Two simple ways of determining the equation of a line are by <u>one point and the slope</u> or by a <u>pair of points</u>

<u>Point–Slope Form</u> of a line that has slope m and contains the point (x_1, y_1) has the equation:

$$y - y_1 = m(x - x_1) \quad \text{or} \quad y = m(x - x_1) + y_1$$

<u>Two–Point Form</u> of a line through points (x_1, y_1) and (x_2, y_2) where $x_1 \neq x_2$ has the equation:

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1) \quad \text{or} \quad y = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1) + y_1$$

<u>Vertical Line</u> with no slope or $m = \text{DNE}$ and contains the point (a, b) has the equation: $x = a$

<u>Horizontal Line</u> with a slope of zero or $m = 0$ and contains the point (a, b) has the equation: $y = b$

<u>Guided Practice</u>

2/92 Through $(5,3)$; $m = 4$ — one point and the slope implies using the point – slope form

$y = m(x - x_1) + y_1$ point – slope form

$y = 4(x - 5) + 3$

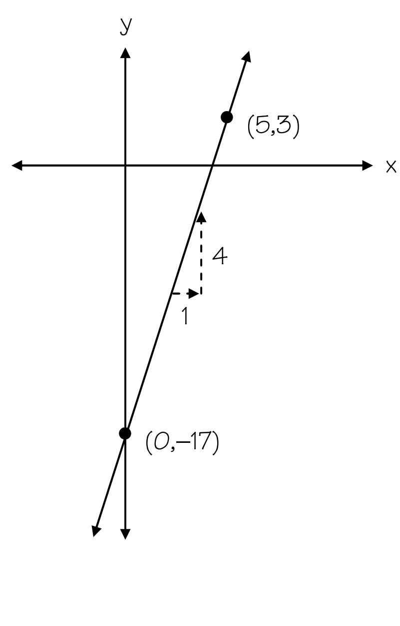
$y = 4x - 20 + 3$

$\boxed{y = 4x - 17}$ slope – intercept form

$17 = 4x - y$

$\boxed{4x - y = 17}$ standard form

$\boxed{4x - y - 17 = 0}$ general form



using the slope – intercept form of $y = 4x - 17$

$y = 4x + (-17)$

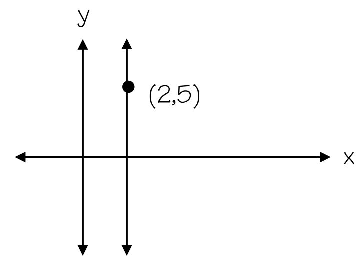
slope $m = 4 = \frac{4}{1} = \frac{\uparrow 4}{\rightarrow 1} = \frac{\text{rise of } 4}{\text{run of } 1}$

y-intercept of -17 or $(0, -17)$

Guided Practice

$\boxed{8/92}$ Through (2,5); no slope $\boxed{\text{no slope implies vertical line through given point}}$

vertical line through (2,5) yields an equation $\boxed{x=2}$



$\boxed{12/92}$ Through (2,1) and (−3,3) $\boxed{\text{two points implies using the two} - \text{point form}}$

$$y=\frac{y_2-y_1}{x_2-x_1}(x-x_1)+y_1 \quad \text{two}-\text{point form}$$

$$y=\frac{3-1}{-3-2}(x-2)+1$$

$$y=-\frac{2}{5}(x-2)+1$$

$$y=-\frac{2}{5}x+\frac{4}{5}+\frac{5}{5}$$

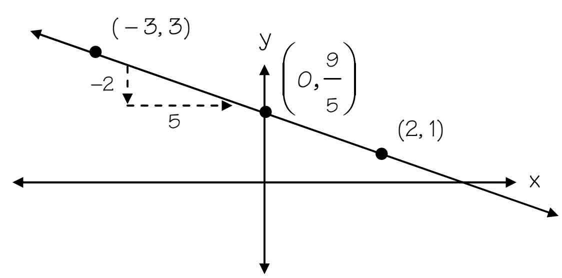
$$\boxed{y=-\frac{2}{5}x+\frac{9}{5}} \quad \text{slope}-\text{intercept form}$$

$$(5)[y]=\left[-\frac{2}{5}x+\frac{9}{5}\right](5)$$

$$5y=-2x+9$$

$$\boxed{2x+5y=9} \quad \text{standard form}$$

$$\boxed{2x+5y-9=0} \quad \text{general form}$$



using the slope−intercept form of $y=-\frac{2}{5}x+\frac{9}{5}$

$\boxed{\text{slope } m=-\frac{2}{5}=\frac{-2}{5}=\frac{\downarrow 2}{\rightarrow 1}=\frac{\text{rise of } -2}{\text{run of } 5}}$

