

Section A.3

Objectives

- find slope of line
- point slope form
- perpendicular / parallel lines

Examples

1) line passes through $(0,1)$, has slope 2.

Set slope $= m = 2$, $x_1 = 0$, $y_1 = 1$

point slope form: $y - y_1 = m(x - x_1)$

$$y - 1 = 2(x - 0)$$

$$y - 1 = 2x$$

$$y = 2x + 1$$

2) line passes through $(0,1)$, $(2,3)$.

Set $x_1 = 0$, $x_2 = 2$, $y_1 = 1$, $y_2 = 3$

$$\text{slope: } m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 1}{2 - 0} = \frac{2}{2} = 1.$$

point slope form: $y - y_1 = m(x - x_1)$

$$y - 1 = 1(x - 0)$$

$$y = x + 1$$

3) Find equation for following line:

x	0	1	2
y	5	8	11

We choose two points: $(0,5)$, $(1,8)$. Set $x_1 = 0$, $x_2 = 1$, $y_1 = 5$, $y_2 = 8$.

$$\text{Find slope: } m = \frac{8 - 5}{1 - 0} = \frac{3}{1} = 3$$

Point slope form: $y - y_1 = m(x - x_1)$

$$y - 5 = 3(x - 0)$$

$$y - 5 = 3x$$

$$y = 3x + 5$$

1) Determine which function can be a linear function and find its equation.

x	0	1	2
$f(x)$	2	4	6
$g(x)$	3	3	4

Can be a line only if slope is constant.

$f(x)$:

$$\text{slope from } (0,2) \text{ to } (1,4): \frac{4-2}{1-0} = \frac{2}{1} = 2$$

$$\text{" " } (1,4) \text{ to } (2,6): \frac{6-4}{2-1} = \frac{2}{1} = 2$$

Slope same for each pair $\rightarrow$ can be a linear function

$$g(x): \text{slope from } (0,3) \text{ to } (1,3): \frac{3-3}{1-0} = \frac{0}{1} = 0$$

$$\text{" " } (1,3) \text{ to } (2,4): \frac{4-3}{2-1} = \frac{1}{1} = 1$$

But $0 \neq 1$, so $g(x)$ does not have constant slope $\rightarrow$ not a line.

Parallel lines:

$$y = mx + b \text{ and } y = nx + c \text{ parallel} \iff m = n.$$

Problem

1) Find line through $(0,1)$ and parallel to $6x - 3y = 3$.

$$6x - 3y = 3 \rightarrow -3y = 3 - 6x \rightarrow 3y = -3 + 6x \rightarrow y = -1 + 2x.$$

$$y = -1 + 2x \text{ has slope } = 2.$$

Want line through $(0,1)$ and slope $= 2$.

Point slope form: $y - y_1 = m(x - x_1)$

$$y - 1 = 2(x - 0)$$

$$y - 1 = 2x$$

$$y = 2x + 1.$$

Perpendicular lines:

$$y = mx + b \text{ and } y = nx + c \text{ perpendicular} \leftrightarrow m = -\frac{1}{n}$$

Problem

1) Find line perpendicular to $y = 2x + 1$, and with y-intercept $(0, 2)$.

$y = 2x + 1$ has slope 2 $\rightarrow$ our line has slope $-\frac{1}{2}$.

Find line passing $(0, 2)$ w/ slope $-\frac{1}{2}$:

point slope form: $y - y_1 = m(x - x_1)$

$$y - 2 = -\frac{1}{2}(x - 0)$$

$$y - 2 = -\frac{1}{2}x$$

$$y = -\frac{1}{2}x + 2.$$