

## Equations of Lines

Slope-Intercept Form:

y-int.

$$\begin{aligned}y &= mx + b \\y + \cancel{b} &= 3(x - \cancel{5}) \\y + \cancel{b} &= 3x - 15 \\y &= 3x - 17\end{aligned}$$

Slope-Point Form:

$$m = 3 \quad (5, -2)$$

$$x_1 = 5$$

$$y_1 = -2$$

$$\begin{aligned}y - y_1 &= m(x - x_1) \\y - (-2) &= 3(x - 5) \\y + 2 &= 3(x - 5)\end{aligned}$$

General Form:

$$\begin{aligned}-3x + y + 17 &= 0 \\3x - y - 17 &= 0\end{aligned}$$

$$ax + by + c = 0$$

$$\begin{aligned}y &= 3x - 17 \\0 &= 3x - y - 17\end{aligned}$$

**Reminder!!!**

Whenever you see the words  
**Parallel & Perpendicular** think  
**Slope**

What is **Parallel** to  $\frac{2y}{2} = \frac{5x}{2} - 8$        $m = \frac{5}{2}$

$$y = \frac{\cancel{2}x}{\cancel{2}} - 4 \quad m_{||} = \frac{5}{2}$$

What is **Perpendicular** to  $3y + 1 = 2x - 5$

$$\begin{aligned} m &= \frac{2}{3} \\ m \perp &= -\frac{3}{2} \end{aligned} \qquad \begin{aligned} \frac{3y}{3} &= \frac{2x}{3} - \frac{6}{3} \\ y &= \left(\frac{2}{3}\right)x - 2 \end{aligned}$$

Find the equation of a line parallel to  $3y = 4x - 1$  and passing through the point  $(4, 2)$ .

① Find slope.

$$\frac{3y}{3} = \frac{4x-1}{3}$$

$$y = \frac{4}{3}x - \frac{1}{3}$$

$$m = \frac{4}{3}$$

$$m_{\parallel} = \frac{4}{3}$$

② Find point:

$(4, 2)$  Given

$$x_1 = 4$$

$$y_1 = 2$$

③ Find equation:

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

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

Slope-Point Form

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

$$y - 2 + 2 = \frac{4}{3}x - \frac{16}{3} + 2$$

$$y = \frac{4}{3}x - \frac{16}{3} + 2$$

$$y = \frac{4}{3}x - \frac{16}{3} + \frac{6}{3}$$

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

$$3 \cdot 0 = \frac{4}{3}x - 3 \cdot y - \frac{10}{3}$$

$$0 = 4x - 3y - 10$$

General form

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

Slope-Intercept form.

Determine the equation of a line perpendicular to  $4x + 5y = 7$  and having an x-intercept of -2.

① Find slope:

$$\begin{aligned} 4x + 5y &= 7 \\ \frac{5y}{5} &= -\frac{4x}{5} + \frac{7}{5} \\ y &= -\frac{4}{5}x + \frac{7}{5} \end{aligned}$$

$$m = -\frac{4}{5}$$

$$m_{\perp} = \frac{5}{4}$$

② Find point:

x-intercept is -2

$$(-2, 0)$$

$$x_1 = -2$$

$$y_1 = 0$$

③ Find equation:

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - 0 &= \frac{5}{4}(x - (-2)) \\ y - 0 &= \frac{5}{4}(x + 2) \end{aligned}$$

Slope-Point Form

$$y - 0 = \frac{5}{4}(x + 2)$$

$$y = \frac{5}{4}x + \frac{10}{4}$$

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

Slope-Intercept Form

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

$$4 \cdot 0 = \frac{4}{4}x - 4y + \frac{4}{2} \cdot 5$$

$$0 = 5x - 4y + 10$$

General Form

Determine the equation of a horizontal line with a y-intercept of -3

① Find slope:

$$m = \frac{0}{1}$$

$m = 0$  (horizontal)

② Find point:

$$(0, -3)$$

$$x_1 = 0$$

$$y_1 = -3$$

③ Find equation:

