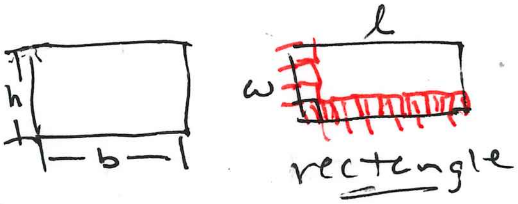
Formulas to Know



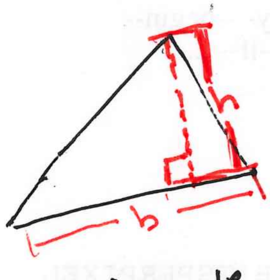
Perimeter (distance around) → linear quantity

$l + w + l + w = 2l + 2w$

$$P = 2(l+w)$$
$$P = 2(b+h)$$

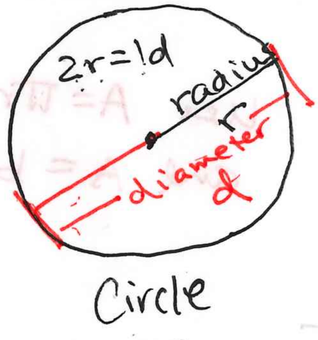
Area (square unit space within figure) → square quantity

$$A = lw \quad \text{or} \quad A = bh$$



$$A = \frac{bh}{2}$$

$$A = bh$$



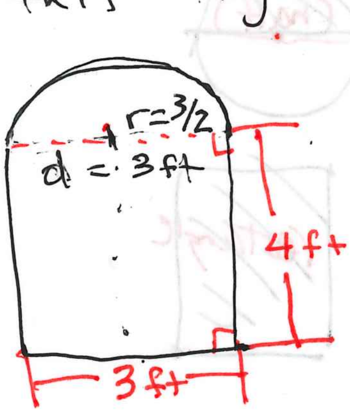
Perimeter is called circumference

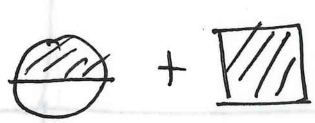
linear ← $C = 2\pi r$ or $C = \pi d$ ← $d = 2r$

from calculus → $A = \pi r^2$ ← square

Ex Find total area of this figure

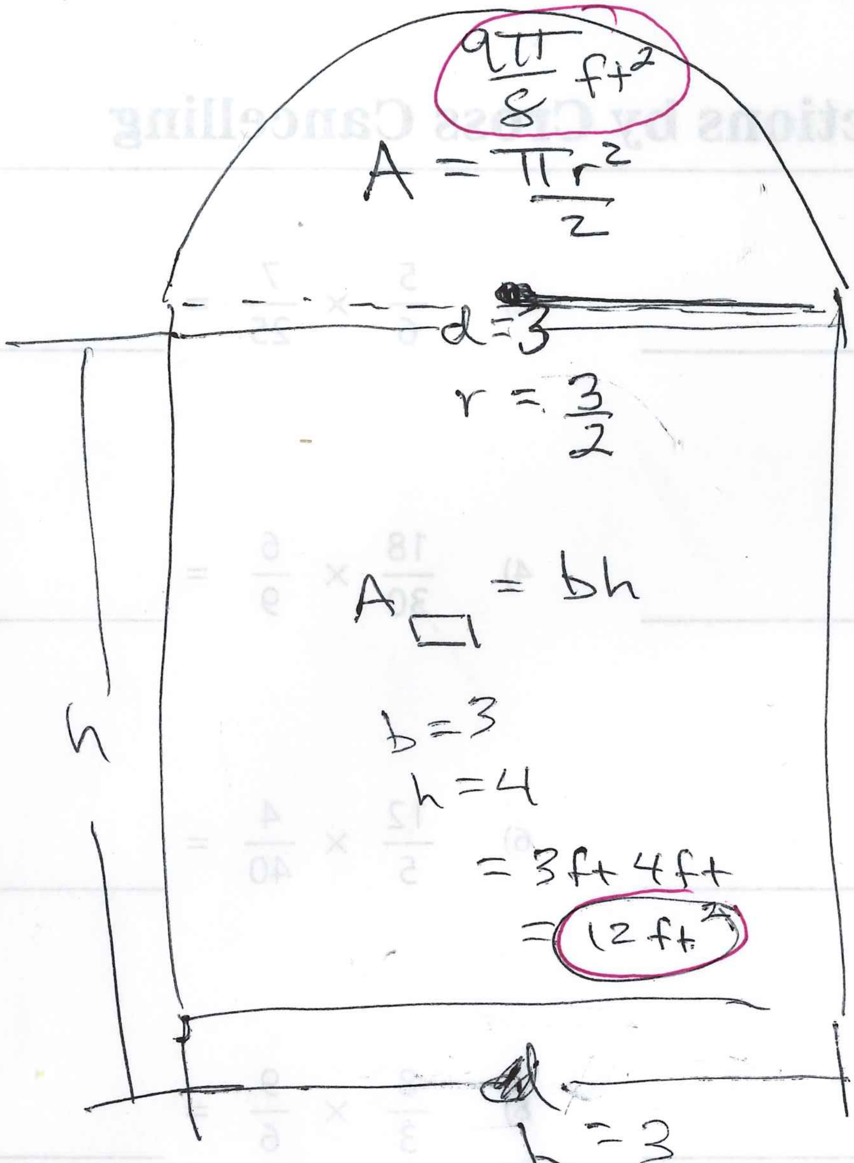
(fancy) (Norman window)



A = 

$= \frac{\pi r^2}{2} + b \cdot h$

$= \frac{\pi}{2}\left(\frac{3}{2}\right)^2 + 3 \cdot 4$



semicircle

$A = \frac{\pi}{2} r^2$

$= \left(\frac{3}{2}\right)^2 \cdot \frac{\pi}{2}$

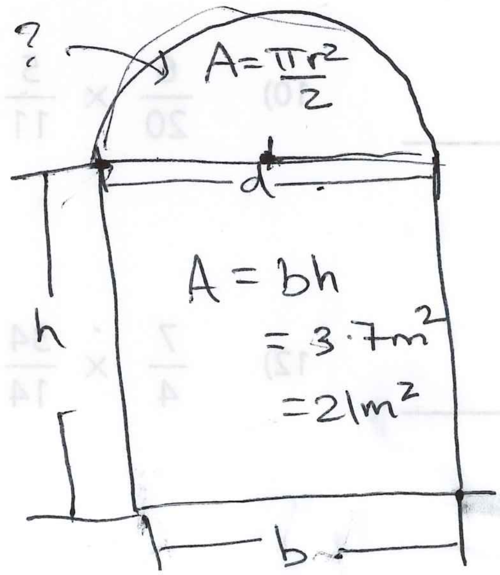
$\frac{9\pi}{8} = \frac{9}{4} \cdot \frac{\pi}{2}$

