Name: _____ **Algebra II**
Date: **Homework 1**

Problem 1. Find the equation of the line passing through the point $(1, 1)$ and perpendicular to the line $2x + 3y = 5$.

We need a line in the form $y = mx + b$. Since the given line can be written as $y = -\frac{2}{3}x + \frac{5}{3}$ and our line is to be perpendicular to it, then our slope must be

$$m = \frac{-1}{-\frac{2}{3}} = (-1)\frac{-3}{2} = \frac{3}{2}$$

Then our line can be written as $y = \frac{3}{2}x + b$. All that remains is to find b. But we know that when we plug in a 1, we get out a 1. That is, when $x = 1$, we must have $y = 1$. So plugging this in to our equation $y = \frac{3}{2}x + b$ gives us

$$\begin{aligned} 1 &= \frac{3}{2}(1) + b \\ 1 &= \frac{3}{2} + b \\ 1 - \frac{3}{2} &= b \\ \frac{2}{2} - \frac{3}{2} &= b \\ -\frac{1}{2} &= b \end{aligned}$$

Therefore, the equation we want is $y = \frac{3}{2}x - \frac{1}{2}$.

Problem 2. Find the equation of the line passing through the point $(2, 3)$ and perpendicular to the line $y = -2x + 3$.

Using the same reasoning as above, in our equation $y = mx + b$ we must have

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

Then $y = \frac{1}{2}x + b$ must pass through $(2, 3)$ giving us

$$\begin{aligned} 3 &= \frac{1}{2}(2) + b \\ 3 &= \frac{2}{2} + b \\ 3 &= 1 + b \\ 3 - 1 &= b \\ 2 &= b \end{aligned}$$

So the line we want is $y = \frac{1}{2}x + 2$.

Problem 3. Find the equation of the line passing through the point $(3, 4)$ and perpendicular to the line $7x - 2y = 1$.

The given line can be written as $y = \frac{7}{2}x - 1$. Using the same reasoning as above, in our equation $y = mx + b$ we must have

$$m = \frac{-1}{\frac{7}{2}} = -\frac{2}{7}$$

Then $y = -\frac{2}{7}x + b$ must pass through $(3, 4)$ giving us

$$4 = -\frac{2}{7}(3) + b$$
$$4 = -\frac{6}{7} + b$$
$$4 + \frac{6}{7} = b$$
$$(4)\frac{7}{7} + \frac{6}{7} = b$$
$$\frac{4 * 7}{7} + \frac{6}{7} = b$$
$$\frac{28}{7} + \frac{6}{7} = b$$
$$\frac{34}{7} = b$$

So the line we want is $y = -\frac{2}{7}x + \frac{34}{7}$.