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

$$y - (-3) = 0(x - 0)$$

$$y + 3 = 0(x - 0)$$

Slope-Point Form

$$y + 3 = 0(x - 0)$$

$$y + 3 = 0x$$

$$y = 0x - 3$$

$$\boxed{y = -3}$$

Slope-Intercept form

$$y = -3$$

$$\boxed{y + 3 = 0}$$

general form

$$y = mx + b \quad (\text{Slope Intercept form})$$

$$ax + by + c = 0 \quad (\text{General form})$$

Ex:  $4x + 5y - 10 = 0$  (General form)

$$\frac{5y}{5} = -\frac{4x}{5} + \frac{10}{5}$$

$$y = -\frac{4}{5}x + 2 \quad (\text{Slope Intercept form})$$


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Ex.  $y = \frac{2}{3}x - 7$  (Slope Intercept form)

$$0 = \frac{3}{3}x - \frac{3}{1}y - \frac{21}{1}$$
Common denominator = 3

$$0 = 3x - 3y - 21 \quad (\text{General form})$$



Check out the sheet.

# Questions from Homework

Equations of lines .... Kicking it up a notch!! ☺

1. Determine the equation of a line...
  - a) Parallel to  $5y=10-3x$  and passing through  $(-2, 7)$ . (State your answer in slope-point form.)
  - b) Perpendicular to  $6x = 3y + 9$  and having an x-intercept of 7. (State your answer in general form.)
  - c) Passing through the points  $(-3, 8)$  and  $(5, 2)$ . (State your answer in general form.)
  - d) Having an x-intercept of 4 and a y-intercept of -2. (slope-point form please)
  - e) Perpendicular to the y-axis and having a y-intercept of 3. (general form please)
  
2. a) The equation  $4x + 3y + 10 = 0$  is in general form, rearrange it so it is in slope-intercept form.  
 b) The equation  $y - 8 = \frac{3}{5}(x - 11)$  is in slope-point form, rearrange it so it is in slope-intercept form.

3.

The graph shows a line passing through the points  $(-4, 7)$  and  $(-2, 0)$ . The line has a negative slope. A red circle highlights the point  $(-2, 0)$ .

a) Determine the equation of the indicated line.  
 (general form please)  
 Hint: Keep an eye on the values of the axes.

$x_1, y_1, x_2, y_2$

$(-4, 7) + (-2, 0)$

(i) Slope

$$m = \frac{0-7}{-2-(-4)}$$

$$m = \frac{-7}{2}$$

(ii) Point

$$(-4, 7)$$

$$x_1 = -4$$

$$y_1 = 7$$

(iii) Equation:

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

$$y - 7 = -\frac{7}{2}(x - (-4))$$

$$y - 7 = -\frac{7}{2}(x + 4)$$

$$\therefore y - 7 = -\frac{7}{2}x - \frac{28}{2}$$

$$2y - 14 = -7x - 28$$

$$7x + 2y - 14 + 28 = 0$$

$$\boxed{7x + 2y + 14 = 0}$$

① a) Determine the equation of a line Parallel to  
 $y = 10 - 3x$  and passing through  $(-2, 7)$

② Find Point  $x_1 = -2$   
 $y_1 = 7$

① Determine Slope

$$y = 10 - 3x$$

$$\frac{y}{5} = \frac{-3x + 10}{5}$$

$$y = -\frac{3}{5}x + 2$$

$$m = -\frac{3}{5}$$

$$m \parallel = -\frac{3}{5}$$

③ Determine equation

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

$$y - 7 = \frac{-3}{5}(x - (-2))$$

$$y - 7 = \frac{-3}{5}(x + 2)$$

$$y - 7 = -\frac{3}{5}x - \frac{6}{5}$$

$$y = -\frac{3}{5}x - \frac{6}{5} + \frac{7}{1}$$

$$y = -\frac{3}{5}x - \frac{6}{5} + \frac{35}{5}$$

(Slope Intercept)

$$y = -\frac{3}{5}x + \frac{29}{5}$$

$$\frac{3}{5}x + y - \frac{29}{5} = 0 \quad D = 5$$

(General form)  $3x + 5y - 29 = 0$

Determine the equation of a line . . .