$b = d = 3ft$

$h = 4ft$

$\frac{12}{1} ft^2 + \frac{9\pi}{8} ft^2$

$\left(\frac{96 + 9\pi}{8}\right) ft^2$



A_{total}

$= 21 m^2 + \frac{9\pi m^2}{8}$

$= \left(21 + \frac{9\pi}{8}\right) m^2$

$b = 3 m$

$h = 7 m$

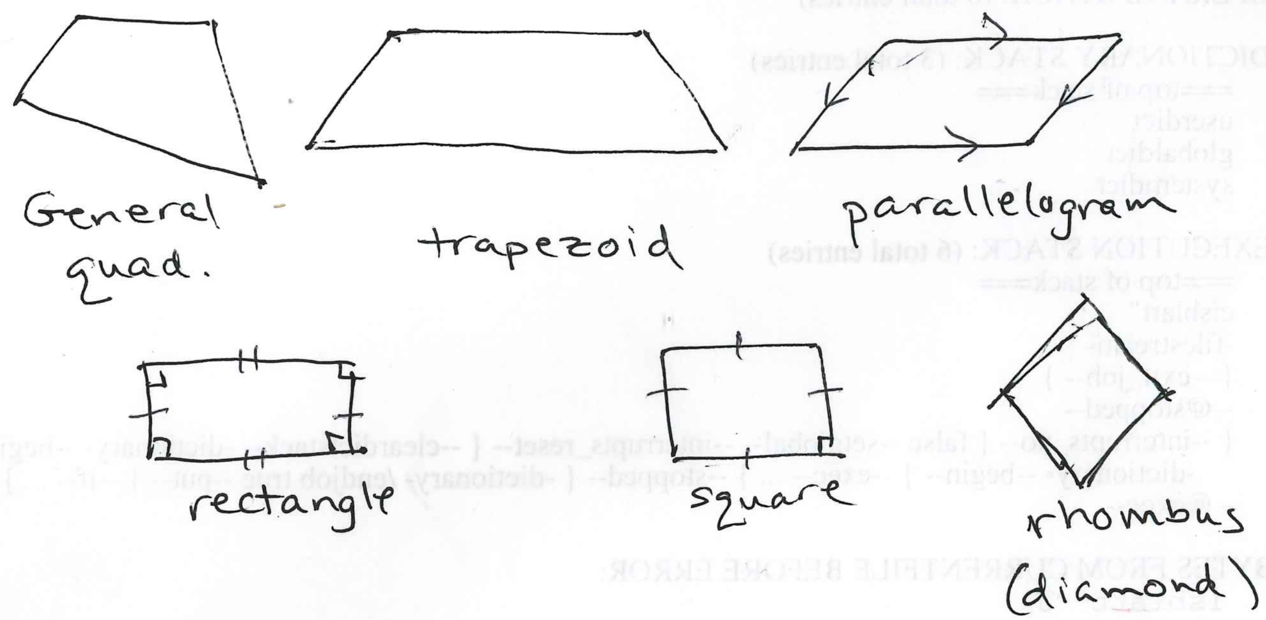
$d = 3m, \; r = \frac{3}{2} m$

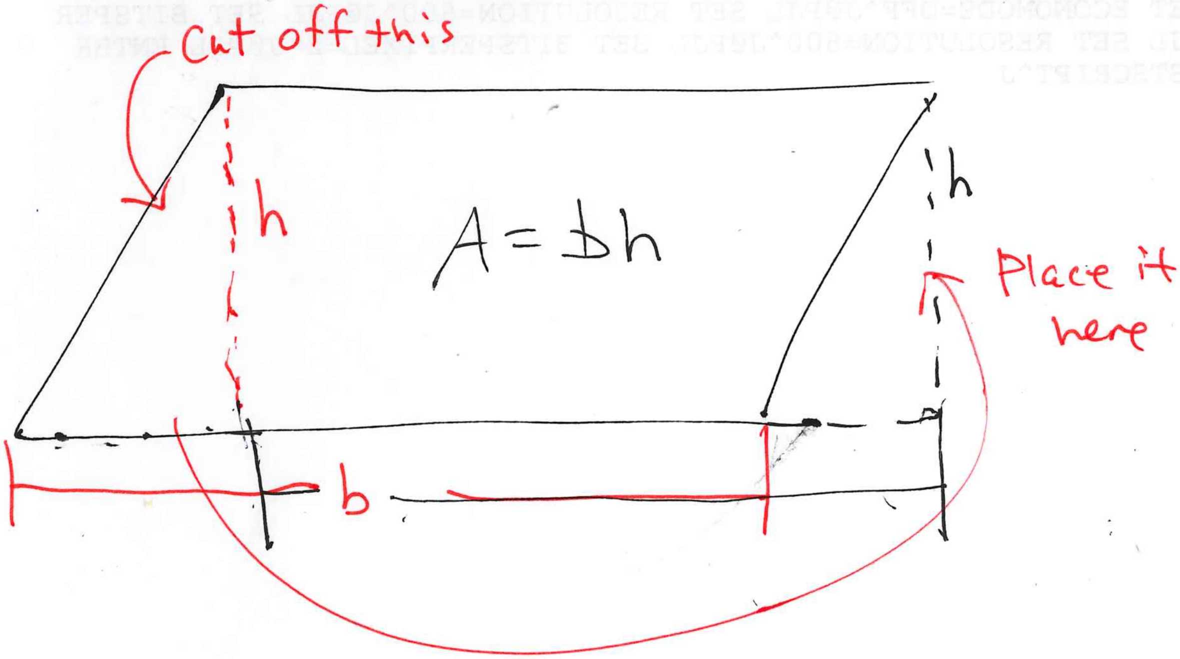
$A = \frac{\pi r^2}{2} = \frac{\pi}{2}\left(\frac{3m}{2}\right)^2$

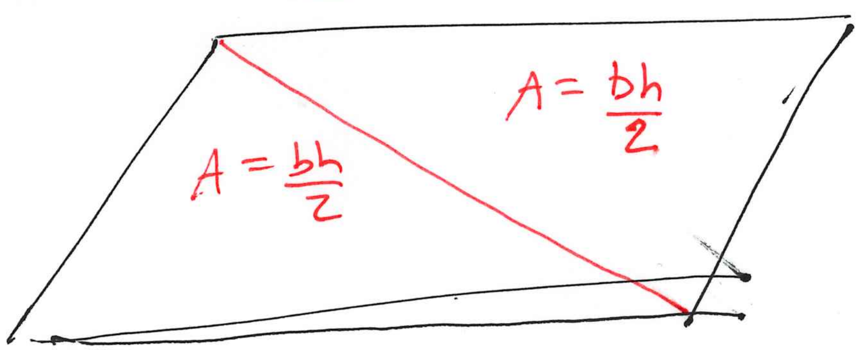
$= \frac{\pi}{2} \cdot \frac{9}{4} m^2$

$= \frac{9\pi}{8} m^2$

Quadrilaterals – 4-sided (convex) polygons







Again!

$3bx - 2x = 4b + 9x$

solve for b

$3bx - 4b = 9x + 2x$

$b \cdot (3x - 4) = 11x$

$b = \frac{11x}{3x-4}$ /

solve for x

$3bx - 2x = 4b + 9x$

$3bx - 2x - 9x = 4b$

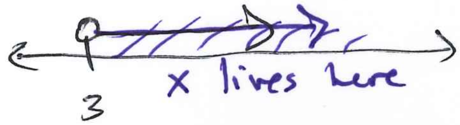
$3bx - 11x = 4b$

$\frac{x \cdot (3b - 11)}{(3b - 11)} = \frac{4b}{3b-11}$

$x = \frac{4b}{3b-11}$ /

Soluing inequalities gives an interval of values that satisfy it!

Ex $x > 3$

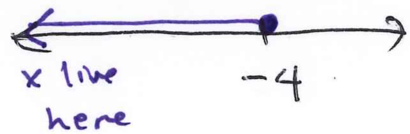


$(3, \infty)$

algebraic notation | graphical notation | interval notation

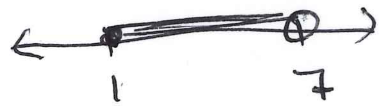
Ex $x \le -4$

algebraic



$(-\infty, -4]$

Ex $1 \le x < 7$



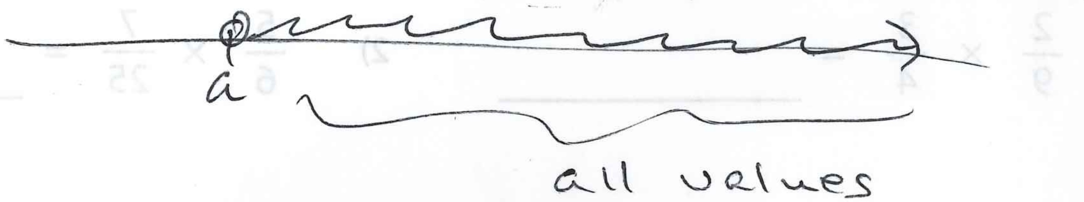
$[1, 7)$

$|x| = a$ $\qquad$ $|x| < a$ $\qquad$ $|x| \ge a$

Side point

$x > a$ ← number

x lives in interval



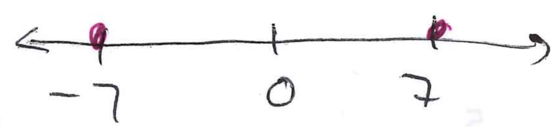
$a = |x|$ **Absolute Value** - distance from zero

Equations

$|x| = a$ $x = a$ or $-a$

↑ variable   ↑ number

Ex $|x| = 7$



$x = 7$ or -7

Ex $|x-3| = 9$ means

$x - 3 = 9$ or $x - 3 = -9$

$x = 12$ or $x = -6$

Name: Key

L2

Note: You MUST showing ALL work. You SHOULD NOT use a calculator on any of these problems. You will have 30 Mins. to complete this quiz.

1. Solve the following for x.

   a) $2x + 5 = -6$

   $2x = -11$

   $x = -\frac{11}{2}$

   b) $2(x-1) = 3(x-3)$

   $2x - 2 = 3x - 9$

   $7 = x$

   Prefer to move variable term to give positive coeff.

2. Given the equation $2ya - 7 = -5 + 3y$

   a) Solve for y

   Isolate y

   $2ya - 3y = -5 + 7$

   $y \cdot (2a - 3) = 2$

   $\frac{y(2a-3)}{2a-3} = \frac{2}{2a-3}$

   $2ya - 7 = -5 + 3y$
   $+7 \qquad -3y$

   $y = \frac{2}{2a-3}$

   B) Solve for a

   ~~$2ya - 7 = -5 + 3y$~~

   ~~$2ya - 3y = -5 + 7$~~

   $2ya - 7 = -5 + 3y$

   $2ya = -5 + 3y + 7$

   $\frac{2y \cdot a}{2y} = \frac{2 + 3y}{2y} = a$

3. The perimeter of a parrallelogram is 48cm. If the longer side is 4cm more than the shorter side, find the dimensions of the figure.

$* \; l = w + 4$

substitute

Perimeter - distance around

$w + l + w + l$

$P = 2(w + l)$

Need cut down to one unknown

$48\text{cm} = 2(w + w + 4)$

$48 = 2(2w + 4)$

$\div 2 \quad 24 = 2w + 4$

$20 = 2w$

$w = 10 \text{ cm}, \; l = 14\text{cm}$

More Problems on back

4. Upon graduating from Binghamton University a student recieved an amount of money from his parents. The student decides to invest all this money in a bank that pays 5% simple interest. After 20 years, the student checks his balance and finds the account has \$2000. Using the formula, $A = P + Prt$, find the amount of money the student originally received from his parents.

r (as decimal)

t

P

A

$A = \$2000 \quad P = ? \quad r = 0.05 \quad t = 20$

$2000 = P + P(.05)(20)$

$2000 = P + (1)P = 2P$

$P = \frac{2000}{2} = \$1000$

5. Solve the following for x. Give your answer in interval notation.

a) $2(x + 2) \leq 3(x - 1)$

$2x + 4 \leq 3x - 3$
$-2x \quad -2x$

$4 \leq x - 3$
$+3 \quad +3$

$7 \leq x$ or $\boxed{x \geq 7}$

algebraic

$[7, \infty)$

7

graph

$1 - x > 3$
$-1 \quad -1$

$-x > 2$
$\overline{-1} \quad < \overline{-1}$

$x < -2$ algebraic notation

$-\infty$

-2

graphical notation

$1 + (-4) = 5 > 3$
?

