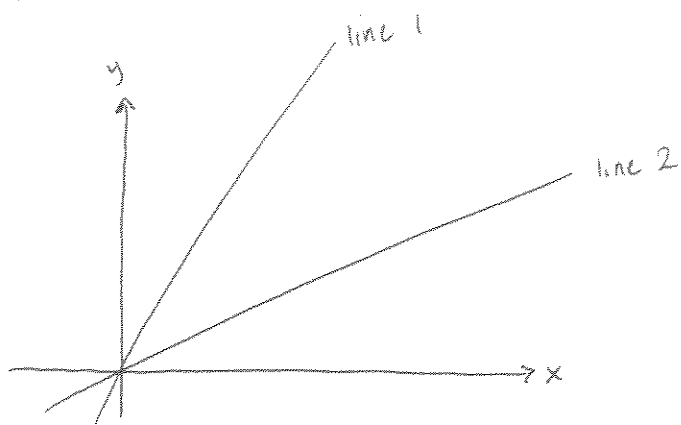


3.3 Slope and Graphs of Linear Equations

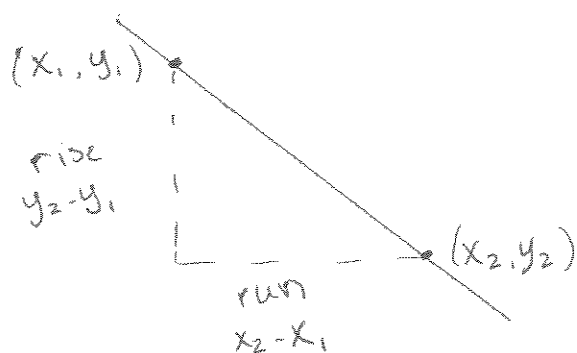
①



- line 1 is clearly steeper than line 2.
- mathematically, this means line 1 has a greater slope than line 2.
- The slope tells us how steep a line is.

Slope : usually use variable m .

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



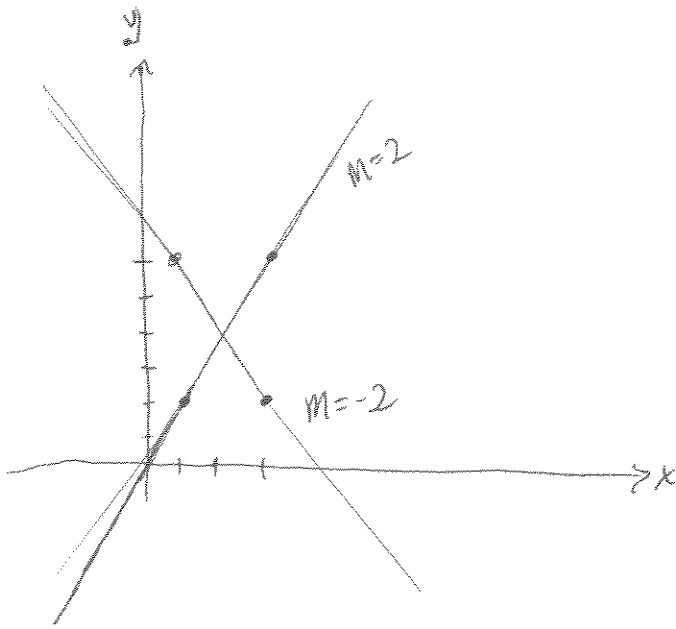
→ you can choose any 2 points on a line and the slope you calculate will always be the same for that line

Ex points (1,2) and (3,6)
(3,2) and (1,6)

$$m = \frac{6-2}{3-1} = \frac{4}{2} = 2$$

$$m = \frac{6-2}{1-3} = \frac{4}{-2} = -2$$

(2)

