Math 1210-3
Monday Jan 7
JWB 335 9:40-10:30

P.1 : Lines in the plane

slope of a line

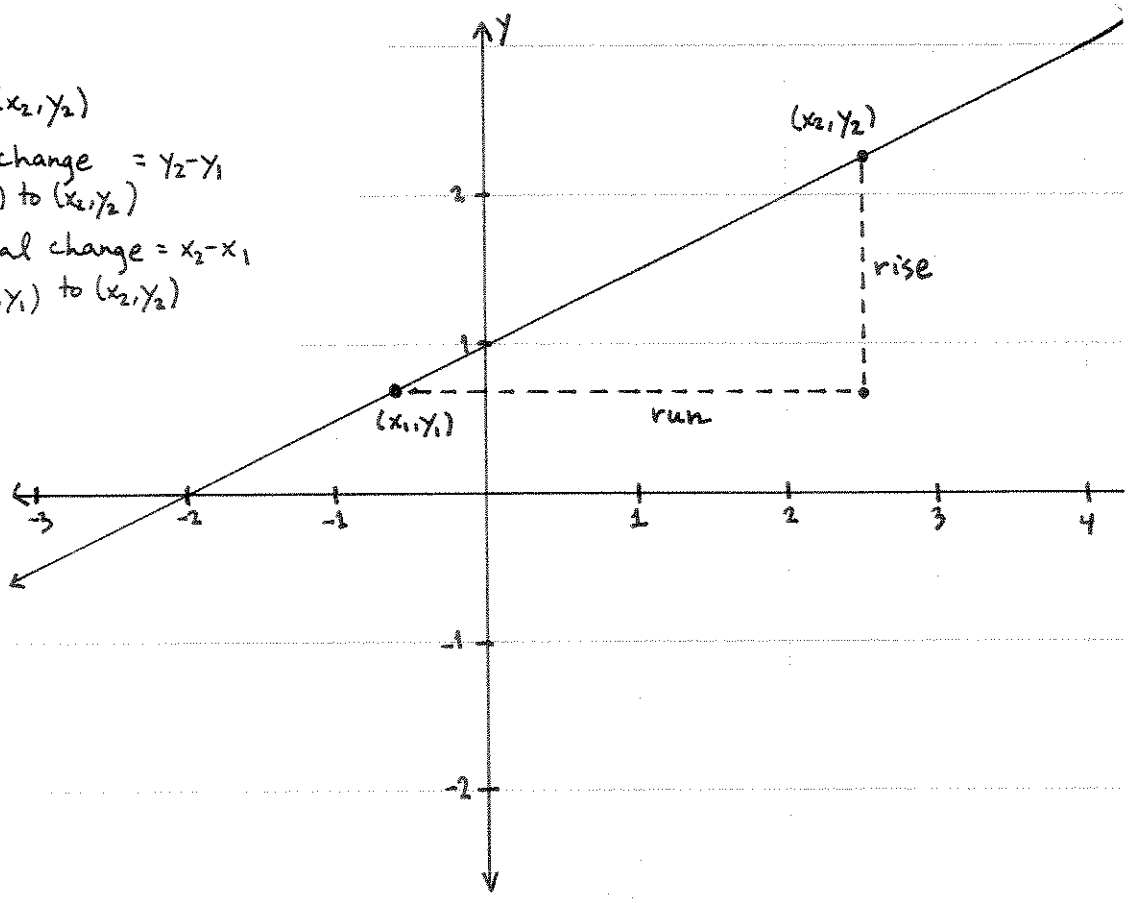
$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

between (x_1, y_1) and (x_2, y_2)

where rise = vertical change $= y_2 - y_1$
from (x_1, y_1) to (x_2, y_2)

run = horizontal change $= x_2 - x_1$
from (x_1, y_1) to (x_2, y_2)

