Worksheet 3 October 9, 2017 General equation of a line $y = mx + b$

$m =$ slope

$b =$ y-intercept.

1. $y = 4x + 1$.

a) slope: $m = 4$

b) Lines that are parallel must have the same slope, so $m = 4$.

c) Lines that are perpendicular have negative reciprocal slope, $-\frac{1}{m}$, so the slope is $-\frac{1}{4}$.

2. $P(-7, 1)$, $Q(4, -2)$.

Slope formula: $\frac{\text{Change in } y}{\text{Change in } x} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$. $P(-7, 1) = (x_1, y_1)$, $Q(4, -2) = (x_2, y_2)$

$\Rightarrow m = \frac{-2-1}{4-(-7)} = \frac{-3}{4+7} = \frac{-3}{11}$.

So, $y = mx + b = -\frac{3}{11}x + b$. Now solve for b, the y-intercept.

Substitute one of the points in to the equation and solve for b; let's sub in $Q(4, -2)$

$\Rightarrow -2 = -\frac{3}{11}(4) + b \Rightarrow -2 = -\frac{12}{11} + b \Rightarrow b = -2 + \frac{12}{11} \Rightarrow b = \frac{-22}{11} + \frac{12}{11} = \frac{-10}{11}$

So, $y = -\frac{3}{11}x + \frac{10}{11}$.

3. Slope: 10, y-intercept: $-5 \Rightarrow y = 10x - 5$.

4. Slope $= m = \frac{2}{3}$. Through $(3, 5) \Rightarrow y = mx + b \Rightarrow y = \frac{2}{3}x + b$. Substitute the point in and solve for b.

$5 = \frac{2}{3}(3) + b \Rightarrow 5 = 2 + b \Rightarrow b = 3$. So the line is $y = \frac{2}{3}x + 3$.

5. through $(-1, -3)$ and $(6, 4)$.

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-3-4}{-1-6} = \frac{-7}{-7} = 1 \Rightarrow y = x + b$. Now substitute in any point we are given.

$4 = 6 + b \Rightarrow b = 4 - 6 = -2$. So the equation of the line is $y = x - 2$.

6. x intercept $= 1 \Rightarrow$ Point $(1, 0)$. y-intercept $= -6 \Rightarrow (0, -6)$.

slope $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-6-0}{0-1} = \frac{-6}{-1} = 6$. $\Rightarrow y = 6x + b$. From the y-intercept $(0, -6) \Rightarrow b = -6$.

$\Rightarrow -6 = 0 + b \Rightarrow b = -6$.

So $y = 6x - 6$.

7. Through $(1,3)$ and parallel to line $y = 4x - 8$

Parallel means same slope. So $m = 4$ is the slope of the line we want.
Thus, $y = 4x + b$. Now we substitute the given point in.

$3 = 4(1) + b \Rightarrow b = 3 - 4 = -1$. So, $y = 4x - 1$ is our line.

8. Through $(-3,5)$, perpendicular to $y = -\frac{1}{3}x + 1$.

Perpendicular means we need to take the negative reciprocal of the slope.

Thus, $m = \frac{-1}{(-\frac{1}{3})} = 3$. So, $y = 3x + b$. Now substitute our supplied point in,

$5 = 3(-3) + b \Rightarrow 5 = -9 + b \Rightarrow b = 9 + 5 = 14$. Therefore, $y = 3x + 14$.

9. Through $(4,8)$, parallel to line passing through $(5,6)$ and $(1,2)$

We need to find the slope of the first line to find the parallel slope.

$(x_1, y_1) = (5,6)$; $(x_2, y_2) = (1,2) \Rightarrow m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2-6}{1-5} = \frac{-4}{-4} = 1$.

So, $y = x + b$. Now sub in the point it must pass through

$8 = 4 + b \Rightarrow b = 4$. Thus, the line is $y = x + 4$.

10. Chirping rate related to temperature, 120 chirps/minute at $70°F$
168 chirps/minute at $80°F$

So, chirps are a function of temperature! Temperature is the independent variable, and chirps per minute is the dependent variable.

Thus we have points: $(70, 120)$, $(80, 168)$.

a) Find linear equation: $n = mt + b$. $m = \frac{n_2 - n_1}{t_2 - t_1} = \frac{168 - 120}{80 - 70} = \frac{48}{10} = \frac{24}{5} = 4.8$

$b = n - mt \Rightarrow b = 120 - \frac{48}{10}(70) = -216$

$\Rightarrow n = 4.8t - 216$ is the equation.

b) Chirping at 150 chirps/minute $\Rightarrow$ $150 = 4.8t - 216$. Solve for t

$4.8t = 150 + 216 = 366 \Rightarrow t = \frac{366}{4.8} = 76.25\,°F \approx 76\,°F$ rounded to the nearest degree.