



## Lines

### Slopes, Intercepts & Equations

#### SLOPE

$$m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

- it's **positive** if the line rises to the right
- it's **negative** if the line falls to the right
- it's **zero** if the line is horizontal
- it's **undefined** if the line is vertical

#### SLOPE-INTERCEPT FORM

$$y = mx + b$$

where  $m$  = slope of the line  
 $b$  =  $y$ -intercept

#### POINT-SLOPE FORM

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

#### STANDARD FORM

$$Ax + By = C$$

$A$ ,  $B$ ,  $C$  are integers;  $A > 0$

#### FINDING INTERCEPTS

##### A. X-INTERCEPT

1. Set  $y = 0$  in the equation.
2. Solve for  $x$ .

##### B. Y-INTERCEPT

1. Set  $x = 0$  in the equation.
2. Solve for  $y$ .

#### PARALLEL LINES

Non-vertical lines are parallel if and only if they have the same slope and different  $y$ -intercepts.

(All vertical lines are parallel.)

#### PERPENDICULAR LINES

Non-vertical lines are perpendicular to each other if and only if their slopes are **negative reciprocals** of each other. This means the product of their slopes is  $-1$ . If  $m$  is the slope of one line, then  $-\frac{1}{m}$  is the slope of the other.

(Vertical lines are perpendicular to horizontal lines.)

#### DISTANCE FORMULA

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

#### MIDPOINT FORMULA

coordinates are:  $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

#### VERTICAL & HORIZONTAL LINES

Vertical lines have equations of the form  $x = a$ . They are parallel to the  $y$ -axis. All points on the line have the same first coordinate.



Horizontal lines have equations of the form  $y = b$ . They are parallel to the  $x$ -axis. All points on the line have the same second coordinate.