$(-\infty, -2)$ interval notation

part of # line that has all values satisfying the inequality

b) $3 < 1 - 2x < 7$

$-1 \quad -1 \quad -1$

$2 < -2x < 6$
$\overline{-2} \quad > \overline{-2} \quad > \overline{-2}$

$-1 > x > -3$ algebraic

$-3 \quad -1$ graphical

$-3 < x < -1$

interval not.

$(-3, -1)$ open interval (does not include end pts)

Use ( ), not [ ]

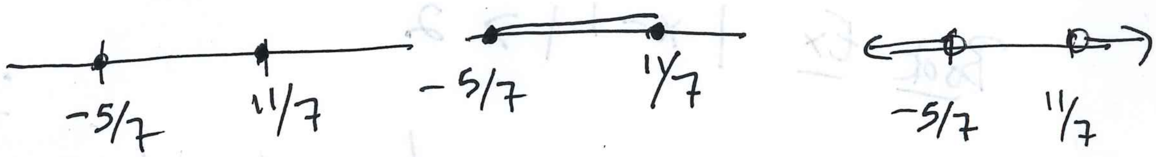
Quiz 4

15 pts

Setup +1 x 3
Soln(x) +2
Intervals +2 x 2 +1U
Pts. +1 +1∞
Graphs +3

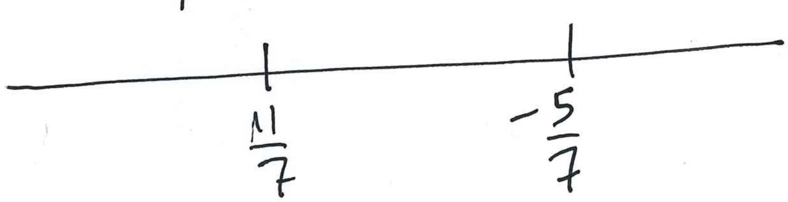
Expression	$3-7x$		
n	8		
	$\|3-7x\| = 8$	$\|3-7x\| \le 8$	$\|3-7x\| > 8$
	$3-7x=8$ $3-7x=-8$	$-8 \le 3-7x \le 8$	$3-7x > 8$ or $3-7x < -8$
Algebraic	$x = -5/7$ $x = 11/7$	$-\frac{5}{7} \le x \le \frac{11}{7}$	$x > 11/7$ or $x < -5/7$
Interval	no	$[-5/7, 11/7]$	$(-\infty, -5/7) \cup (11/7, \infty)$

Graph



Inequality flip

$$-8 \le 3-7x \le 8$$
$$-3 \quad -3 \quad -3$$
$$\frac{-11}{-7} \ge \frac{-7x}{-7} \ge \frac{5}{-7}$$
$$\frac{11}{7} \ge x \ge -\frac{5}{7}$$



Patterns

① $|express| = n \rightarrow \pm n$

② $|express| > n$ beyond

③ $|express| < n$: $-n < exp < n$

② $exp < -n$ or $exp > n$

$-n$ $\qquad$ n

$(-\infty, -n) \cup (n, \infty)$

Book Ex $|x-1| > 2$

me

$x-1 > 2$ or $x-1 < -2$

book

$x-1 > 2$

or

$-(x-1) > 2$

$x-1 < -2$

Quiz 3

Name ____________

Ex $\quad Ax^1 + By^1 + C = 0, \quad A, B, C \in \mathbb{Q}, \mathbb{Z}$

It's possible that ~~...~~ one or two of A, C or B, C are = 0. But not both A, B.

$1x - 7 = 0$

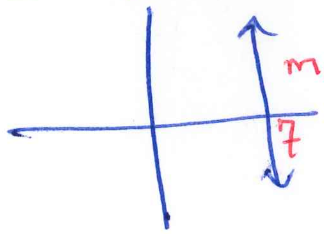
General $\quad Ax + By + C = 0$

$A = 1, B = 0, C = -7$

Slope-Intercept?

It's not possible to write vertical lines in $y = mx + b$ form because m is undefined.

$x - 7 = 0 \rightarrow x = 7$



m is not defined

Ex $\quad y = -\frac{3}{5}x - 1$

- $m = \frac{-3}{5} \quad b = -1$
- rewrite in general form

$y = mx + b$

$+\frac{3}{5}x + y + 1 = 0 \rightarrow A = 3/5, B = 1, C = 1$

Make all coeffs. integers

$5\left(\frac{3}{5}x + y + 1\right) = (0)5$

$3x + 5y + 5 = 0$

Try this: Find m, b, a, where m is slope, b is y-int, a is x-int. ("root")

for $\boxed{4x - 7y + 9 = 0}$

1. Put in $y = mx + b$ + read m, b off the eqn
2. Let $y = 0$ and solve for x to get a.

1. $y = \frac{4}{7}x + \frac{9}{7}$

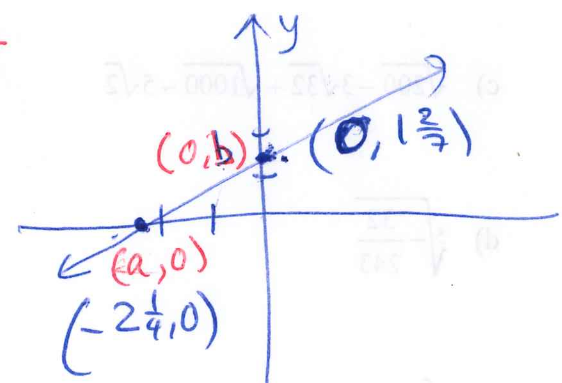
$y = \frac{4}{7}(0) + \frac{9}{7} = \frac{9}{7} = b = 1\frac{2}{7}$ when $x=0$

2. $0 = \frac{4}{7}x + \frac{9}{7}$; find x-int (root)

$\frac{7}{4} \cdot \frac{4}{7}x = -\frac{9}{7} \cdot \frac{7}{4}$

$x = -9/4$

$= -2\frac{1}{4}$



Practice converting improper fractions to mixed no.

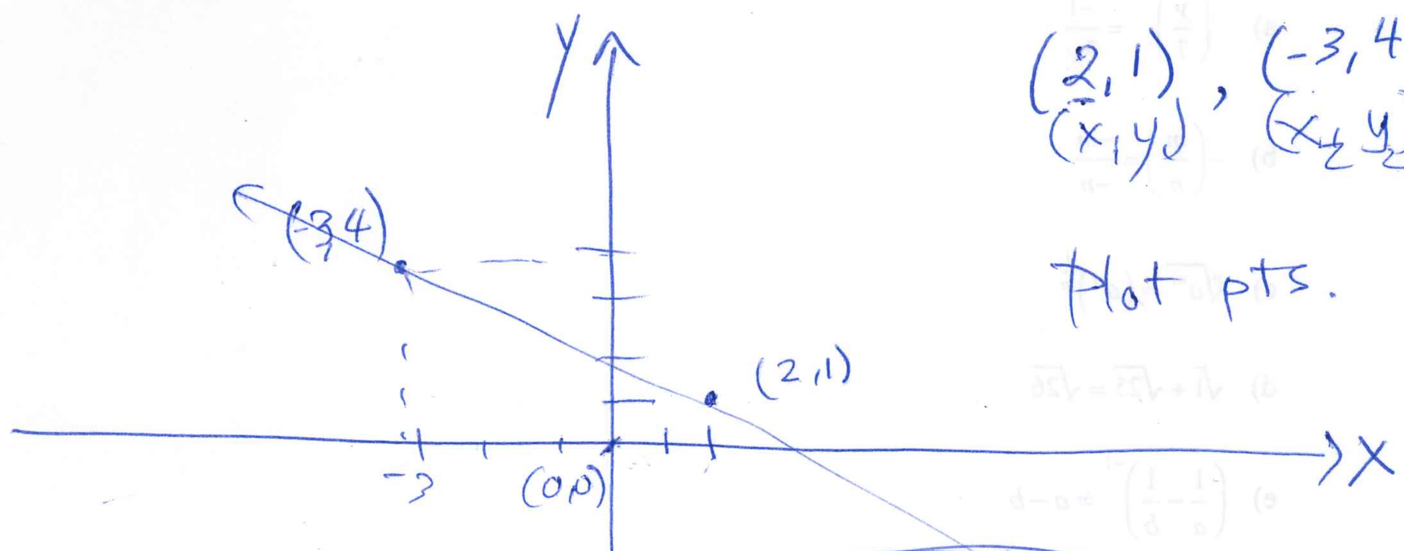
$\frac{9}{4} = 4\overline{)9}$ → $2\frac{1}{4}$, -8, 1

- name x-intercept as (a,0)
- name y-intercept as (0,b)

$(2,1)$, $(-3,4)$

(x_1, y_1), (x_2, y_2)

Plot pts.



