

# Lines

2.2

# Slope

The **slope** of a line is the ratio of vertical change (rise) to horizontal change (run).

Through any two points  $(x,y)$  and  $(x',y')$  on a line, the slope “m” is given by

$$m = (y - y') / (x - x')$$

Note: Vertical lines have no change in run,  $x - x' = 0$ , which results in dividing by 0.

We refer to vertical lines as having an undefined slope.

Find the slope between the two points.

- EX:  $(5, -2)$  and  $(3, 8)$
- EX:  $(0, 3)$  and  $(6, 3)$
- EX:  $(-18, 4)$  and  $(-18, 335)$

# Forms of Lines

- Slope Intercept :  $y = mx + b$   
m is the slope of the line; (0,b) is the y-intercept.
- Point-Slope:  $y - y_1 = m(x - x_1)$  ; given one point and a slope.
- Horizontal Line: Slope of “0”, flat line. Satisfies  $y = 0x + b$ . **Y = b.**
- Vertical Line: Undefined slope, cannot use slope intercept form. **X = a.** A vertical line may not have a y-intercept.

# Forms of Lines

- General Form :  $Ax + By + C = 0$ ; A and B are not both 0.
- Standard Form :  $Ax + By = C$  ; A and B are integers and A must be positive. In this form,  $m = -A/B$  and  $b = C/B$ .

EX: Translate  $4x = 2y - 8$  into slope-intercept, general, and standard form.

# Graphing Lines

- In slope intercept, plot the y-intercept, then use the slope to plot the second point.
- Think of vertical and horizontal lines in terms of their T-charts.
- Locate the x and y intercepts by plugging in 0 for the opposite variable.

EX: Graph  $2x - 3y = 6$ , first by translating to slope intercept and then by finding the x and y intercepts.

# Parallel and Perpendicular Lines

- Parallel lines have equal slopes and different y-intercepts.
- Perpendicular lines have opposite reciprocal slopes. Their slopes have a product of -1.

EX: Name a line that is parallel to  $y = \frac{1}{2}x + 3$ .

    Name a line that is perpendicular to  $y = \frac{1}{2}x + 3$ .

# Examples

1. Write the equation of the line that passes through  $(2, 1)$  and  $(-3, -5)$ .
2. Write the equation of the line that passes through  $(-6, 4)$  and is parallel to  $y = -4x + 3$ .
3. Write the equation of the line that passes through  $(2, 3)$  and is perpendicular to  $Y = 4$ .
4. Write the equation of the line perpendicular to the x-axis.