$\boxed{\text{y-intercept of } \frac{9}{5} \text{ or } \left(0,\frac{9}{5}\right)}$

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Guided Practice

$\boxed{20/92}$ $l_1:\ x-5y+8=0,\ \ l_2:\ 4x-y-6=0,\ \ l_3:\ 3x+4y+5=0$

$\boxed{l_1 \text{ intersects } l_2}$

$$\begin{aligned} x-5y+8&=0\\ 4x-y-6&=0 \end{aligned}$$

$$\begin{aligned} x-5y+8&=0\\ [-5][4x-y-6]&=[0][-5] \end{aligned}$$

$$\begin{aligned} x-5y+8&=0\\ -20x+5y+30&=0 \end{aligned}$$

$$\begin{aligned} -19x+0y+38&=0\\ -19x&=-38\\ x&=\frac{-38}{-19}\\ x&=2 \end{aligned}$$

$$\begin{aligned} x-5y+8&=0\\ \text{at } x=2,\ \ 2-5y+8&=0\\ -5y+10&=0\\ -5y&=-10\\ y&=\frac{-10}{-5}\\ y&=2 \end{aligned}$$

$\boxed{(2,2)}$

$\boxed{l_2 \text{ intersects } l_3}$

$$\begin{aligned} 4x-y-6&=0\\ 3x+4y+5&=0 \end{aligned}$$

$$\begin{aligned} [4][4x-y-6]&=[0][4]\\ 3x+4y+5&=0 \end{aligned}$$

$$\begin{aligned} 16x-4y-24&=0\\ 3x+4y+5&=0 \end{aligned}$$

$$\begin{aligned} 19x+0y-19&=0\\ 19x&=19\\ x&=\frac{19}{19}\\ x&=1 \end{aligned}$$

$$\begin{aligned} 4x-y-6&=0\\ \text{at } x=1,\ \ 4x-y-6&=0\\ 4(1)-y-6&=0\\ -y&=2\\ y&=\frac{2}{-1}\\ y&=-2 \end{aligned}$$

$\boxed{(1,-2)}$

$\boxed{l_1 \text{ intersects } l_3}$

$$\begin{aligned} x-5y+8&=0\\ 3x+4y+5&=0 \end{aligned}$$

$$\begin{aligned} [-3][x-5y+8]&=[0][-3]\\ 3x+4y+5&=0 \end{aligned}$$

$$\begin{aligned} -3x+15y-24&=0\\ 3x+4y+5&=0 \end{aligned}$$

$$\begin{aligned} 0x+19y-19&=0\\ 19y&=19\\ y&=\frac{19}{19}\\ y&=1 \end{aligned}$$

$$\begin{aligned} x-5y+8&=0\\ \text{at } y=1,\ \ x-5(1)+8&=0\\ x-5+8&=0\\ x+3&=0\\ x&=-3 \end{aligned}$$

$\boxed{(-3,1)}$

$\boxed{26/92}$ $c_1:\ x^2+y^2+2x-19=0,\ \ c_2:\ x^2+y^2-10x-12y+41=0$

$\boxed{c_1 \text{ intersects } c_2}$

$$\begin{aligned} x^2+y^2+2x+0y-19&=0\\ x^2+y^2-10x-12y+41&=0 \end{aligned}$$

$$\begin{aligned} x^2+y^2+2x+0y-19&=0\\ [-1][x^2+y^2-10x-12y+41]&=[0][-1] \end{aligned}$$

$$\begin{aligned} x^2+y^2+2x+0y-19&=0\\ -x^2-y^2+10x+12y-41&=0 \end{aligned}$$

$$\begin{aligned} 12x+12y-60&=0\\ 12[x+y-5]&=0 \end{aligned}$$

$$\boxed{x+y-5=0}$$

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