Reread 7.1, 7.2

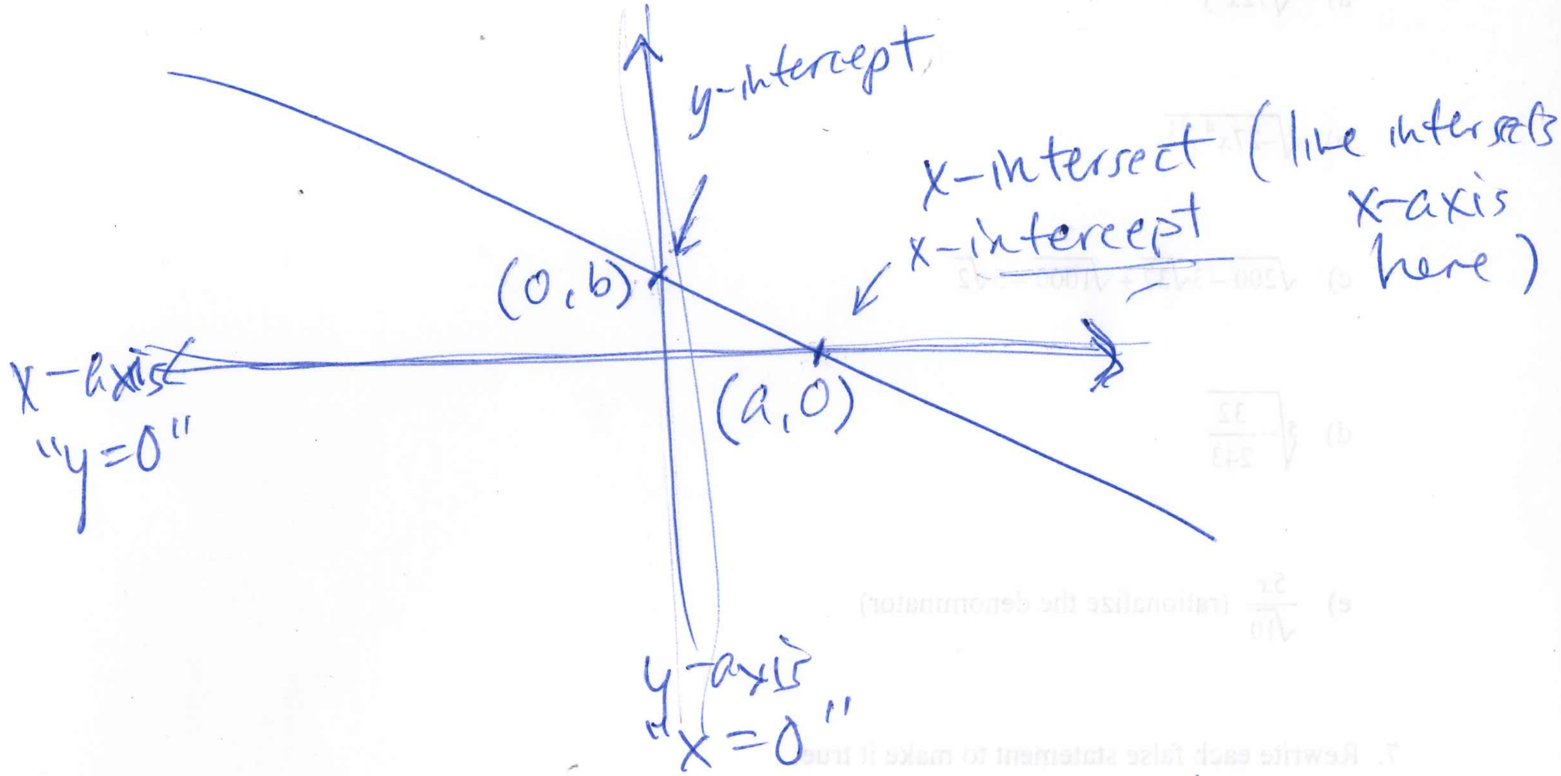
Watch videos

$y = mx + b$

~~$x = \frac{1}{m}y - \frac{b}{m}$~~

~~$x = \frac{1}{m}y + a$~~

Find x + y intercepts



To find x-intercept, let $y=0$;
To find y-intercept, let $x=0$.

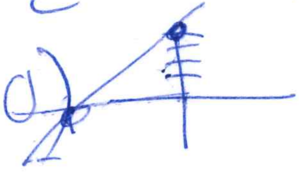
Ex $y = \frac{1}{2}x + 4 = mx + b$

Find both intercepts:

$y = \frac{1}{2} \cdot 0 + 4 = 4$

$0 = \frac{1}{2}x + 4 \rightarrow -4 = \frac{1}{2}x \rightarrow x = -8$

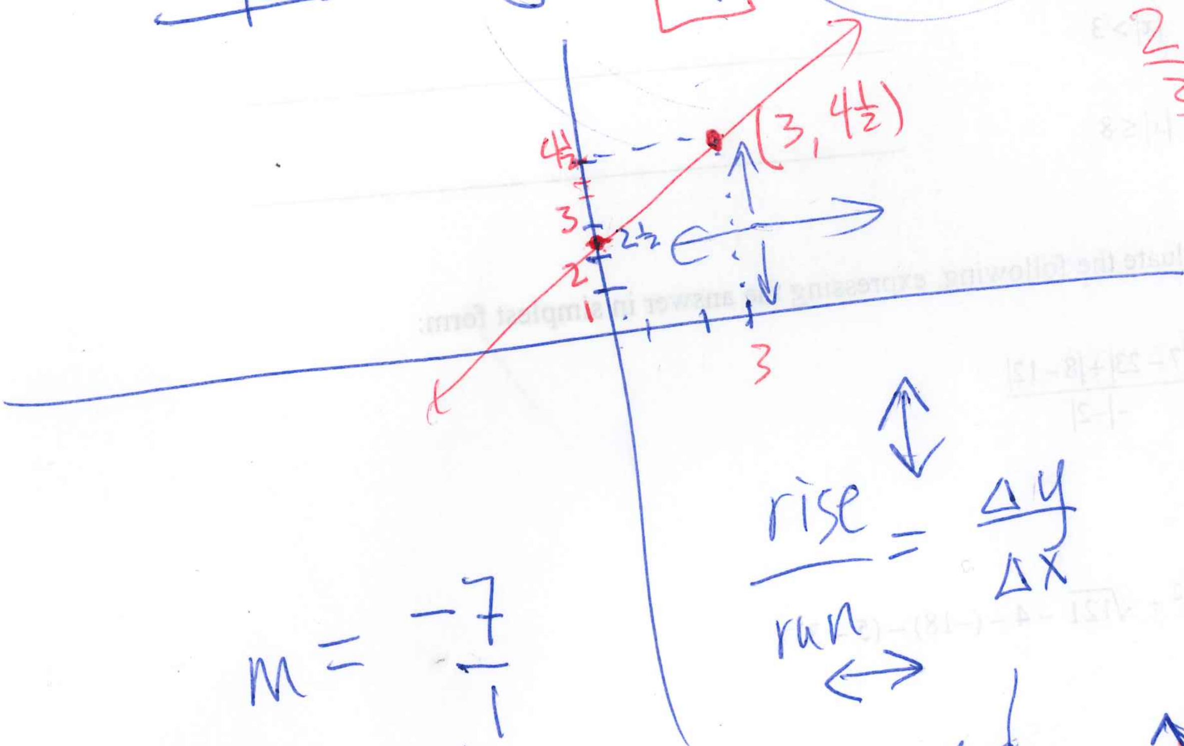
$(0,4)$; $(-8,0)$



$mx + b$

Graph $y = \frac{2}{3}x + \frac{5}{2}$

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

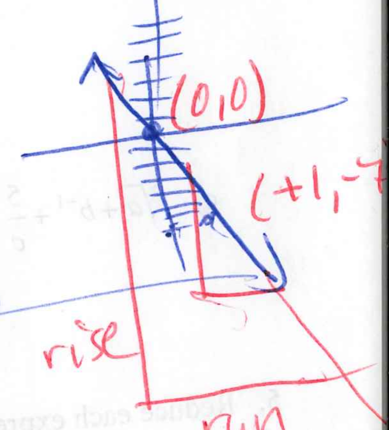


$\frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x}$

$m = \frac{-7}{1}$

$y = \frac{-7}{1}x + 0$

$= \frac{7}{-1}$



Oct 4 All three forms of the line

General form $Ax + By + C = 0$ $A, B, C \in \mathbb{R}$, usually $\mathbb{Q}$

but I like $A, B, C \in \mathbb{Z}$

Ex $5x - y + 3 = 0$

$A = 5,\ B = -1,\ C = 3$

Ex $\frac{x}{2} + \frac{3}{4}y - \frac{1}{1} = 0$

$A = \frac{1}{2},\ B = \frac{3}{4},\ C = -1$

Equivalently, multiply all by LCD to clear denominators:

$4 \cdot \left(\frac{x}{2} + \frac{3}{4}y - 1\right) = (0)4$

$2x + 3y - 4 = 0$

Slope-intercept form $y = mx + b$ $m = \frac{\Delta y}{\Delta x}$, $(0, b)$

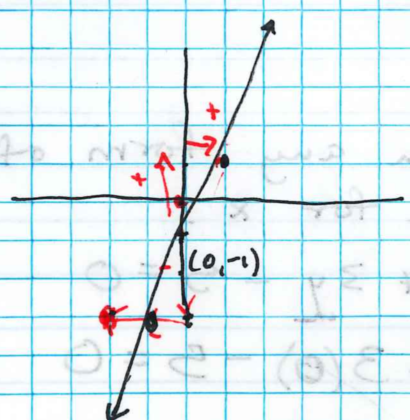
b, y-intercept (the value where line intercepts (cuts) the y-axis)

