

P.2 Linear Models and Rates of Change

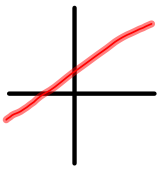
Slope = rise over run

$$= \frac{\text{change in } y}{\text{change in } x}$$

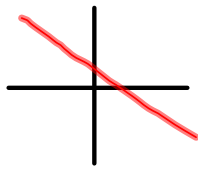
$$= \frac{\Delta y}{\Delta x} = \frac{dy}{dx}$$

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

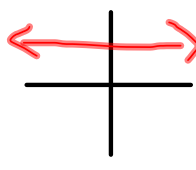
positive m



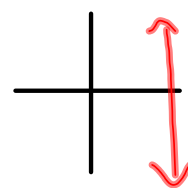
negative m



zero m



no slope



Slope-intercept equation: $y = mx + b$

ex1) Write the eqn of the line through $(-2,3)$ & $(4,7)$

$m = \frac{2}{3}$

$y = \frac{2}{3}x + b$

$7 = \frac{2}{3}(4) + b$

$7 = \frac{8}{3} + b$

$7 - \frac{8}{3} = b$

$b = \frac{2}{3} - \frac{8}{3} = -\frac{6}{3} = -2$

$y = \frac{2}{3}x + \frac{13}{3}$

Point-Slope eqn: $y - y_1 = m(x - x_1)$

2) Write the eqn of the line with slope $\frac{1}{2}$ and point $(4,8)$

$y - 8 = \frac{1}{2}(x - 4)$

$y - 8 = \frac{1}{2}x - 2$

$y = \frac{1}{2}x + 6$

Summary of Line Equations:

1. General Form $Ax + By + C = 0$
2. Vertical Line $x = a$
3. Horizontal Line $y = b$
4. Point-Slope Form $y - y_1 = m(x - x_1)$
5. Slope-Int. Form $y = mx + b$

Parallel Lines

- have the same slope
- never intersect
- distance between them is constant

Perpendicular Lines

- slopes are negative reciprocals (if $m_1 = a/b$, then $m_2 = -b/a$)
- intersect at right angles
- $m_1 \cdot m_2 = -1$

ex3) Write an eqn parallel to $2x - 4y = 7$ and passes through the point $(-1, 4)$

Handwritten work for ex3):

$$y = \frac{1}{2}x + \frac{1}{4}$$

$$y = \frac{1}{2}x + b$$

$$4 = \frac{1}{2}(-1) + b$$

$$4 = -\frac{1}{2} + b$$

$$b = 4.5$$

4) Write an eqn perpendicular to $5x + 2y = 8$ and passes through the point $(1, -2)$

Handwritten work for 4):

$$2y = -5x + 8$$

$$y = -\frac{5}{2}x + 4$$

$$y = \frac{2}{5}x - \frac{12}{5}$$

HW: p 17, # 1-8, 18, 22, 30, 44-48, 69-72, 76