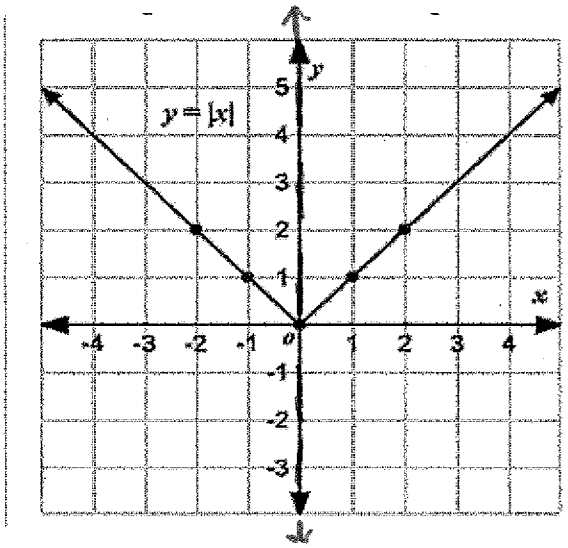
NOTES 2-1

Algebra II UNIT 2 Absolute Value Functions

Parent Function:

Name: Absolute Value

Equation: $y = |x|$ or $f(x) = |x|$ Graph:



Domain: $(-\infty, \infty)$

Range: $[0, \infty)$

Minimum: (0 , 0)

Symmetrical about the line: $x = 0$

Parameter Changes: $y = a|b(x - h)| + k$

a =vertical stretch, vertical compress, and reflect x-axis

b= horizontal stretch, horizontal compress, and reflect y-axis (1/b)

h = horizontal shift left, right

k = vertical shift up, down

Describe the Transformation:

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

1. V. Comp 1/2
2. H. Reflection
3. Up 4

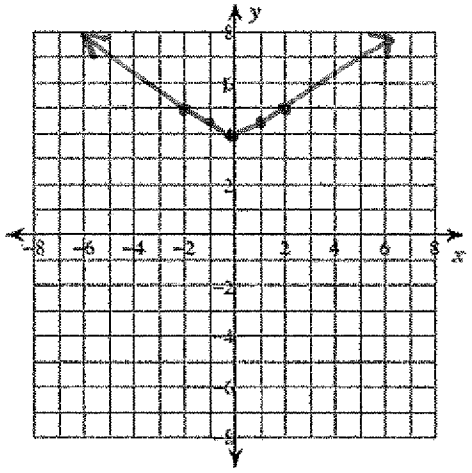
Domain $(-\infty, \infty)$

Range $[4, \infty)$

Max or (Min) (0 , 4)

Symmetric about the line $x = 0$

h +0	b (-1)	x	y	a (1/2)	k +4
2	2	-2	2	1	5
1	1	-1	1	.5	4.5
0	0	0	0	0	4
-1	-1	1	1	.5	4.5
-2	-2	2	2	1	5



2. $y = 2|x - 5| + 3$

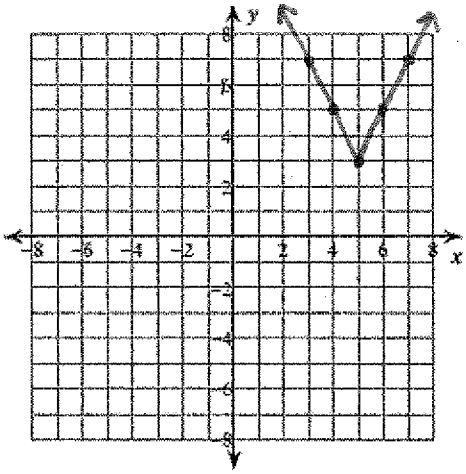
1. V. Stretch 2
2. Right 5
3. Up 3

Domain $(-\infty, \infty)$

Range $[3, \infty)$

Max or (Min) (5 , 3)

h +5	b (1)	x	y	a (2)	k +3
3	-2	-2	2	4	7
4	-1	-1	1	2	5
5	0	0	0	0	3
6	1	1	1	2	5
7	2	2	2	4	7



Symmetric about the line $x = 5$

3. $y = -3|2x + 6| - 5$

Factor first:

