Writing Equations in Point – Slope Form

You can write an equation of a line if you know its slope and the coordinates of one point on the line.
Let us derive the rule starting from the definition of the slope

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

$$\frac{y - y_1}{x - x_1} = m \qquad \textit{multiply both sides by } (x - x_1)$$

$$\Rightarrow \left(\frac{y - y_1}{x - x_1}\right)(x - x_1) = m(x - x_1) \qquad \textit{simplify}$$

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

This equation is in the point – slope form.

Definition 1: Point/Slope Form: For a non-vertical line passing through the point (x_1, y_1) with slope m, the point-slope form of a linear equation is $(y - y_1) = m(x - x_1)$.

Example 1 : Find the equation of the line passing through (1, 7) and has a slope of -2 .Write the equation in slope/intercept form.

$$(y - y_1) = m(x - x_1)$$
$$y - 7 = -2(x - 1)$$
$$y - 7 = -2x + 2$$
$$y - 7 + 7 = -2x + 2 + 7$$
$$y = -2x + 9$$

The equation of the line that passes through (1, 7) and has a slope of -2 is $y = -2x + 9$.

Rule 1 Finding the equation of a line given two points:
Step 1: Find the slope of the line connecting the two points.
Step 2: Substitute the first given point and the slope into the point-slope formula.
Step 3: Rewrite this equation into standard form.

Rule 2 : The horizontal line passing through the point A(a,b) has an equation of y=b

Rule 3 : The vertical line passing through the point A(a,b) has an equation of x=a