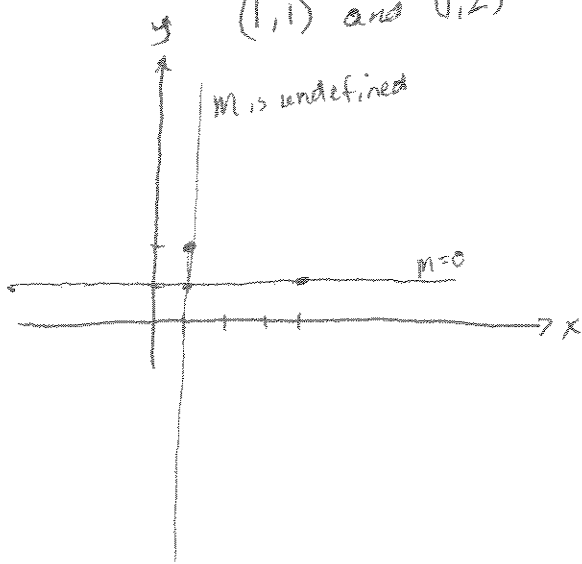


Ex points: (1,1) and (4,1)

$$m = \frac{1-1}{4-1} = \frac{0}{3} = 0$$

(1,1) and (1,2)

$$m = \frac{2-1}{1-1} = \frac{1}{0} \text{ undefined}$$



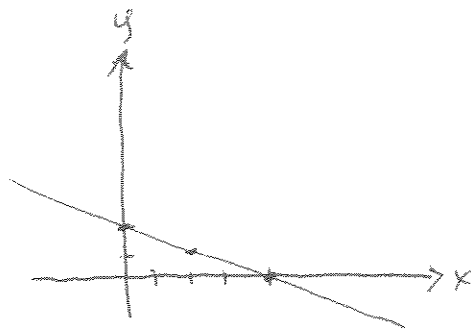
Slope, $m > 0$	ascending (up & to right)
$m < 0$	descending (down & to left)
$m = 0$	horizontal
m undefined	vertical

Consider the line $2y + x = 4$. To plot, solve for y .

③

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

x	$y = -\frac{1}{2}x + 2$
0	2
2	1
4	0
6	-1



What is the slope of the line? Choose 2 points. $(0, 2)$ and $(2, 1)$

$$m = \frac{1-2}{2-0} = \frac{-1}{2}$$

What is the y-intercept of the line? set $x=0$

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

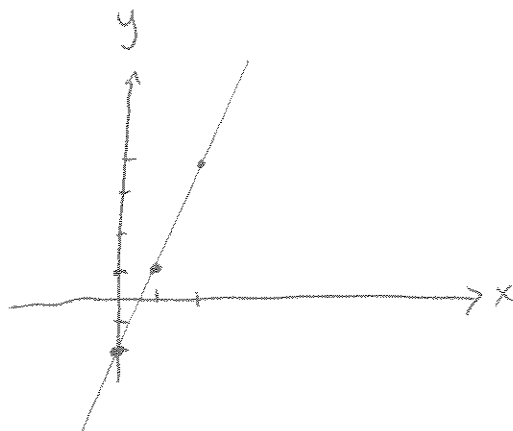
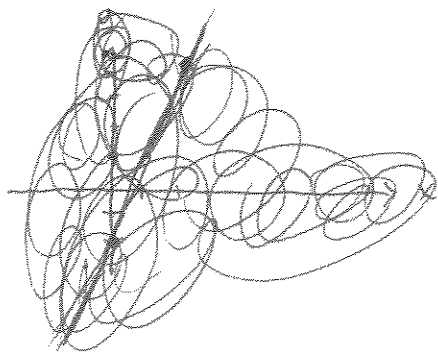
$$y = 2$$

So in $y = -\frac{1}{2}x + 2$ → Slope intercept form
Annotations: "slope" points to $-\frac{1}{2}$, "y-intercept" points to 2 .

in general $y = mx + b$
Annotations: "slope" points to m , "y-intercept" points to b .

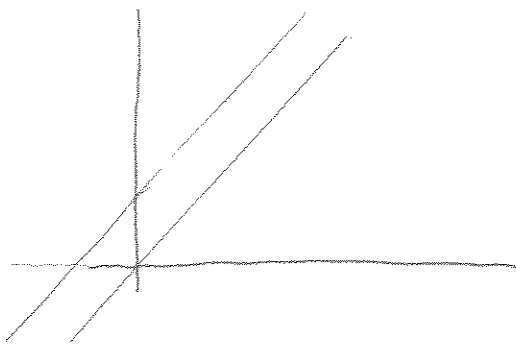
Ex plot $y = 3x - 2$

slope: 3. y-intercept: -2



Parallel/Perpendicular lines

(4)