$y = -3|\ 2(x+3)| - 5$

1. V. Reflect
2. V. Stretch 3
3. H. Comp 1/2
4. Left 3
5. Down 5

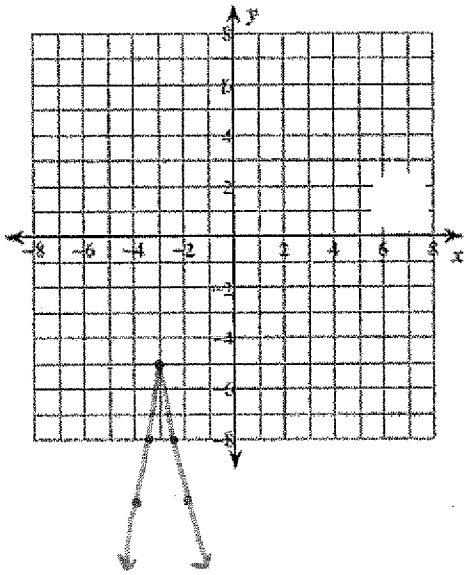
Domain $(-\infty, \infty)$

Range $(-\infty, -5]$

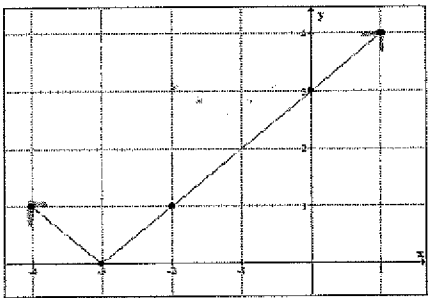
Max or Min $(-3, -5)$

Symmetric about the line $x = -3$

h	b	x	y	a	k
-3	(1/2)			(-3)	-5
-4	-1	-2	2	-6	-11
-3.5	-.5	-1	1	-3	-8
-3	0	0	0	0	-5
-2.5	.5	1	1	-3	-8
-2	1	2	2	-6	-11

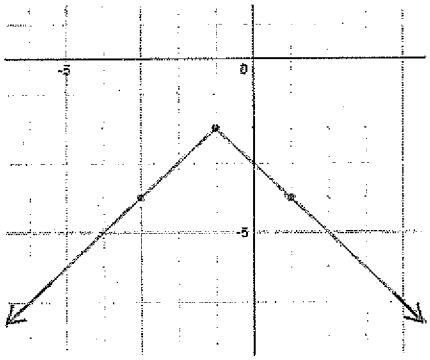


Given the graph:

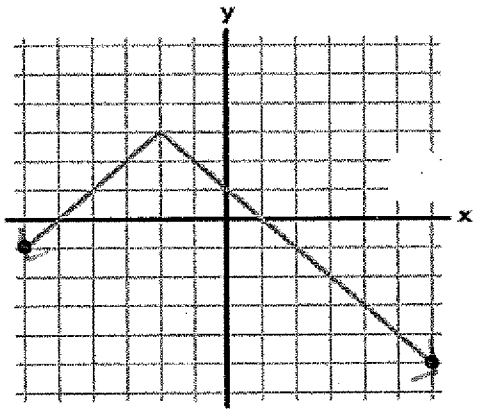


Transformations:

1. Left 3



1. V. Reflect
2. Left 1
3. Down 2



1. V. Reflect
2. Left 2
3. Up 3

Equation: $y = |x+3|$

Domain: $(-\infty, \infty)$

Range: $[0, \infty)$

Max or Min $(-3, 0)$

Symmetric about the line $x = -3$

Equation: $y = -|x+1| - 2$

Domain: $(-\infty, \infty)$

Range: $(-\infty, -2]$

Max or Min $(-1, -2)$

Symmetric about the line $x = -1$

Equation: $y = -|x+2| + 3$

Domain: $(-\infty, \infty)$

Range: $(-\infty, 3]$

Max or Min $(-2, 3)$

Symmetric about the line $x = -2$

NOTES 2-2

Algebra II Unit 2 Absolute Value Functions
Solving Absolute Value Equations

Steps:

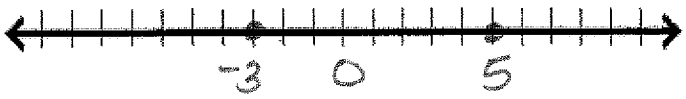
1. Isolate the Absolute Value.
2. **Is the Absolute Value equal to a negative number? If yes, then there is *no solution*.** If no, continue to Step 3...
3. Set the expression inside the Absolute Value equal to the - and + quantity on other side.
4. Solve for the variable in both equations (2 solutions).

