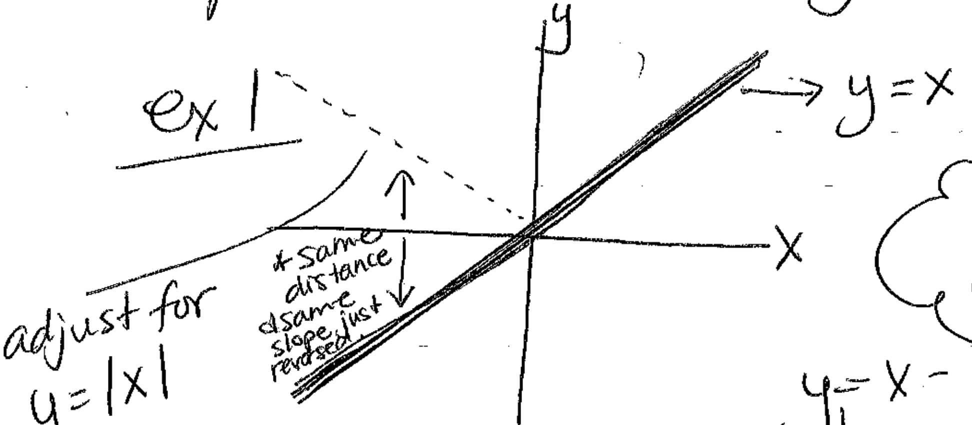
8.1

CHAPTER 8 Notes

* just like | | of a number $|f(x)|$ cannot be less than zero
So to draw an absolute value graph, draw the graph as it normally would be the 'adjust' the values positive when they are negative.

