$ on the line of $2x + 3y = 6$?

$2(-3) + 3(4) = -6 + 12 = 6 = 6$ So yes, $(-3,4)$ is on the line.