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



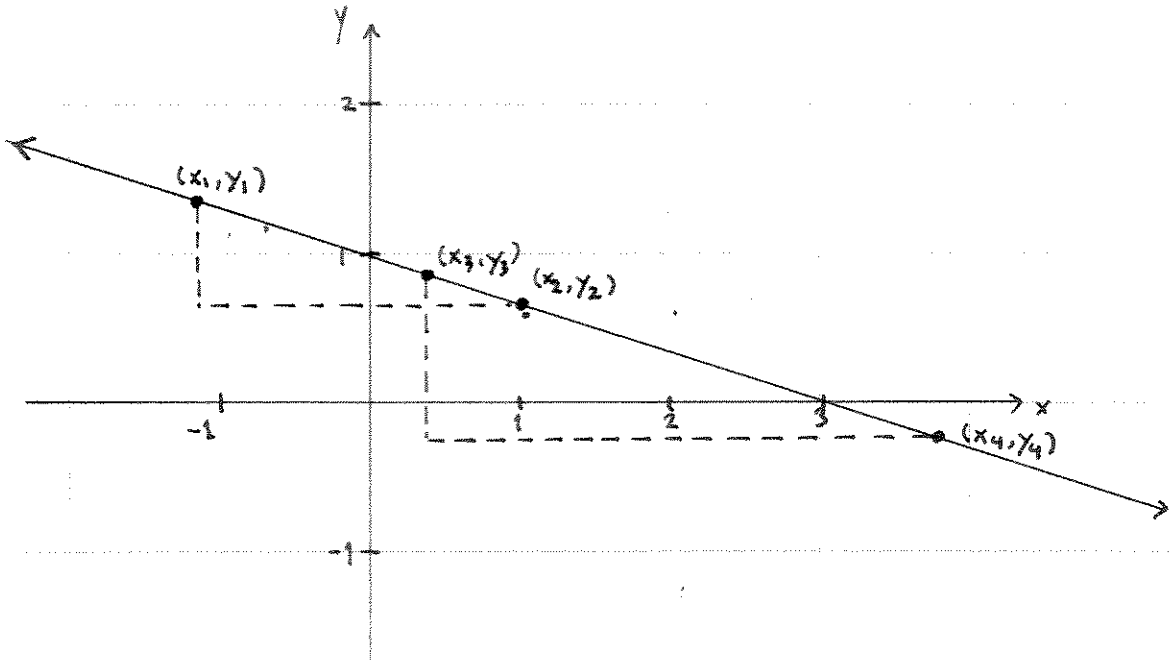
Exercise 1 Find m (slope) on the line above, from (0,1) to (2,2)

Exercise 2 How about from (2,2) to (0,1)

Exercise 3 Try other pairs of points on the same line. Is the slope always the same?

Exercise 4 What does $m > 0$ mean about the inclination of a line?
How about $m < 0$?

- Why value of slope is independent of choice of pair of points on a given line: Use geometry! Hint: similar triangles



point-slope form of equation for a line through (x_0, y_0) with slope m

If (x, y) is a variable point on the line

$$m = \frac{y - y_0}{x - x_0}$$

yields

$$\boxed{(y - y_0) = m(x - x_0)}$$

Exercise 5: The point $(3, 0)$ is on the line above. What is the point slope equation of this line, using $(3, 0)$?

Exercise 6 Find an equation of the line through $(-1,-1)$ and $(1,2)$, and sketch it on previous page.

slope-intercept form: If you simplify the point-slope form of the equation for a line (by solving for y), you get

$$y = mx + b \qquad \text{(where } b = y_0 - mx_0\text{)}$$

this line intercepts the y-axis when $x=0$, and then $y = m0 + b = b$
so b is the y-intercept

Exercise 7: Put the line equations from exercises 5, 6 into slope-intercept form, and compare to your sketches