ex 1



with a table of values

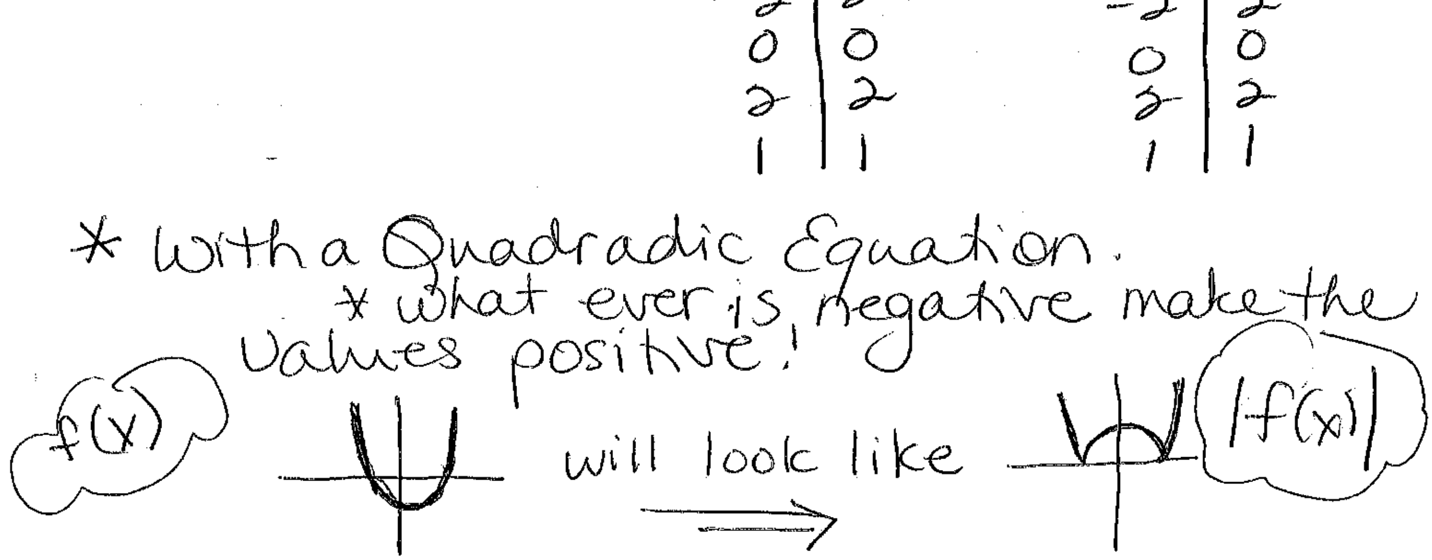
$y = x$

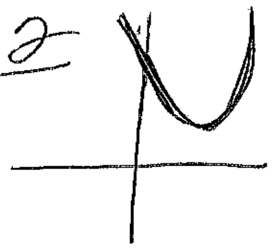
x	y
-1	-1
-2	-2
0	0
2	2
1	1

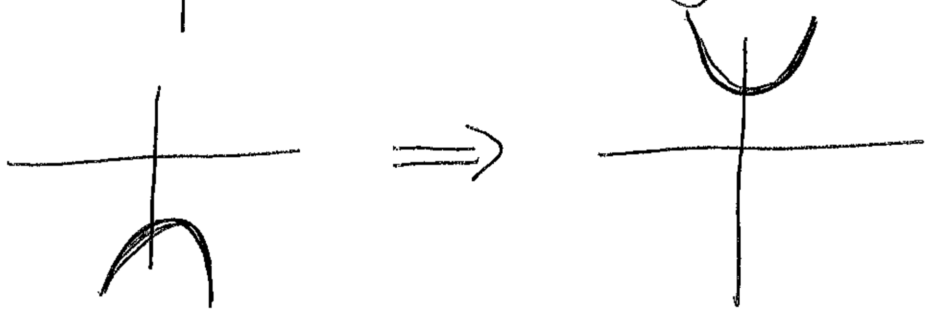
$y = |x|$

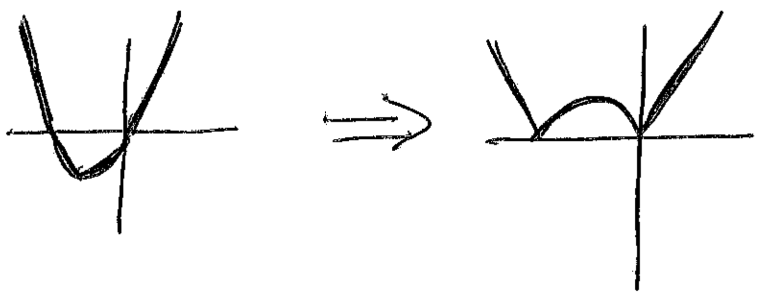
x	y
-1	1
-2	2
0	0
2	2
1	1

* with a Quadradic Equation.
  * what ever is negative make the values positive!



ex 2  ⇒ stays the same
*no neg values!



and 

* piecewise notation

ex #1 $y = |2x - 1|$

so $y = \begin{cases} 2x - 1 & \text{if } x \geq \frac{1}{2} \\ -2x + 1 & \text{if } x < \frac{1}{2} \end{cases}$

* State when the equation "flips" because of negative values.

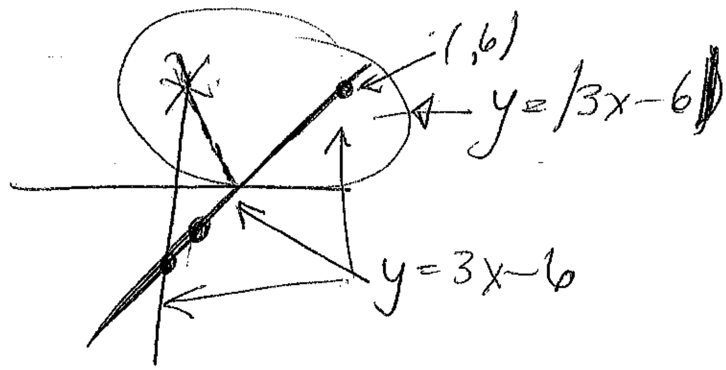
ex #2 $y = |x + 1|$

piecewise $y = \begin{cases} x + 1 & \text{if } x \geq -1 \\ -x + 1 & \text{if } x < -1 \end{cases}$

8.2 Solving absolute value Equations

(1) Solve by graphing

$|3x-6| = 6$



a) graph → $3x - 6 = y$

slope ↑ 3/1 — 3 - up, 1 - over

y intercept ↑

(i) Ask is y=6 on the line
(ii) Is the answer a + #?
(iii) use algebra to find the answer

$6 = 3x - 6$
$+6 \quad +6$
$\frac{12}{3} = \frac{3x}{3}$
$x = 4$ ← is this the answer on the graph?

Now ask - is there another point? (X on graph above)

What would that point be?

