Algebra Review — Bard College

Equations for Lines

1. **Vertical and Horizontal Lines:** The equation for a vertical line is of the form $x = a$ where a is a constant. The equation for a horizontal line is of the form $y = a$ where a is a constant.

   Example: Find the equation for the line through the points $(3, 2)$ and $(3, 7)$.

   Answer: The x-coordinate of both points is 3, so the equation for the line is $\boxed{x = 3}$

   Example: Find the equation for the line through the points $(1, 4)$ and $(2, 4)$.

   Answer: The y-coordinate for both points is 4, so the equation for the line is $\boxed{y = 4}$.

2. **Slope:** The slope of the line through the points (x_1, y_1) and (x_2, y_2) is

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

   Example: Find the slope of the line that contains the points $(2, 1)$ and $(5, 3)$.

   Answer: The slope is $m = \dfrac{3-1}{5-2} = \boxed{\dfrac{2}{3}}$

3. **Equation for line:** The *point-slope* form for the equation of a line with slope m through the point (x_0, y_0) is:

$$y = m(x - x_0) + y_0$$

   Example: Find the equation for the line through the points $(1, 4)$ and $(3, 8)$.

   Answer: First, we find the slope of the line:

$$m = \frac{8-4}{3-1} = \frac{4}{2} = 2$$

   Using the point-slope form, the equation for the line is

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

Exercises:

1. Find the equation for the line with slope 5 through the point $(3, 7)$.

2. Find the equation for the line with slope 2 through the point $(-1, 4)$.

3. Find the slope of the line through the given points:

   (a) $(2, 3)$ and $(4, 9)$

   (b) $(-1, 3)$ and $(3, -5)$

4. Find the equation for the line through the given points:

   (a) $(-1, -3)$ and $(1, 5)$

   (b) $(-5, 8)$ and $(1, -4)$

   (c) $(-1, 3)$ and $(-1, 8)$

Answers: (1) $y = 5(x - 3) + 7$ (2) $y = 2(x + 1) + 4$ (3) (a) 3 (b) -2
(4) (a) $y = 4(x + 1) - 3$ (b) $y = -2(x + 5) + 8$ (c) $x = -1$