- ① b) Perpendicular to  $6x = 3y + 9$  and have  
an x-intercept of 7 (Answer in general form)

① Find Slope:    (ii) Find Point    (iii) Find equation

$$\cancel{6x} = \cancel{3y} + 9$$

$$-\frac{3y}{-3} = -\frac{6x}{-3} + \frac{9}{-3}$$

$$y = 2x - 3$$

$$m = 2$$

$$m_{\perp} = -\frac{1}{2}$$

$$\text{x-intercept} = 7$$

$$(7, 0)$$

$$x_1 = 7$$

$$y_1 = 0$$

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

$$y - 0 = -\frac{1}{2}(x - 7)$$

$$y = -\frac{1}{2}x + \frac{7}{2}$$

$$2y = -1x + 7$$

$$x + 2y - 7 = 0$$

Determine the equation of a line . . .

- ① c) Passing through the points  $(x_1, y_1)$ ,  $(x_2, y_2)$   
 (Answer in general form)

(i) Find slope

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{2 - 8}{5 - (-3)}$$

$$m = \frac{-6}{8} = \frac{-3}{4}$$

(ii) Point

$$(-3, 8)$$

$$x_1 = -3$$

$$y_1 = 8$$

(iii) Find equation:

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

$$y - 8 = -\frac{3}{4}(x - (-3))$$

$$y - 8 = -\frac{3}{4}(x + 3)$$

$$\begin{aligned} 4(y - 8) &= 4(-\frac{3}{4}x - \frac{9}{4}) \\ 4y - 32 &= -3x - 9 \end{aligned}$$

$$3x + 4y - 32 + 9 = 0$$

$$\boxed{3x + 4y - 23 = 0}$$

Determine the equation of a line . . .

- ① d) Having an x-intercept of 4 and a y-intercept of -2  
 (Answer in Slope Point form)

(i) Find slope:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$x_2 - x_1$$

$$m = \frac{-2 - 0}{0 - 4}$$

$$m = \frac{-2}{-4} = \frac{1}{2}$$

(ii) Point:

$$(4, 0)$$

$$x_1 = 4$$

$$y_1 = 0$$

(iii) Equation:

$$\boxed{y - y_1 = m(x - x_1)}$$

$$\boxed{y - 0 = \frac{1}{2}(x - 4)}$$

$$(4, 0)$$

$$(0, -2)$$

Determine the equation of a line . . .

① Is Perpendicular to the y-axis and having a y-intercept of 3 (Answer in general form)

(i) Slope:

$$\text{Slope of } y\text{-axis} = \frac{1}{0}$$

$$m = \frac{1}{0}$$

$$m_1 = \frac{0}{-1} = \textcircled{0}$$

(ii) Point:

$$y\text{-intercept} = 3$$

$$(0, 3)$$

$$x_1 = 0$$

$$y_1 = 3$$

(iii) Equation:

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

$$y - 3 = 0(x - 0)$$

$$\boxed{y - 3 = 0}$$

② a)  $4x + 3y + 10 = 0$  (General form)

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

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

(Slope Intercept form)

$$m = -\frac{4}{3} \text{ (slope)}$$

$$b = -\frac{10}{3} \text{ (y-intercept)}$$

② b)  $y - 8 = \frac{3}{5}(x - 11)$  (Slope-Point Form)

$$y - 8 = \frac{3}{5}x - \frac{33}{5}$$

$$\begin{aligned} y &= \frac{3}{5}x - \frac{33}{5} + \frac{8}{1} \\ y &= \frac{3}{5}x - \frac{33}{5} + \frac{40}{5} \end{aligned} \quad \text{(get a common denominator)}$$

$$y = \frac{3}{5}x + \frac{7}{5}$$

(Slope Intercept Form)

$$m = \frac{3}{5}$$

$$\therefore b = \frac{7}{5}$$