$|3x - 6| = 6$

↑ what would make this 6 → $|3(0) - 6| = 6$

$|-6| = 6$

$6 = 6$

8.2 Use a graphing calculator (can find online)

$|x^2-2x-15|=16$

① [$y_1=$] [MATH] > [NUM] (at top) 1: abs

$x^2-2x-15)$

② [$y_2=$] 16

③ go to 2nd TRACE – intersection

④ find all intersection points (just like gr. calc. assignment ① put on one line; enter ② put on other U; enter ③ enter.

you should find 3 points:

$x = \sim 4.7,\ 1,\ \sim 6.7$

Find by Algebra → $2|3x+1|=2x-8$

* because we dont know if it is positive or negative; you have to force it to be positive and negative.

make it positive	make it negative
$2(3x+1)=2x-8$	$2(3x+1)=2x-8$
$\div 2 \qquad \div 2$	$\div 2 \qquad \div 2$
$3x+1=x-4$	$-(3x+1)=x-4$
$-1 \qquad -1$	$-3x-1=x-4$
$3x=x-5$	$+1 \qquad +1$
$-x \qquad -x$	$-3x=x-3 \Rightarrow -4x=-3 \Rightarrow x=\frac{-3}{-4}$ or $\frac{3}{4}$
$2x=-5 \Rightarrow x=\frac{-5}{2}$	$-x \qquad -x$

Algebra cont... $|3x+1| = x-4$

* **now** check to see if it works (plug back in)

$-\frac{5}{2}$	$\frac{3}{4}$
$\left|3\left(-\frac{5}{2}\right)+1\right| = \left(\frac{-5}{2}\right)-4$	$\left|3\left(\frac{3}{4}\right)+1\right| = \left(\frac{3}{4}\right)-4$
$\left|\frac{-15}{2}+1\right| = \frac{-5}{2}-\frac{8}{2}$	$\left|\frac{9}{4}+\frac{4}{4}\right| = \frac{3}{4}-\frac{16}{4}$
$\left|\frac{-15}{2}+\frac{2}{2}\right| = \frac{-13}{2}$	$\left|\frac{13}{4}\right| = \frac{-13}{4}$
$\left|\frac{-13}{2}\right| = \frac{-13}{2}$	$\frac{13}{4} \neq \frac{-13}{4}$
$+\frac{13}{2} \neq \frac{-13}{2}$	
* doesn't work!	* doesn't work!

↳ Therefore - these two lines DO NOT intersect.

Chapter 8 notes:

Absolute value graphs:

* CANNOT BE NEGATIVE!

