

Linear Equations and Graphs (Part 2): Equation Forms

Section 1: Slope-intercept intro (KA link)

1. What is the y-intercept of $y = -6x + 4$?

For the y-intercept, the x-coordinate value is 0; the corresponding y-coordinate value is:

$$y = -6(0) + 4 = 4$$

y-intercept: (0, 4)

2. Write the equation of the line whose slope is -4 and the y-intercept is $(0, -5)$.

The general equation of a line in slope-intercept form is:

$$y = mx + b$$

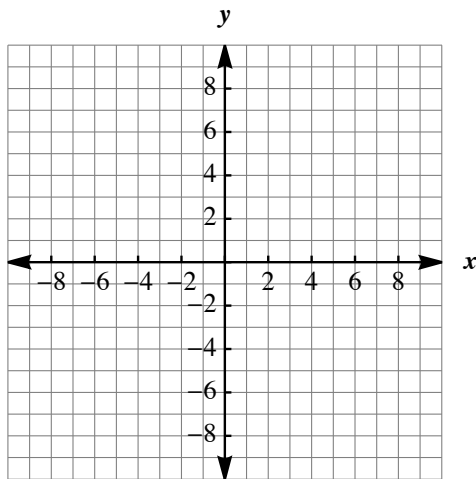
where m is the slope and b is the y-coordinate of the y-intercept point:

$$m = -4 \text{ and } b = -5$$

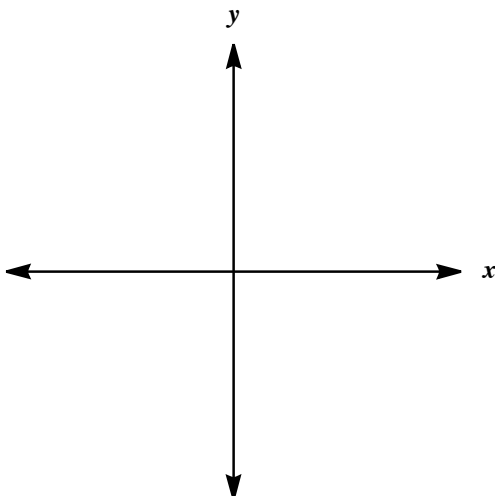
$$y = -4x + (-5) = -4x - 5$$

Section 2: Graph from slope-intercept form (KA link)

1. Graph $y = \frac{3}{5}x - 7$



2. [Challenge] Graph $y = mx + b$ where $m < 0$ and $b > 0$.



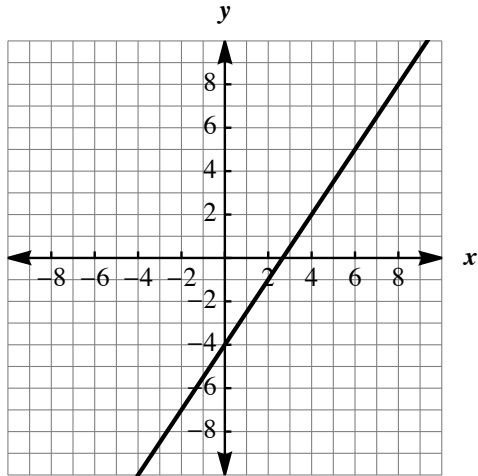
Section 3: Slope-intercept equation from graph (KA link)

1. Find the equation of the line in slope-intercept form. Use exact numbers.

$$b = -4$$

$$m = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-4)}{4 - 0} = \frac{6}{4} = \frac{3}{2}$$

$$y = \frac{3}{2}x + (-4) = \frac{3}{2}x - 4$$



Section 4: Slope-intercept from two points (KA video link)

1. Find the equation of the line with slope $-1/3$ through $(-3, 6)$ in slope-intercept form.

$$m = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{or} \quad y_2 - y_1 = m(x_2 - x_1)$$

$$y - y_1 = m(x - x_1)$$

$$y - 6 = -\frac{1}{3}(x - (-3))$$

$$y = -\frac{1}{3}x - 1 + 6$$

$$y = -\frac{1}{3}x + 5$$

2. [Challenge] Find the equation of the line with slope m through (x_1, y_1) in slope-intercept form.

$$m = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{or} \quad y_2 - y_1 = m(x_2 - x_1)$$

$$y - y_1 = m(x - x_1)$$

$$y = mx - mx_1 + y_1$$

$$y = mx - (mx_1 - y_1) \quad \text{or} \quad y = mx + (y_1 - mx_1)$$

Section 5: Slope-intercept from two points (KA link)

1. Find the equation of the line through $(-10, -4)$ and $(-3, 5)$ in slope-intercept form.

$$y - y_1 = m(x - x_1)$$

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1} (x - x_1)$$

$$y - (-4) = \frac{5 - (-4)}{-3 - (-10)} (x - (-10))$$

$$y + 4 = \frac{9}{7} (x + 10)$$

$$y = \frac{9}{7}x + \frac{90}{7} - \frac{28}{7}$$

$$y = \frac{9}{7}x + \frac{62}{7}$$

2. [Challenge] Find the equation of the line through $(-1/3, -1/2)$ and $(3/4, 4)$ in slope-intercept form.

$$y - y_1 = m(x - x_1)$$

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1} (x - x_1)$$

$$y - (-1/2) = \frac{4 - (-1/2)}{3/4 - (-1/3)} (x - (-1/3))$$

$$y + 1/2 = \frac{9/2}{13/12} (x + 1/3)$$

$$y = \frac{54}{13}x + \frac{54}{13} \cdot \frac{1}{3} - \frac{1}{2}$$

$$y = \frac{54}{13}x + \frac{23}{26}$$

Section 6: Point-slope form (KA link)

1. Find the equation of the line through $(10, -4)$ and $(-3, -5)$ in point-slope form.

$$m = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - (-4)}{-3 - 10} = \frac{-1}{-13} = \frac{1}{13}$$

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

$$y - (-4) = \frac{1}{13} (x - 10) \quad \text{or} \quad y - (-5) = \frac{1}{13} (x - (-3))$$

$$y + 4 = \frac{1}{13} (x - 10) \quad \text{or} \quad y + 5 = \frac{1}{13} (x + 3)$$

2. [Challenge] Find the equation of the line through $(1/3, -1/2)$ and $(-3/4, 4/3)$ in point-slope form.

$$m = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4/3 - (-1/2)}{-3/4 - 1/3} = -\frac{22}{13}$$

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

$$y - (-1/2) = -\frac{22}{13} (x - 1/3) \quad \text{or} \quad y - 4/3 = -\frac{22}{13} (x - (-3/4))$$

$$y + 1/2 = -\frac{22}{13} (x - 1/3) \quad \text{or} \quad y - 4/3 = -\frac{22}{13} (x + 3/4)$$