Ex $y = 2x - 1$

$m = \frac{2}{1}$, $b = -1$, $(0, -1)$

We can graph it right off the form $y = mx + b$

↑ map to 2nd pt ↑ begin



$y = 2(0) - 1$

$y = -1$

Point-slope form

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

where (x_1, y_1) is given

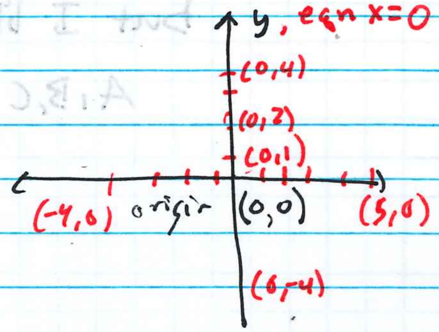
Subscripts indicate given

Ex $m = \frac{2}{3}$, $(1, 5)$, $(0, -2)$

Either $y - 5 = \frac{2}{3}(x - 1)$

or $y + 2 = \frac{2}{3}(x - 0)$

x, y intercepts



(a,0) x-intercept

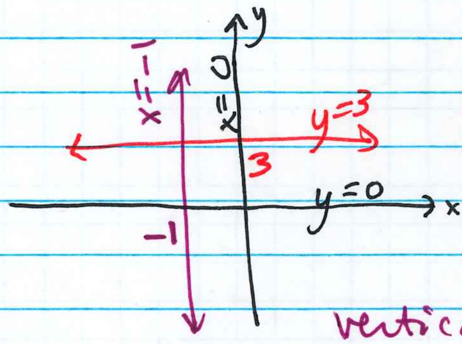
(0,b) y-intercept

↑

same b as in $y = mx + b$ form

* x-axis has eqn $y = 0$ — horizontal line

* y-axis has eqn $x = 0$ — vertical line



horizontal line through (0,3) has eqn $y = 3$

vertical line through (-1,0) has eqn $x = -1$

Ex

Find eqn. of horizontal line through $(\frac{1}{2}, -4)$

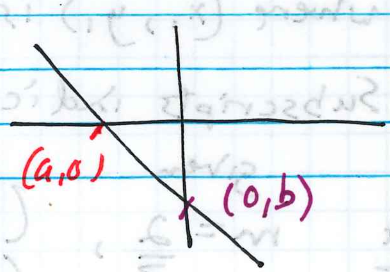
$$y = -4$$

Find eqn of vertical line through $(\frac{1}{2}, -4)$

$$x = \frac{1}{2}$$

Intercepts

To find the x-intercept given any form of the line, let $y = 0$ and solve for x.



Ex

$$-\frac{1}{2}x + 3y - 5 = 0$$

$$-\frac{1}{2}x + 3(0) - 5 = 0$$

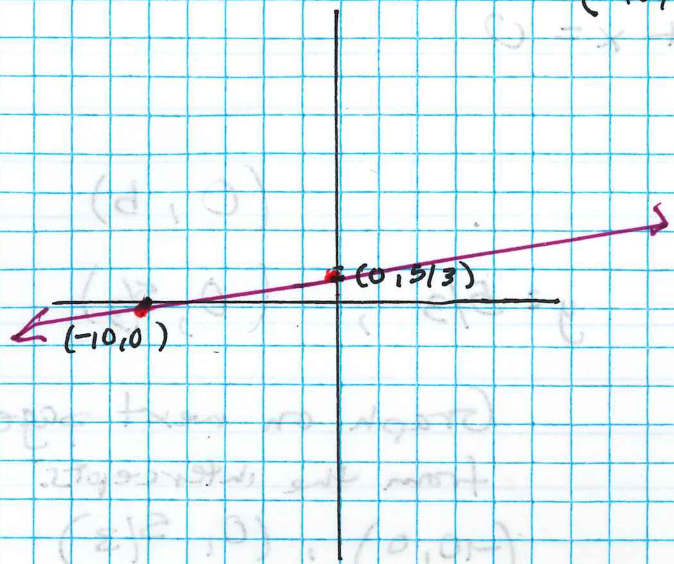
$$-\frac{1}{2}x - 5 = 0$$

$$\left(-\frac{2}{1}\right)\left(-\frac{1}{2}\right)x = \frac{5}{1}\left(\frac{-2}{1}\right) = -10$$

$(a, 0) = (-10, 0)$

continued

$(-10,0), \quad (0, 5/3)$



$$-\frac{1}{2}x + 3y - 5 = 0$$

Put into slope-intercept form

$$y = mx + b$$

$$\frac{3y}{3} = \frac{\frac{1}{2}x}{3} + \frac{5}{3}$$

$$y = \frac{1}{2} \cdot \frac{1}{3}x + \frac{5}{3}$$

$$y = \frac{1}{6}x + \frac{5}{3} \quad //$$

Find y-intercept, let $x = 0$

$$-\frac{1}{2}x + 3y - 5 = 0$$

$$-\frac{1}{2}(0) + 3y - 5 = 0$$

$(0, b)$

$$3y - 5 = 0$$

$y = 5/3$, $(0, 5/3)$

$$3y = 5$$

Graph on next page from the intercepts: $(-10, 0)$, $(0, 5/3)$

Oct 4 · 3 forms of the line

· finding x, y - intercepts

Ex Use the ~~point~~ slope-intercept form of the line to find the equation of a line through $(1,-3)$, $(0,7)$.

Pt - slope form	General form	Slope-intercept
$y-y_1 = m(x-x_1)$	$Ax+By+C=0$	$y=mx+b$

Find m; then substitute either point given into $y=mx+b$ to find b; rewrite with m, b found

Recall that any form of the line can be morphed (changed) into any other forms.

$Ax + By + C = 0$ general

$y = mx + b$ slope-intercept

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

Find the slope-int form from general (given). Then find a point on the line other than the y-intercept $(0, b)$.

Ex $6x - 5y + 1 = 0$ → ~~6x − 5y~~ or $6x + 1 = 5y$

$\frac{5y}{5} = \frac{6x}{5} + \frac{1}{5}$

$6x - 5y = -1$

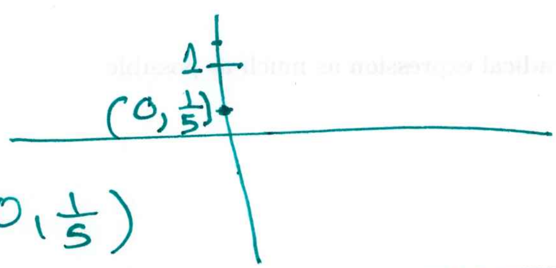
$\frac{-5y}{-5} = \frac{-6x}{-5} - \frac{1}{-5} \rightarrow y = \frac{6x}{5} + \frac{1}{5}$ (m = $\frac{6}{5}$, b = $\frac{1}{5}$)

$y = \frac{6x+1}{5}$ ok but not clear as $y = \frac{6}{5}x + \frac{1}{5}$ for m, b

Aside:

$\frac{6}{5}x = \frac{6x}{5}$

$\frac{1}{2}x = \frac{x}{2}$



y-int: $(0, \frac{1}{5})$

$y = mx + b$ represents a function

Ex $y = x + 2$

x is input value

y is output value

where, we say, "y is a function of x"

(1)

By "y is a function of x", think of this idea: "You give me (input) an x-value; I'll tell you the y-value (output)!"

Ex $y = x + 2$ $(0,2)$, $(3,5)$, $(-7,-5)$, $(\frac{1}{2}, 2\frac{1}{2})$

Back to $y = \frac{6}{5}x + \frac{1}{5}$

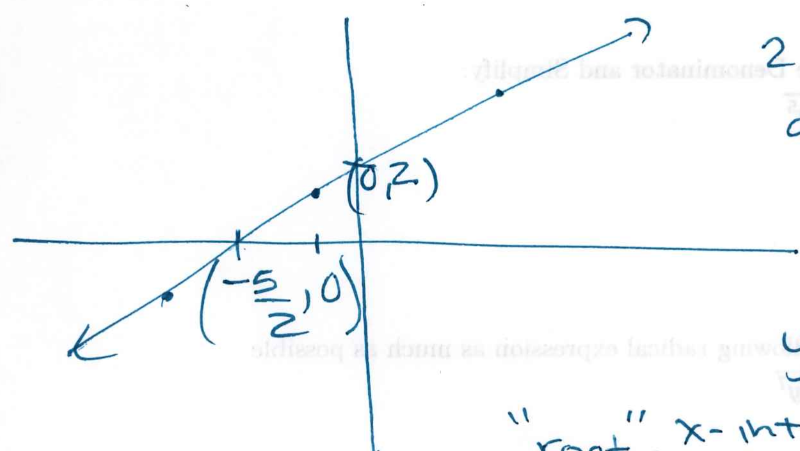
$x = 1$, $y = \frac{6}{5}\cdot 1 + \frac{1}{5} = \frac{7}{5}$ $(1, \frac{7}{5})$

$x = -15$, $y = \frac{6}{5}(-15) + \frac{1}{5} = -18 + \frac{1}{5} = -17\frac{4}{5}$

$-\frac{185}{15} + \frac{1}{3}$

$-18 \quad -17$

Ex



2 pts define a unique line.

