3.3 and 3.4 Notes Name: 3-3 / 3.4 NOTES

Slopes of Lines and Equations of Lines Date: _____ Hour: _____

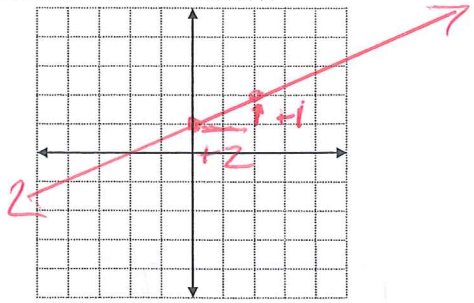
Goals:

- Find slopes of lines.
- Use slope to identify parallel and perpendicular lines.
- Write an equation of a line given information about its graph.

Slope:

Ratio of vertical rise to its horizontal run.

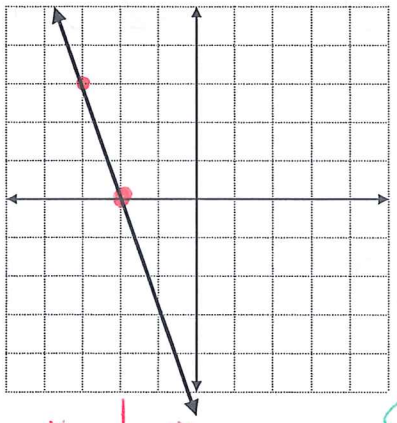
m = slope $= \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{1}{2}$



- Have you seen this notation? $\frac{\Delta y}{\Delta x}$, *read delta y over delta x.*
- Δ is a Greek symbol that mathematicians and scientists use to represent the change in a value.

Find the slope for the following lines, choose two points on each line and use the slope formula.

a.

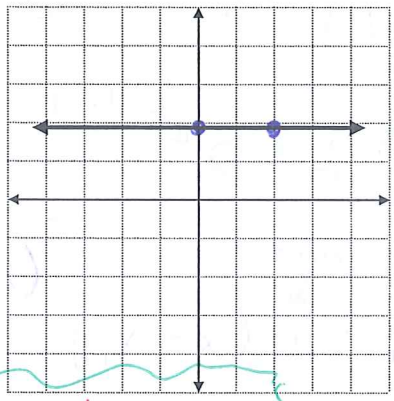


x	y
-3	3
-2	0

+1 < > -3

$m = \frac{\Delta y}{\Delta x} = \frac{-3}{1}$

b.



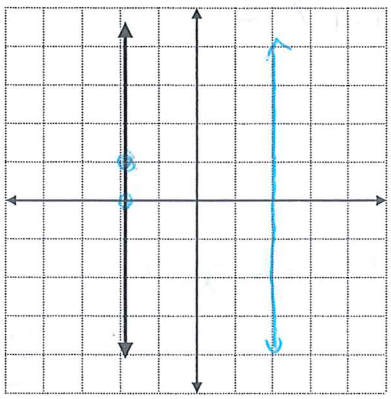
$m = \frac{y_2 - y_1}{x_2 - x_1}$

x	y
0	2
2	2

+2 < > +0

$m = \frac{\Delta y}{\Delta x} = \frac{0}{2} = 0$

c.

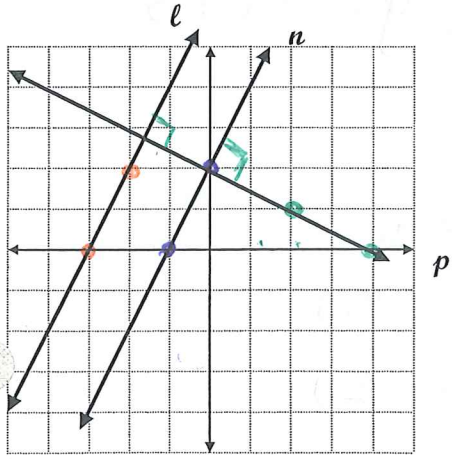


x	y
-2	1
-2	0

+0 < > +1

$m = \frac{\Delta y}{\Delta x} = \frac{-1}{0}$ undefined $\emptyset$

Parallel and Perpendicular Lines



Parallel ↘ ↙ Perpendicular

Given: line ℓ // n, line $p \perp \ell$

m of line ℓ =

x	y
-3	0
-2	2

+1 < > +2 $\quad \frac{\Delta y}{\Delta x} = \frac{2}{1}$

m of line n =

x	y
-1	0
0	2

+1 < > +2 $\quad \frac{\Delta y}{\Delta x} = \frac{2}{1}$

m of line p =

x	y
2	1
4	0

+2 < > -1 $\quad \frac{\Delta y}{\Delta x} = \frac{-1}{2}$

Parallel lines have the same slope

Perpendicular lines have slopes that are opposite reciprocals

Main Idea

- Parallel lines have *slopes* that are the same.
- Perpendicular lines have *slopes* that are opposite reciprocals

The opposite reciprocal of $\frac{1}{2}$ *is* $-\frac{2}{1}$

The opposite reciprocal of $\frac{-3}{5}$ *is* $\frac{5}{3}$

The opposite reciprocal of 5 *is* $-\frac{1}{5}$

The opposite reciprocal of -3 *is* $\frac{1}{3}$

Determine whether $\overleftrightarrow{FG}$ and $\overleftrightarrow{HJ}$ are *parallel*, *perpendicular*, or *neither*.

$\overleftrightarrow{FG} \parallel \overleftrightarrow{HJ}$ Parallel

a. F(1,-3), G(-2, -1), H(5, 0), J(6,3) Neither

x	y
1	-3
-2	-1

$-3 < -2$, $+2$

$\frac{\Delta y}{\Delta x} = -\frac{2}{3}$

x	y
5	0
6	3

$+1 < +3$

$\frac{\Delta y}{\Delta x} = \frac{3}{1}$

b. F(4, 2), G(6, -3), H(-1, 5), J(-3, 10)

x	y
4	2
6	-3

$+2 < -5$

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

x	y
-1	5
-3	10

$-2 < +5$

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

Equations of Lines

- **Slope-Intercept Form:** $y = mx + b$ (slope, y-int)

Write the equation in *slope-intercept form* of the line with slope of -4 and y-intercept of 1.

$y = -4x + 1$

- **Point-Slope Form:** $y - y_1 = m(x - x_1)$ (slope, (x_1, y_1))

Write the equation in *point-slope form* of the line whose slope is $\frac{1}{2}$ that contains (3, -7)

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

$y - (-7) = \frac{1}{2}(x - 3)$

$y + 7 = \frac{1}{2}(x - 3)$

Example 1: Write an equation in *slope-intercept* form for line ℓ, if the line contains the points (-1, 6) and (3, 2).

x_1 y_1

1. Find the slope:

x	y
-1	6
3	2

$+4 < -4$

$\frac{\Delta y}{\Delta x} = \frac{-4}{4} = -1$

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

3. Solve for *y*: $y - 2 = -1(x - 3)$

$y - 2 = -1x + 3$

$+2 \quad +2$

$y = -1x + 5$

Example 2: Write an equation in *slope-intercept* form for a line containing (2, 0) that is perpendicular to the line $y = -x + 5$

x_1 y_1

1. Find the slope: $-\frac{1}{1}$ flip $+\frac{1}{1}$
2. Use point-slope form: $y - y_1 = m(x - x_1)$
3. Solve for *y*: $y - 0 = 1(x - 2)$

$y = 1x - 2$