10 - Equations of lines in THREE FORMS...continued...

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10) equations of lines in three forms...continued...

Remember! What are the three different equations of lines?

① Point-Slope form: $y - y_1 = m(x - x_1)$ where (x_1, y_1) point↗

② Slope-Intercept form: $y = mx + b$

③ General form: $Ax \pm By \pm C = 0$

Example 1: Write the following equations in general form.

Remember: General form means NO __Fractions__ or __decimals (integers only)__.

The __x coefficient__ ALWAYS has to be ⊕ __Positive__.

Order matters! Always write in this order: __x__ ± __y__ ± C = 0

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

$+9x \qquad +9x$

$+2 = -2y + 5 \quad +9x$
$-2 \qquad -2$

$\boxed{0 = 9x - 2y + 3}$

b) $\left(\dfrac{3}{?}y - 4 = 5x - 10\right)$ ×4

$+3y - 16 = 20x - 40$
$-3y \qquad -3y$

$-16 = 20x - 40 + 3y$
$+16 \qquad\qquad +16$

$\boxed{0 = 20x - 3y - 24}$

c) $\left(1 = \dfrac{-2}{5}x + \dfrac{1}{2}y\right)$ ×10

$10 = \dfrac{-20}{5}x + \dfrac{10}{2}y$

$10 = -4x + 5y$
$+4x \quad +4x$

$10 + 4x = +5y$
$\qquad -5y \quad -5y$

$\boxed{4x - 5y + 10 = 0}$

Example 2: Write the equation of the line in all three forms.

a) $m = -3 \qquad (5, 2)$ (x, y)

① Point-Slope Form:

$y - 2 = -3(x - 5)$

② Slope-intercept form:

$y - 2 = -3(x - 5)$

$y - 2 = -3x + 15$
$+2 \qquad\qquad +2$

$\boxed{y = -3x + 17}$ y-int = 17

③ General Form:

$y = -3x + 17$
$+3x \quad +3x - 17$
-17

$\boxed{3x + y - 17 = 0}$ rearrange

b) $m = -\dfrac{2}{5} \qquad (6, -1)$

① Point Slope form:

$y - (-1) = -\dfrac{2}{5}(x - 6)$

$\boxed{y + 1 = -\dfrac{2}{5}(x - 6)}$

② Slope-Intercept form:

$\left(y + 1 = -\dfrac{2}{5}(x - 6)\right)$ ×5

$5y + 5 = -2(x - 6)$
$5y + 5 = -2x + 12$
$5y = -2x + 7$
$\dfrac{5y}{5} = \dfrac{-2x + 7}{5}$

$\boxed{y = \dfrac{-2}{5}x + \dfrac{7}{5}}$

③ General Form:

$\left(5y = \dfrac{-2}{5}x + \dfrac{7}{5}\right)$ ×5

$\boxed{2x + 5y - 7 = 0}$

Example 3: Write the equation of the line, in general form, that has the points (8, -2) and (6, 3).

$x_1\ y_1\quad x_2\ y_2$

slope = ?

① Find the slope: $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{3-(-2)}{6-8} = \dfrac{5}{-2} = \boxed{-\dfrac{5}{2}}$

② if $m = -\dfrac{5}{2}$ and $(8,-2),(6,3)$ are on the the line. choose a coordinate and use slope-point form.

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

$y - (-2) = \dfrac{-5}{2}(x - 8)$

$\boxed{y + 2 = \dfrac{-5}{2}(x-8)}\ \times 2$

$2y + 4 = -5(x-8)$

$2y + 4 = -5x + 40$

$+5x \qquad\qquad +5x$

$5x + 2y + 4 = 40$
$\qquad\qquad -40\ -40$

$\boxed{5x + 2y - 36 = 0}$

Example 4: Write the equation of the line, in slope intercept form, that has the points (9, 5) and (-6, 4).

$x_1\ y_1\quad x_2\ y_2$

① Find slope: $m = \dfrac{4-5}{-6-9} = \dfrac{-1}{-15} = \boxed{\dfrac{1}{15}}$

y-int: $(0, y_2)$

② Point-Slope Form

$y - 5 = \dfrac{1}{15}(x - 9)$

$y - 5 = \dfrac{1}{15}x - \dfrac{9}{15}$

$+5 \qquad\qquad +5$

$y = \dfrac{1}{15}x - \dfrac{9}{15} + 5$

$y = \dfrac{1}{15}x - \dfrac{9}{15} - \dfrac{75}{15}$

$\boxed{y = \dfrac{1}{15}x - \dfrac{66}{15}}$

② Solve for y-int ⟹ slope int. form.

$\dfrac{1}{15} = \dfrac{y_2 - 5}{0 - 9}$

$\dfrac{1}{15} = \dfrac{y-5}{-9}$

$1 \times (-9) = 15(y-5)$

$-9 = 15y - 75$

$+75 \qquad +75$

$\dfrac{66}{15} = \dfrac{15y}{15}$

$y = \dfrac{66}{15} = 4.4 = \text{``b''}$

$y = mx + b$

$\boxed{y = \dfrac{1}{15}x + \dfrac{22}{5}}$

$\dfrac{22}{5}$

Example 5: Write the equation of the line, in general form, that has the points (-0.9, 0.2) and (-0.1, -0.8).

① Find Slope $m = \dfrac{-0.8 - 0.2}{-0.1 - (-0.9)} = \dfrac{-1}{0.8} = -1.25$

② $m = -1.25$ and point $(-0.9, 0.2)$

$y - 0.2 = -1.25(x - (-0.9))$

$\left(y - 0.2 = -1.25x - 1.125\right) \times 1000$

$1000y - 200 = -1250x - 1125$

$+1250x \quad +1125 \qquad +1250x\ +1125$

$\therefore 1250x + 1000y + 925 = 0$

$0.2 = \dfrac{2}{10}$

$1.25 = 1\dfrac{25}{100}$ ×1000

$1.125 = 1\dfrac{125}{1000}$

÷25 can simplify.

$\boxed{50x + 40y + 37 = 0}$

Homework

assignment #10
pages #36-38 questions #157-165

157. **Challenge #7:**

Write the equation of a line in general form given that the line passes through (3,4) and (4,6).

Given two points:

When given two points we must first find the slope of the line. Then we will follow the same process as above.

Write the equation of the line that passes through (3,4) and (4,6).

$m = \frac{y_2 - y_1}{x_2 - x_1}$	Find the slope.
$m = \frac{6-4}{4-3} = \frac{2}{1} = 2$	The slope is 2.
$2 = \frac{y-4}{x-3}$	Substitute slope and **ONE** of the points.
$2(x-3) = y - 4$	Cross-multiply. **Point-slope form**
$2x - 6 = y - 4$	Expand and simplify.
$2x - y - 2 = 0$	Write in general form.
$y = 2x - 2$	And in slope-intercept form if necessary.

Write the equation of the line that passes through the following two points in general form.

158. (3,4) and (4,6)	Explain your reasoning
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159. (-2, -4) and (0, 6)   Explain your reasoning

Write the equation of the line that passes through the following two points in general form.

160. (-5, -8) and (-7, -9)	161. (-1, -2) and (3,0)	162. (0,4) and (5, 0)
163. (8, -7) and (-6, -7)	164. $\left(\frac{2}{3}, \frac{1}{4}\right)$ and $\left(\frac{1}{3}, \frac{1}{3}\right)$	165. (0.3, 0.4) and (0.5, 0.7)