$m = 4/5$

$b = 2$

$y = \frac{4}{5}x + 2$

"root", x-int (let $y = 0$)

$0 = \frac{4}{5}x + 2$

$\left(\frac{5}{4}\right)(-2) = \frac{4}{5}x \cdot \frac{5}{4}$

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

$y = \frac{4}{5}x + 2$

$y = \frac{4}{5}(-1) + 2$

$= -\frac{4}{5} + 2$

$= 1\frac{1}{5}$

1 2

(0)

Sec 7.2 HW

#9. $x = \frac{1}{2}$ $Ax + By + C = 0$

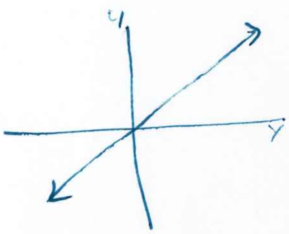
$1x + 0y - \frac{1}{2} = 0$ $A = 1$

$B = 0$

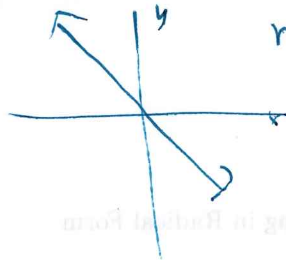
$C = -\frac{1}{2}$

---

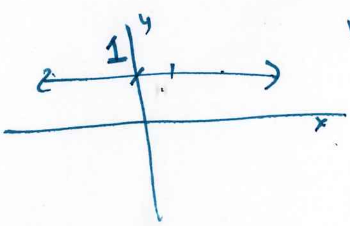
* Essential ~~forms~~ (graphs) of lines



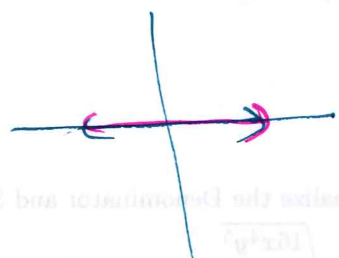
$m = 1$
$b = 0$
$y = x$



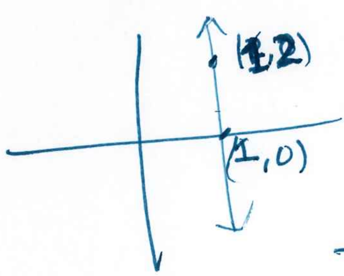
$m = -1$
$b = 0$
$y = -x$



$m = 0$
$b = 1$
$y = 1$
for all x



$m = 0$
$b = 0$
$y = 0$
x-axis

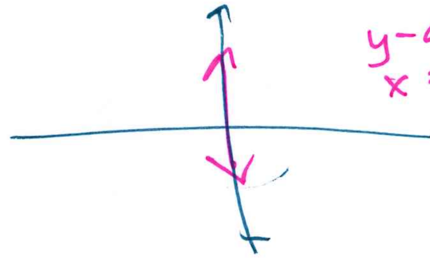


m undefined $\frac{\text{rise}}{\text{run}} = \frac{\#}{0}$

b none

$x = 1$ ~~m=0~~ $m = \frac{2-0}{1-1} = \frac{2}{0}$ undef.

for all y



y-axis
$x = 0$

1)

Oct 6

Sec 7.2

begin / map } $y = mx + b$

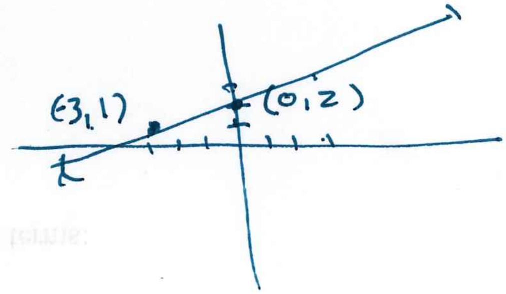
Ex #24 $x - 3y + 6 = 0$

$3y = x + 6$

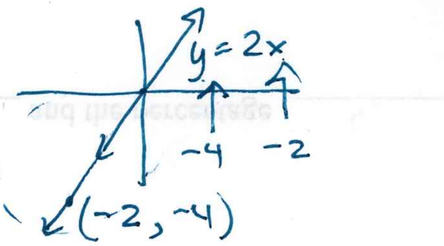
$y = \frac{x}{3} + 2$ ($\frac{1}{3}x$)

$m = \frac{1}{3}$

$b = 2$



Ex $x = \frac{y}{2} \longrightarrow 2x = y \longrightarrow y = 2x + 0,\quad m = 2,\ b = 0$



Ex Find x, y - intercepts

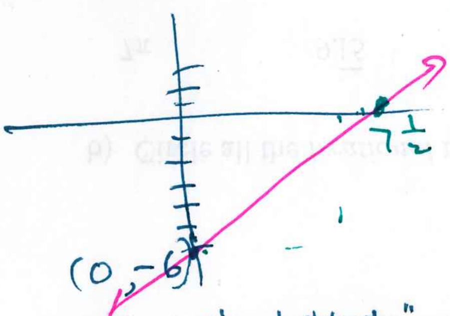
$y = \frac{4}{5}x - 6$ ($mx + b$) $\quad b = -6$ y-int!

To find "root" x-int, let $y = 0$

$0 = \frac{4}{5}x - 6$

$\frac{6}{\frac{4}{5}} = \frac{\frac{4}{5}x}{\frac{4}{5}} \longrightarrow \frac{5}{4} \cdot \frac{6}{1} = \frac{5}{4} \cdot \frac{4}{5}x$

$\frac{15}{2} = x = 7\frac{1}{2}$



line : $\{(x,y) \mid y = \frac{4}{5}x - 6\}$

"such that" — ordered pairs — "the set"

Rewrite $y = \frac{4}{5}x - 6$ in general form $\rightarrow \frac{4}{5}x - y - 6 = 0$

Sec 7.2 #70.

\$10 store pays this C_1 (cost)

\$13.50 store charges this S_1 (sale)

Order of Phoenix

\$12 store pays this C_2

\$15.90 " charges " S_2

Assuming that "mark-up" is linear

Find eqn. that relates cost C to sale price S.

$y = mx + b$; $S = mC + b$

$y - y_1 = m(x - x_1)$ — slope; point (x_1, y_1)

$m = \frac{\text{change in } y}{\text{change in } x}$ (S over C)

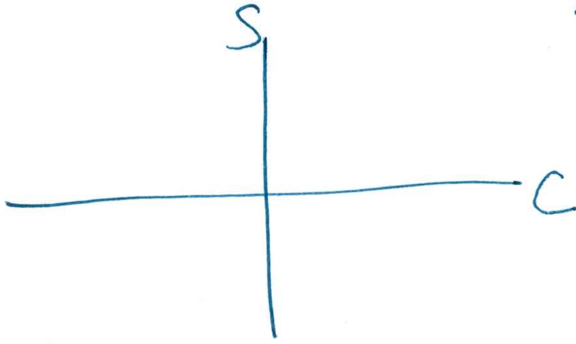
It doesn't matter whether you use pt 1 − pt 2 or pt 2 − pt 1

$$\frac{-(y_1 - y_2)}{-(x_1 - x_2)} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{y_1 - y_2}{x_1 - x_2} = \frac{S_1 - S_2}{C_1 - C_2}$$

$$\frac{S_1 - S_2}{C_1 - C_2} = \frac{S_2 - S_1}{C_2 - C_1}$$

$$\frac{\Delta S}{\Delta C} = \frac{S_2 - S_1}{C_2 - C_1} = m = \frac{15.90 - 13.50}{12 - 10} = \frac{2.40}{2.00} = \frac{6}{5} = m$$

$$\frac{24 \div 4}{20 \div 4} = \frac{6}{5}$$



What should I sell (S) the book for if I pay (C) so much?

2)

Counter-clockwise numbering of quads.

x<0, y>0 Quadrant 2, II	Quadrant 1, I x>0, y>0
x<0, y<0 Quadrant 3, III	Quadrant 4, IV x>0, y<0

(axes labelled y and x)

- (x, y) - coordinate system
- x, y - plane
- rectangular coordinate system
- Cartesian plane

#70. Sec 7.2

Sale price S, Cost to store C

$y = mx + b \rightarrow S = m \cdot C + b$

Given 2 examples (2 points (C, S))

find m, then eqn. using $y - y_1 = m(x - x_1)$

$\rightarrow S - S_1 = m(C - C_1)$

1 (\$10, 13.50)

2 (\$12, 15.90)

$m = \frac{\Delta y}{\Delta x} = \frac{\Delta S}{\Delta C} = \frac{15.90 - 13.50}{12 - 10}$

$= \frac{2.40}{2.00} = \frac{24}{20} = \frac{6 \cdot 4}{5 \cdot 4} = \frac{6}{5}$

~~S = 15.90~~

$S - 15.90 = \frac{6}{5}(C - 12)$

$\frac{6}{5} = 1\frac{1}{5} = 1.$

$\frac{1}{5}$: 5) 1.00 = .20

$S - 15.90 = 1.2(C - 12)$

What is cost C when sale S = 22

$22 - 15.90 = 1.2(C - 12)$

$\$6.10 = 1.2C - 14.40$

$m = \frac{6}{5} = 1\frac{1}{5} \overset{?}{=} \text{decimal} = 1.2$ slope

$5\overline{)6.0}$ = 1.2
-5
10

$5\overline{)1.0}$ = 0.2

Plug in values into

$S - S_1 = m(C - C_1)$

$S - 13.50 = 1.2(C - 10)$

Solve for S: $S = 1.2C - 12 + 13.50$

$$\boxed{S = 1.2C + 1.50}$$

Find Cost of ~~te~~ book they sell for \$22 (S)
to ~~se~~ bookstore
C = ?