1) $|p-1|=4$

$p-1=4$ $\quad$ $p-1=-4$

$+1 \quad +1$ $\quad$ $+1 \quad +1$

$\boxed{p=5}$ $\quad$ $\boxed{p=-3}$



OYO: $|5-b|=2$

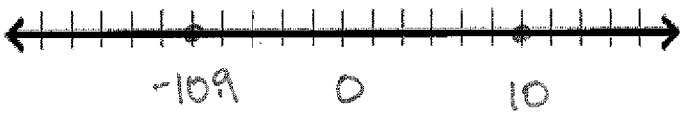
2) $|3+7x|=73$

$3+7x=73$ $\quad$ $3+7x=-73$

$-3 \quad -3$ $\quad$ $-3 \quad -3$

$\frac{7x}{7}=\frac{70}{7}$ $\quad$ $\frac{7x}{7}=-\frac{76}{7}$

$\boxed{x=10}$ $\quad$ $\boxed{x=-10.9}$



OYO: $|-3x-15|=12$

3) $\frac{5|7x+3|}{5} = \frac{0}{5}$

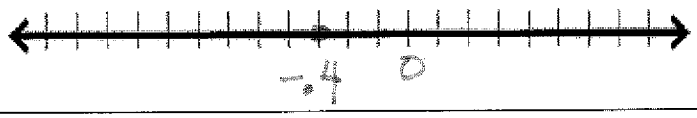
$|7x+3| = 0$ → one solution because there isn't a negative 0

$7x+3 = 0$

$-3 \quad -3$

$\frac{7x}{7} = \frac{-3}{7}$

$\boxed{x = -.4}$



OYO: $-8|3-8k| = 40$

4) $-3|9m+3| + 13 = 13$

$-13 \quad -13$

$\frac{-3|9m+3|}{-3} = \frac{0}{-3}$

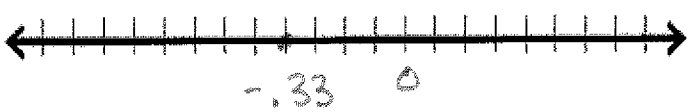
$|9m+3| = 0$

$9m+3 = 0$

$-3 \quad -3$

$\frac{9m}{9} = \frac{-3}{9}$

$m = -1/3$ or $-.33$

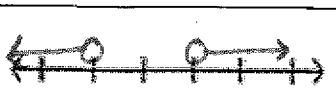
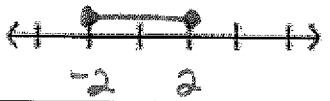


OYO: $4-3|-6-x| = -14$

NOTES 2-3

Algebra II Unit 2 Absolute Value Functions

Solving Absolute Value Inequalities

Math Sentence	Answer	Graph	What does it mean in words?
$\|x\|=2$	$x=2$ $x=-2$		the solutions ARE 2 units from 0
$\|x\|>2$	$x>2$ OR $x<-2$		Solutions are more than 2 units from 0
$\|x\|\leq 2$	$x\leq 2$ AND $x\geq -2$		Solutions are less than or equal to 2 units from 0

"great-or"
Shade in opposite directions
"less th-and"
Shade between

"KISS" Method for Solving Absolute Value Inequalities: **KEEP IT – SWITCH - SWITCH**

Step 1: Get the absolute value part alone.

Step 2: Write the problem in two ways.

1) **Re-write the inequality the same, just drop the absolute value bars**
2) **Flip the inequality symbol and change the sign of the number on the other side.**

****Never change the expression on the inside****

Step 3: Solve both inequalities for x.

Step 4: Graph your solutions on the number line.

Step 5: Write your solution as a compound inequality.

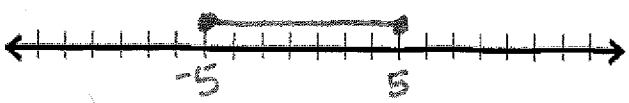
(If the shading goes outward, it's an "OR". If it goes inward, it's an "AND".)