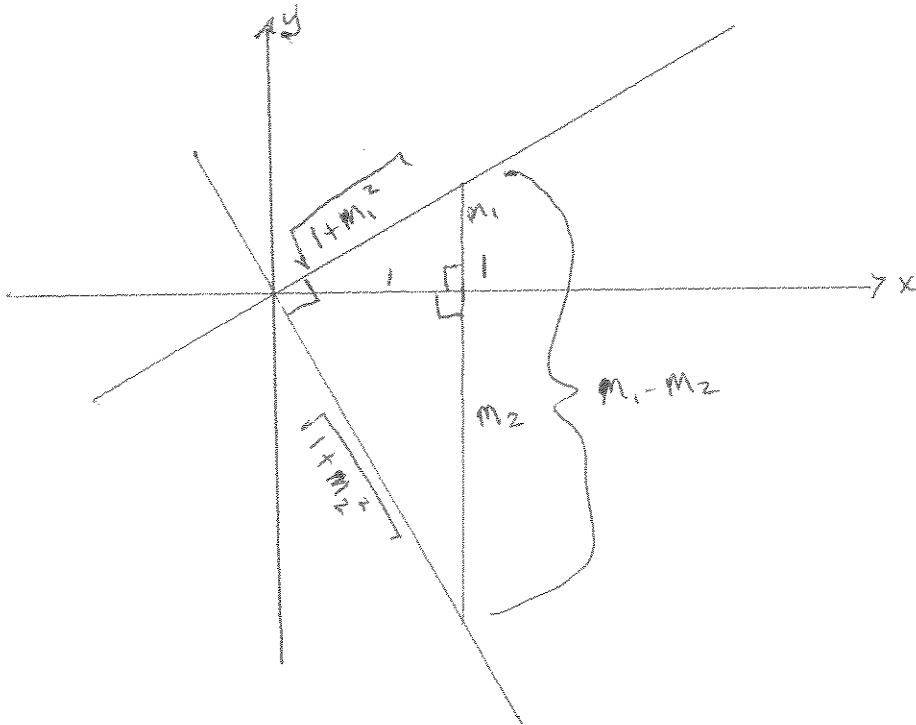
→ these lines are parallel.

→ what about their slopes?

→ they have the same slopes.

2 lines are parallel if they have the same slopes: $m_1 = m_2$
2 lines are perpendicular if $m_1 \cdot m_2 = -1$, or $m_1 = -\frac{1}{m_2}$

↳ why?



$$(\sqrt{1+m_1^2})^2 + (\sqrt{1+m_2^2})^2 = (m_1 - m_2)^2$$

$$1+m_1^2 + 1+m_2^2 = (m_1 - m_2)(m_1 - m_2)$$

$$2 + m_1^2 + m_2^2 = m_1^2 - m_1 m_2 - m_1 m_2 + m_2^2$$

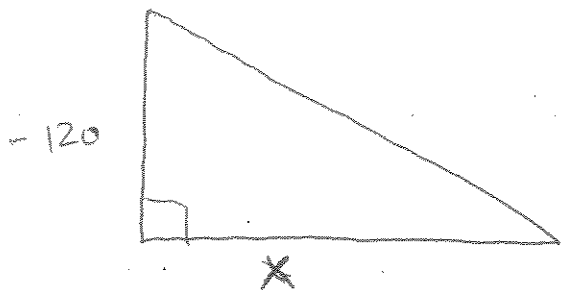
$$2 + m_1^2 + m_2^2 = m_1^2 - 2m_1 m_2 + m_2^2$$

$$2 = -2m_1 m_2$$

$$-1 = m_1 m_2$$

Ex You ~~descend~~ ski down a hill with a ~~75%~~ 75% grade. (That $\approx 36.7^\circ$ which is pretty steep). If you go down 120 vertical feet, how far do you travel horizontally? (5)

\rightarrow 75% grade means go down 75' & over 100'. So the slope is $m = -\frac{75}{100} = -\frac{3}{4}$



similar triangles!

$$-\frac{3}{4} = \frac{-120}{x}$$

$$-3x = -480$$

$$x = 160'$$

How long was the hill? Use Pythagorean Theorem

$$(120)^2 + (160)^2 = d^2$$

$$d = \sqrt{40,000}$$
$$= 200'$$