$22 = 1.2C + 1.50$

$20.50 = 1.2C$

$\frac{20.50}{1.2} = C$

C = \$17.08
17.09
\$17.10

Sec 7.2

4)

#72. \$ money, time t input

price \$ p, output

2 points $(250, 0), (325, 3), (?, 9)$

(p, t) ~~crossed out~~

(t, p)

3 yrs ago $(0, 250), (3, 325), (9, ?)$

p | t

slope $\frac{\Delta p}{\Delta t} \left(\frac{\Delta y}{\Delta x}\right) = \frac{325-250}{3-0} = \frac{75}{3} = 25 = m$

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

$p - p_1 = 25(t - t_1)$

$p - 250 = 25(t - 0) = 25t$

$p = 25t + 250$

Find p when $t = 9$

$p = 25(9) + 250$

$= 225 + 250$

$p = \$475$ at $t = 9$ yrs.

(1)

Oct 7 2022 WEEK 7 FRIDAY

Exam 2 – THURSDAY OCT 13

Topics – Abs. value eqns + inequalities ✓
– Solving linear eqns. ✓
– Lines in all forms – converting from one to another; properties such as multiply through by constant gives same line, slope of vertical, horizontal, + others + essential graphs + eqns of lines; all graphs – Find x, y-intercepts or any other pt

$y - y_1 = m(x - x_1)$
$y = mx + b$
$Ax + By + C = 0$
$x = a$ vert.
$y = b$ hor.

$y = mx + b$ where $m = 0$ — $y = b$ for all x

* Linear inequalities – solving + graphing
– Perpendicular + parallel lines. 7.3
– Word problems (2) on lines – you come up with the relevant $y = mx + b$ from two data pts given
– (12.1) – easy – distance + midpt between 2 given pts – formulas

VIDEOS REQUIRED VIEWING

Sec 7.2 #49 $x = \frac{2}{3}y + 2$

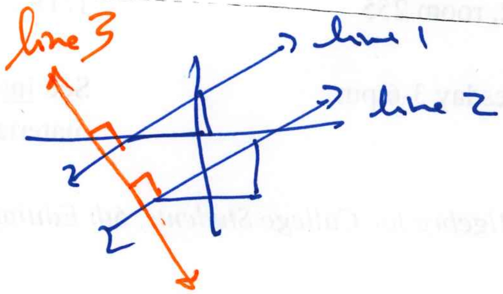
$3x = 2y + 6$

$2y = 3x - 6$ (0, b)

$y = \frac{3}{2}x - 3$ (0, -3)

(2)

~~7.4~~ Sec 7.3



$m_1 = m_2$

$m_3 = -\frac{1}{m_1}$

Video!! Parallel lines have equal slope

Perpendicular lines (90° right angle positions) have slopes which are negative reciprocal

Ex l_1: $m = 6$, l_2 is parallel ||, $m_2 = 6$

l_3 is perpendicular to l_1, l_2, $m_3 = \frac{-1}{6}$

⊥

Ex l_1: $m_1 = -\frac{1}{9}$, l_3: ⊥ to l_1, $m_3 = 9$

$-\left(\frac{-9}{1}\right)$

Ex Given l_1: $y = 3x - 2$, find any line parallel to l_1 (its eqn): $y = 3x + 2$

and perpendicular to l_1: $y = -\frac{1}{3}x + 2$

Ex Find the slope of a line perpendicular to $8x - 2y = 1$ → establish the slope of this line first

$-2y = -8x + 1 \longrightarrow y = \frac{-8}{-2}x + \frac{1}{-2}$ (3)

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

So any ⊥ line to this line has $m = -\frac{1}{4}$

Finally, with $m = -\frac{1}{4}$, find the eqn of the line through $(2, -3)$. [we have $m = -\frac{1}{4}$; we have pt $(2, -3)$; use pt-slope form:

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

$y - (-3) = -\frac{1}{4}\left(x - \frac{2}{1}\right)$

Now convert this to $Ax + By + C = 0$ general form

$y + 3 = -\frac{1}{4}x + \frac{1}{2} \Rightarrow 0 = -\frac{1}{4}x + \frac{1}{2} - y - 3$

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

$A = -\frac{1}{4}, \; B = -1, \; C = -2\frac{1}{2}$

Ex Find the eqn of the line parallel to $x - 4y + 9 = 0$ and through $(-1, 5)$.

To Solve: First put $x - 4y + 9 = 0$ into $y = mx + b$ form

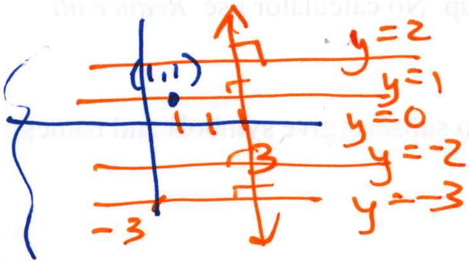
$-4y = -x - 9 \longrightarrow y = \frac{x}{4} + \frac{9}{4}$ $\boxed{m = \frac{1}{4}}$

Then put this into form $y - y_1 = m(x - x_1)$:

$y - 5 = \frac{1}{4}(x + 1)$

Ex Find the eqn of line ⊥ to $x = 3$, through pt $(1, 1)$

$m = 0$



First, any line ⊥ to $x=3$ are shown!

Horizontal lines $y = b$.

So $y = 1$ is our eqn.

$m = 0$, $m_{\perp}$ is ∞
→ undefined; "unbounded" is actual meaning.

Ex Find ① ∥ line and ② ⊥ line through pt $(7, -2)$ relative to $x - y + 3 = 0$

Last topic Sec 7.4 – Linear inequalities

We know that $x - y < 1$, then $y \gtrless$?

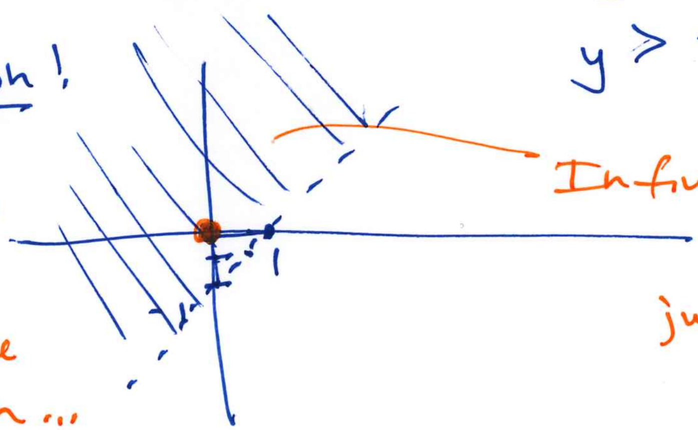
$x < y + 1 \rightarrow x - 1 < y$ or $\boxed{y > x - 1}$

or solve like: $-1y < 1 - x$, then

$y > -1 + x \rightarrow \boxed{y > 1x - 1}$

Graph!

1. First graph line



Infinite # of solns to linear inequality just like in one dimension.

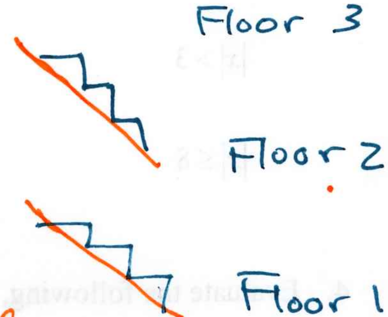
2. Shade region...

3. Check a pt in region; (0,0) if possible $0 - 0 < 1$ ✓

(2)

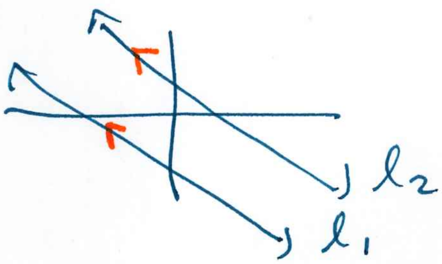
Sec 7.3 Parallel + Perpendicular Lines

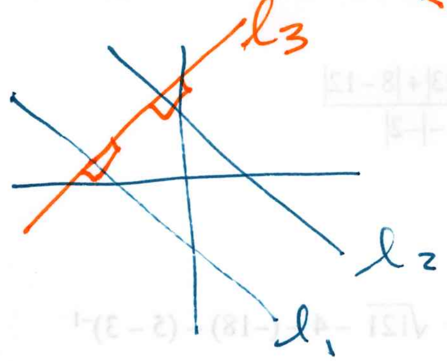
Symbols "||" "⊥"



Facts || lines have equal slopes.

Parallel l_1, l_2: $m_1 = m_2$





$m_3 = -\frac{1}{m_1}$

and $= \frac{-1}{m_2}$

⊥ lines have slopes that are negative reciprocals

Ex l_1 has $m_1 = \frac{2}{5}$,

$l_1 \parallel l_2$; $m_2 = \frac{2}{5}$

$l_1 \perp l_3$; $m_3 = -\frac{5}{2}$

Ex l_1: $2y - 6x = -3$, $l_2 \parallel l_1$ and goes through $(0, 0)$. Find eqn of l_2.