- graph regular line + then switch the sign on any negative y values

A LINEAR EQUATION

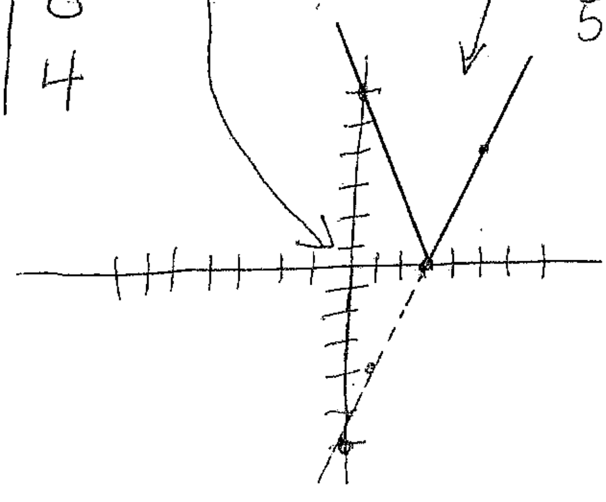
ex. $y = |2x - 6|$

$2x-6$

x	y
0	-6
1	-4
3	0
5	4

$|2x-6|$

x	y
0	$\|-6\| = 6$
1	$\|-4\| = 4$
3	$\|0\| = 0$
5	$\|4\| = 4$



A QUADRATIC EQUATION

* do regular quad equation then flip neg. y values

ex $y = |x^2 + 2x - 3|$

$x^2 + 2x - 3 = y$

① $(x-1)(x+3)$ — x intercepts

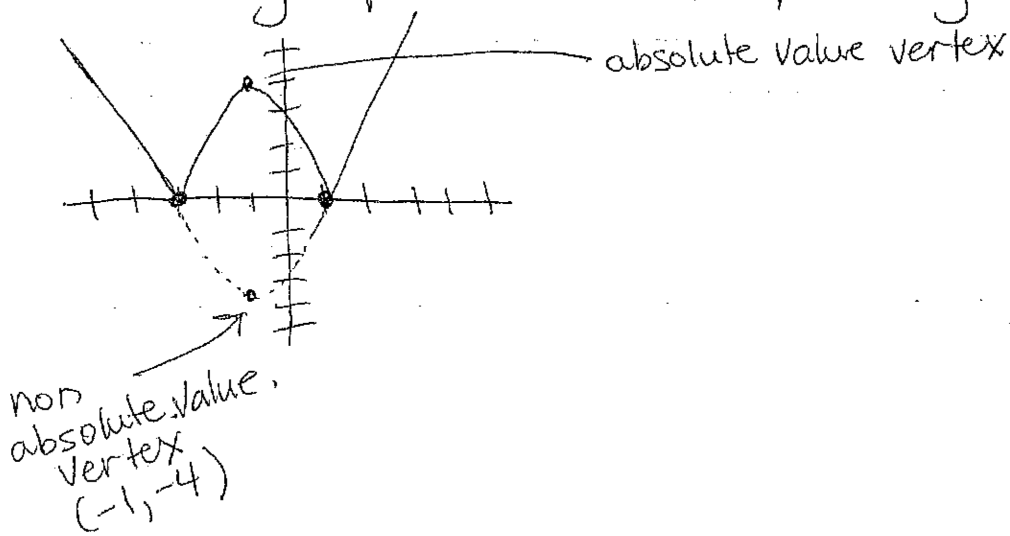
② $\frac{1+-3}{2} = \frac{-2}{2} = -1$ — line of symmetry

③ $(-1)^2 + 2(-1) - 3 = 0$ — vertex — plug in x value of line of symmetry

$1 - 2 - 3 = -4$

$(-1, -4)$

* now graph then flip neg values

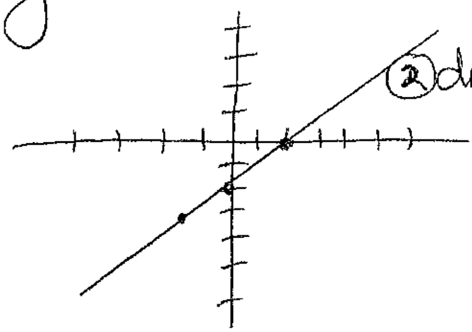


Graphing Reciprocal of a Line $\frac{1}{f(x)}$

① find the asymptotes (what x cant be or x intercepts of the original line)

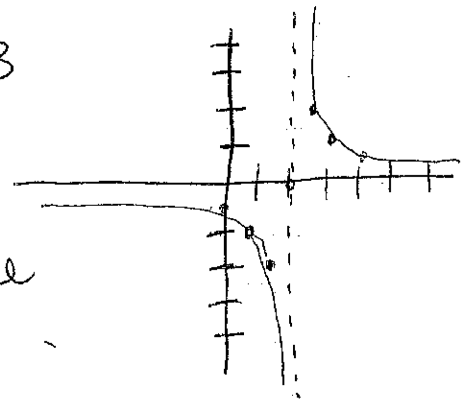
original equation

$y = x - 2$ ⇒ reciprocal $\frac{1}{x-2}$ $x \neq 2$ * or $\frac{1}{0}$



② draw original equation using a table of values

x	y
0	-2
2	0
-1	-3



③ fill in asymptote
④ calculate a few values on either side of the asymptote

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

x	y
3	1
1	-1
4	$\frac{1}{2}$
2.5	$\frac{1}{.5}$ or $\frac{1}{\frac{1}{2}}$ or $\frac{2}{1}$

⑤ sketch in lines & continue curve approaching 0

GRAPHING A RECIPROCAL OF A QUADRATIC

① find asymptotes (what x can't be or where original equation's x intercepts are located)

<u>original equation</u>: $x^2 - x - 6$

$(x-3)(x+2) \Rightarrow$ x intercepts $\Rightarrow +3, -2$

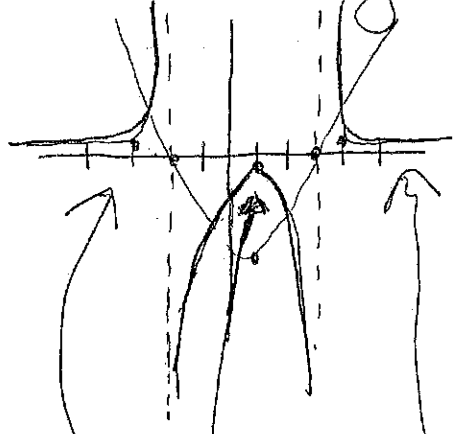
② find vertex

line of symmetry $\frac{+3 + -2}{2} = \frac{1}{2}$

$\left(\frac{1}{2}\right)^2 - \left(\frac{1}{2}\right) - 6 = \frac{1}{4} - \frac{1}{2} - 6 = -6\frac{1}{4}$