General equation of a line Every equation of the form

$$Ax + By + C = 0$$

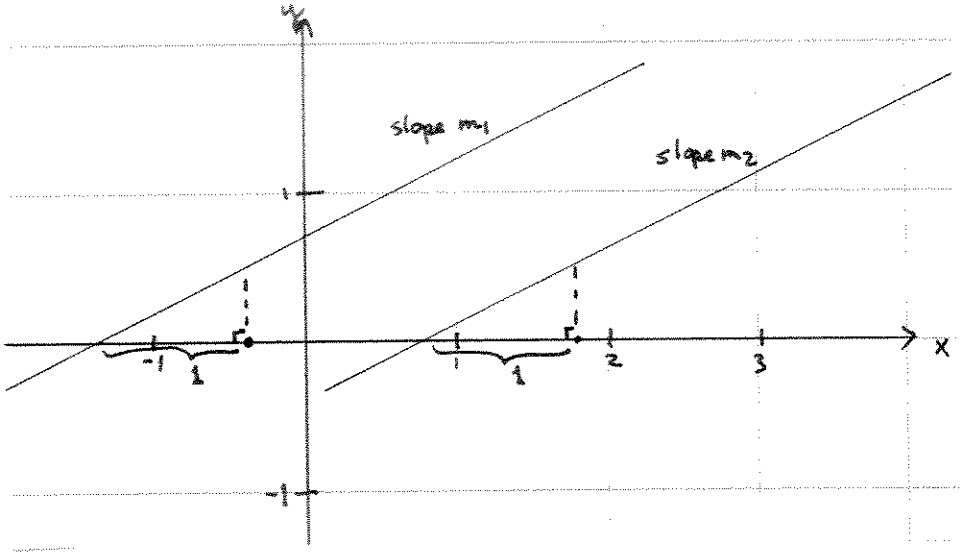
is the equation of a line, and every line (even vertical ones) has an equation that can be put in this form

Exercise 8 Find the slope and y-intercept for the line with equation

$$2x + 3y - 6 = 0$$

two lines are parallel if and only if they have the same slope

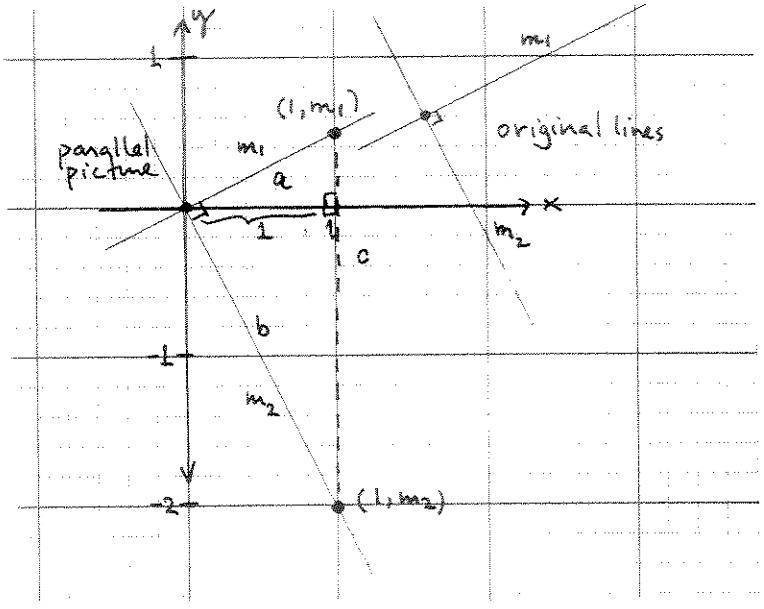
Details: (use congruent Δ's)



Exercise 8: Find equation of line // to page 2 line, through point (3, 1)

two lines are perpendicular if and only if their slopes are "negative reciprocals", i.e. $m_1 m_2 = -1$ $\left(m_2 = -1/m_1\right)$

Details: (Use Pythagorean Theorem) $a^2 + b^2 = c^2$



Exercise 9: Find equation of line $\perp$ to page 2 line, through (3, 0).