$m_1 = ?$ $2y - 6x = -3 \to 2y = 6x - 3$

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

$m_1 = 3$

Use pt-slope form: $y - y_1 = m(x - x_1)$

$y - 0 = 3(x - 0)$ → Simplified $y = 3x$

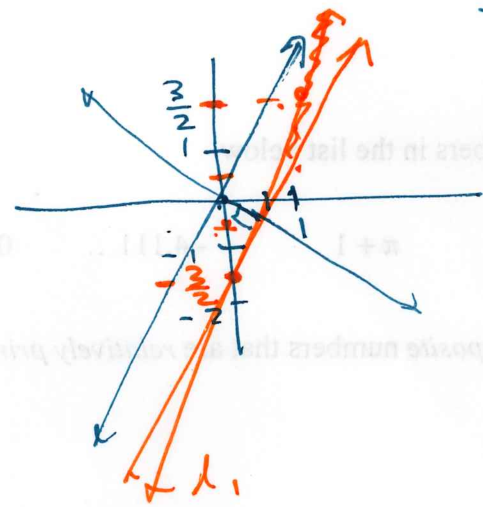
③ Now find l_3, which is $\perp$ to l_1: $y = 3x - \frac{3}{2}$

through $(0,0)$: $\boxed{m_3 = -\frac{1}{3}}$

from $m_1 = 3$ for l_1

$y - 0 = -\frac{1}{3}(x - 0) \longrightarrow \boxed{y = -\frac{1}{3}x}$ simplified

Graph!



l_1: $y = 3x - \frac{3}{2}$

$b = -\frac{3}{2}$

$m = \frac{3}{1}$

Ex for ~~hom~~ home:

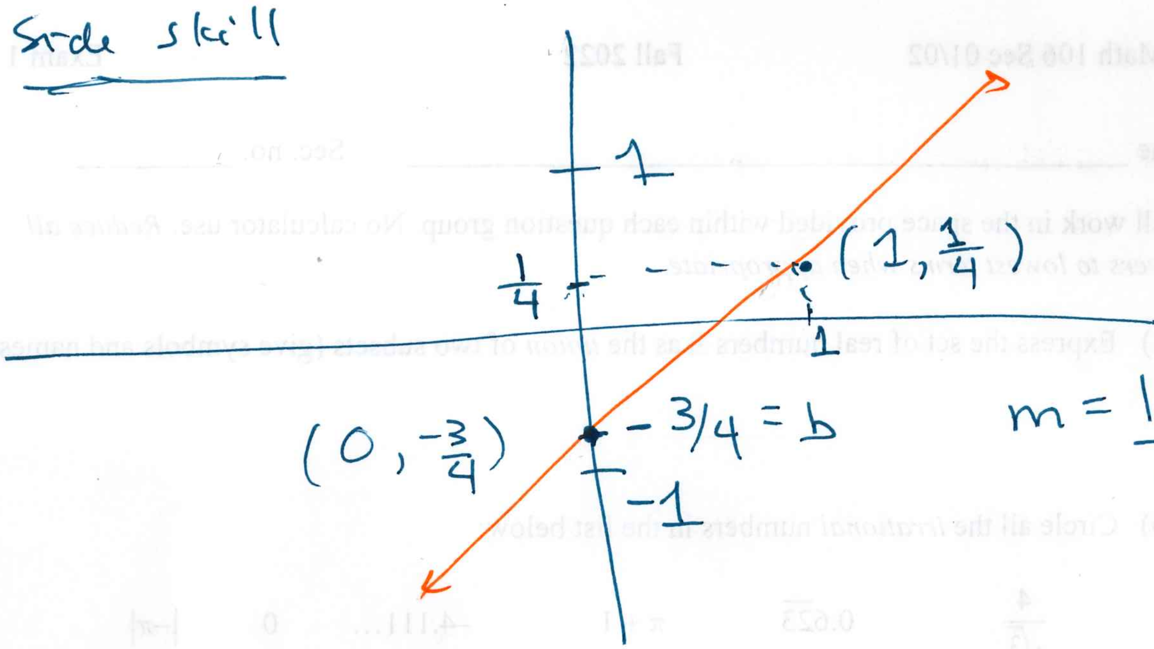
Find $l_2 \parallel$ to l_1: $2y - 8x + 1 = 0$

~~Fin~~ + through $(-3, 1)$.

Find $l_3 \perp$ to l_1 through $(-3, 1)$.

(Hint: Use pt-slope form)

(4) Side skill



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

Eqn? $b = -\frac{3}{4}$, $m = 1$ ∴ $y = mx + b$

$y = 1x - \frac{3}{4}$

As $Ax + By + C = 0$

$0 = x - y - \frac{3}{4}$ → $1x - y - \frac{3}{4} = 0$ $\quad A = 1,\ B = -1,\ C = -\frac{3}{4}$

or $4x - 4y - 3 = 0$

~~Back to $y = 3x$, $y = 3x - \frac{3}{2}$~~

5)

Sec 7.4 Graphing Linear Inequalities

Before $2x - y < 6 \rightarrow$ Isolate y:

$-y < -2x + 6 \rightarrow y > 2x - 6$

$\div -1$

Graph 1. Treat it like $y = 2x - 6$ and graph it, using dashed line because it's "strict inequality"

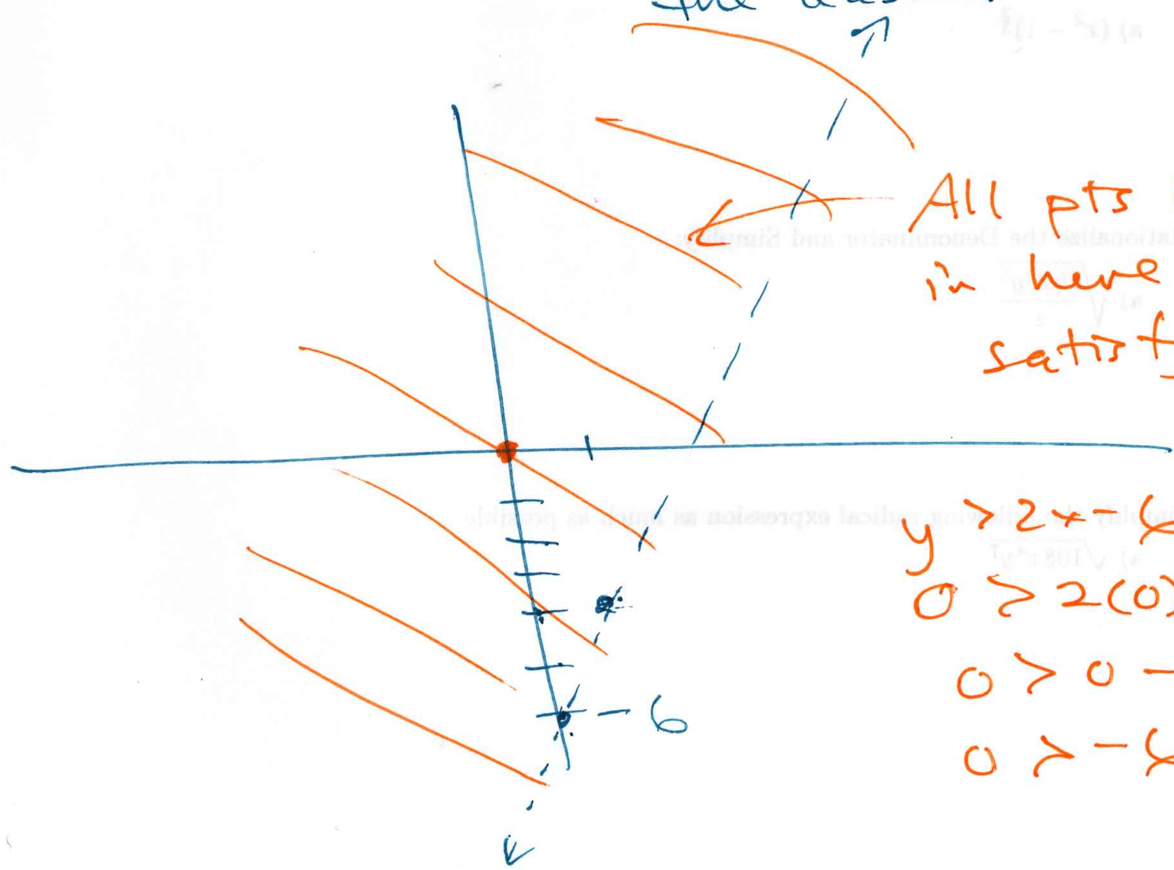
$<$

$>$

$\leq$

$\geq$

2. Shade the region above the dashed line.



All pts (x, y) in here satisfy

$y > 2x - 6$

$0 > 2(0) - 6$

$0 > 0 - 6$

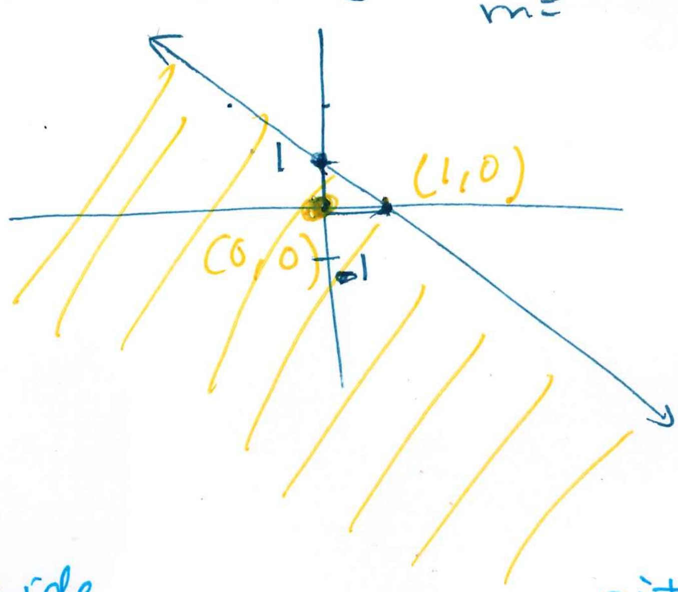
$0 > -6$

6

Ex Graph $y \leq -x + 1$
$m =$

Instead of dashed line, draw solid line

"less than or equal to"



Aside

$\frac{\text{rise}}{\text{run}}$ positive

$\frac{\text{rise}}{\text{run}}$ negative