$V\left(\frac{1}{2}, -6\frac{1}{4}\right)$

③ Draw original equation



④ draw asymptotes

⑤ calculate a few values on the sides of the asymtotes for the reciprocal

$\frac{1}{x^2-x-6}$

x	y
4	$\frac{1}{4^2-4-6} = \frac{1}{6}$
-3	$\frac{1}{(-3)^2-(-3)-6} = -\frac{1}{6}$

* asymtotes at 3 & -2

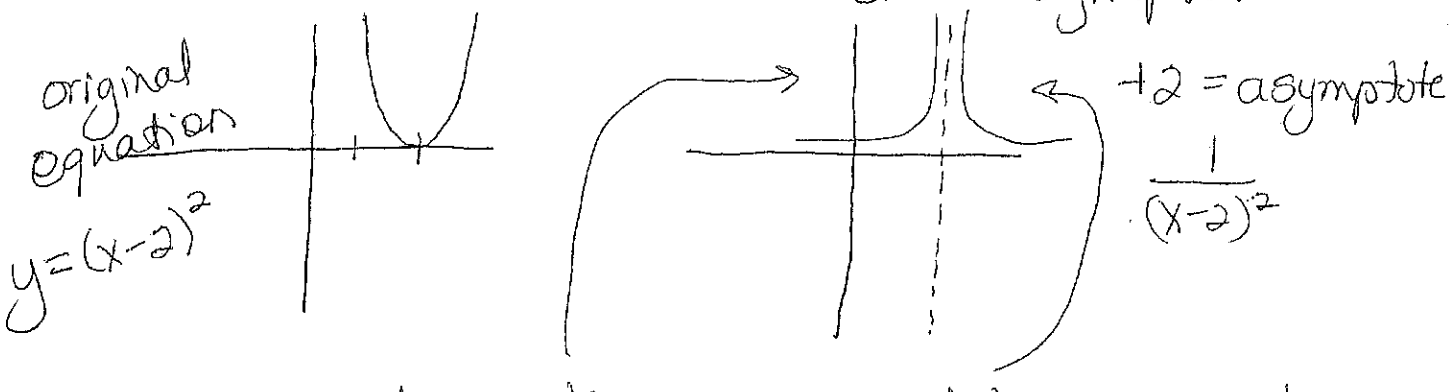
then draw curves approaching but not crossing asymptote or $y=0$

⑥ Calculate the reciprocal of the vertex

$x = \frac{1}{2}$ $\quad y = \frac{1}{-6\frac{1}{4}} = -\frac{1}{\frac{25}{4}}$ or $-\frac{4}{25}$ & graph filling in curves between asymtotes

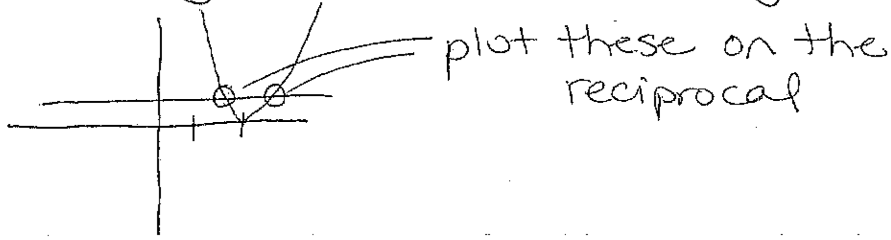
IF the quadratic has only **one root**

it curves around the one asymptote



* draw lines approaching $y=0$ & asymptote

To get more exact points → record where $y=1$ intersects the graph



IF the quadratic has **NO ROOTS**

the reciprocal curves up to meet it.

* find the vertex for the original equation then the reciprocal

$-2x^2-0.5$

$-2(x)^2-0.5$

$V(0,-0.5)$

reciprocal $V(0,\frac{1}{-0.5})$ $\quad \frac{1}{-\frac{1}{2}}=-2$

or $(0,-2)$