$|x|+2\leq 7$

$-2 \quad -2$

$|x|\leq 5$

$x\leq 5 \qquad x\geq -5$



$x\leq 5$ AND $x\geq -5$

$-5\leq x\leq 5$

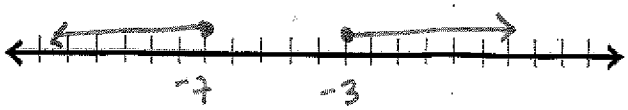
$\frac{3|x+5|}{3}\geq\frac{6}{3}$

$|x+5|\geq 2$

$x+5\geq 2 \qquad x+5\leq -2$

$-5 \quad -5 \qquad -5 \quad -5$

$x\geq -3 \qquad x\leq -7$



$x\geq -3$ OR $x\leq -7$

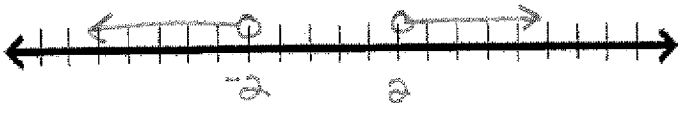
1. $\left|\frac{m}{2}\right| + 5 > 6$

$-5 \quad -5$

$\left|\frac{m}{2}\right| > 1$

2. $\frac{m}{2} > 1 \cdot 2$ 2. $\frac{m}{2} < -1 \cdot 2$

$m > 2$ $m < -2$



$m < -2$ OR $m > 2$

OYO: $|2x - 6| - 5 > 3$

2. $-2|3p + 12| - 10 \geq -24$

$+10 \quad +10$

$\frac{-2|3p+12|}{-2} \geq \frac{-14}{-2}$

*divided by negative, flip symbol

$|3p + 12| \leq 7$

$3p + 12 \leq 7$ $\quad -12 \quad -12$

$\frac{3p}{3} \leq \frac{-5}{3}$

$p \leq -1.7$

$3p + 12 \geq -7$ $\quad -12 \quad -12$

$\frac{3p}{3} \geq \frac{-19}{3}$

$p \geq -6.3$

$-6.3 \leq p \leq -1.7$

OYO: $-3|6 - 3k| - 10 \leq -82$

3. $9 - 2|4x + 1| > 3$

$-9 \quad -9$

$\frac{-2|4x+1|}{-2} > \frac{-6}{-2}$

$|4x + 1| < 3$

$4x + 1 < 3$ $\quad -1 \quad -1$

$\frac{4x}{4} < \frac{2}{4}$

$x < 1/2$

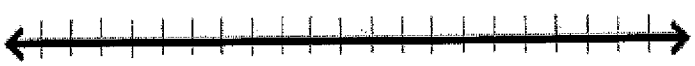
$4x + 1 > -3$ $\quad -1 \quad -1$

$\frac{4x}{4} > \frac{-4}{4}$

$x > -1$

$-1 < x < 1/2$

OYO: $-4 - 3|x| \leq -16$



NOTES 2-4

Algebra II UNIT 2 Absolute Value Functions

bsolute Value Word Problems:

$$|x - acceptable\ amount| = tolerance$$

1. You have money in your wallet, but you don't know the exact amount. When a friend asks you, you say that you have 50 dollars give or take 15. Write an absolute value equation to find the least and greatest amount of money in your wallet.

Let x be the possible amount in your wallet. $|x-50| = 15$

Separate into 2 equations. Solve each equation.

$X - 50 = 15$
$+50 \quad +50$
$X = 65$
greatest amount

$X - 50 = -15$
$+50 \quad +50$
$X = 35$
least amount

A machine fills Quaker Oatmeal containers with 32 ounces of oatmeal. After the containers are filled, another machine weighs them. If the container's weight differs from the desired 32 ounce weight by more than .5 ounces, the container is rejected. Write an absolute value equation that can be used to find the lowest and highest acceptable weights. Solve the equation.

$|X - 32| = .5$

$X - 32 = .5$
$+32 \quad +32$
$X = 32.5$
greatest

$X - 32 = -.5$
$+32 \quad +32$
$X = 31.5$
least

3. A company that makes golf tees needs to ship bags that contain 690 tees, plus or minus six tees. Write an absolute value equation that can be used to find the minimum and maximum number of tees that can be shipped. Solve the equation.

$|X - 690| = 6$

$X - 690 = 6$
$+690 \quad +690$
$X = 696$
greatest

$X - 690 = -6$
$+690 \quad +690$
$X = 684$
least