

Name: Key

Math 20-1

Absolute Value and Reciprocal Functions  
Assignment 2: Solving Absolute Value Equations

1. Describe clearly how to use the method of intersection to solve the equation  $|x + 3| = 4$ . State the solution.

graph  $y_1 = |x + 3|$

$y_2 = 4$

use intersect function to find  
x-coordinates of points of  
intersection

$x = -7, 1$

2. Describe clearly how to use the x-intercept method to solve the equation  $|x - 2| = x + 1$ . State the solution.

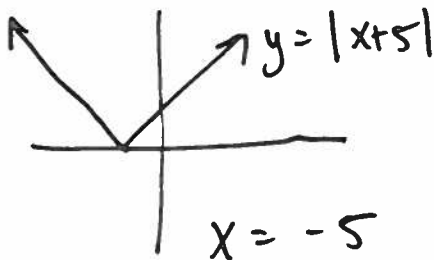
graph  $y_1 = |x - 2| - x - 1$

→ use zero feature to find x-intercept

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

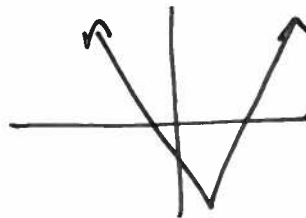
3. Solve each of the following equations graphically. Sketch and label each graph.

a.  $|x + 5| = 0$



b.  $|1 - 4x| = x + 4$

$y_1 = |1 - 4x| - x - 4$

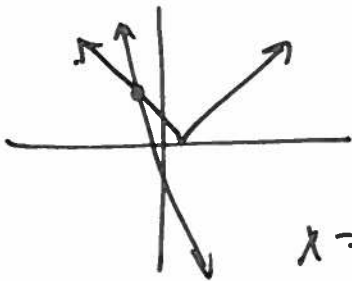


$x = -0.6, 1^2/3$

$$c. |4 - x| = -2x - 10$$

$$y_1 = |4 - x|$$

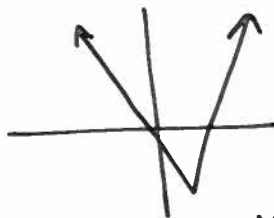
$$y_2 = -2x - 10$$



$$x = -14.$$

$$d. 3|x - 8| = 2x + 7$$

$$y_1 = 3|x - 8| - 2x - 7$$



$$x = 31, 3.4$$

$$x \in [-10, 50, 5]$$

$$y \in [-10, 10, 1]$$

4. Solve each of the following equations algebraically. Verify.

$$a. |2x + 1| = x$$

$$-2x - 1 = x$$

$$-1 = 3x$$

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

verify:

$$|2(-\frac{1}{3}) + 1| = -\frac{1}{3}$$

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

no

$$2x + 1 = x$$

$$x = -1$$

$$|2(-1) + 1| = -1$$

$$|-2 + 1| = -1$$

$$|-1| = -1$$

$$1 = -1$$

no

no solution.

$$b. |3x - 1| = 4$$

$$-3x + 1 = 4$$

$$-3x = 3$$

$$x = -1$$

verify:

$$|3(-1) - 1| = 4$$

$$|-3 - 1| = 4$$

$$|-4| = 4$$

yes.

$$3x - 1 = 4$$

$$3x = 5$$

$$x = \frac{5}{3}$$

$$|3(\frac{5}{3}) - 1| = 4$$

$$|5 - 1| = 4$$

$$4 = 4$$

yes.

$$x = -1, \frac{5}{3}$$

$$c. 3|x-8| = 2x+7$$

$$3(x-8) = 2x+7$$

$$3x-24 = 2x+7$$

$$x = 31$$

verify.

$$3|31-8| = 2(31)+7$$

$$3(23) = 69$$

$$69 = 69$$

✓

$$x = 31, \frac{17}{5}$$

$$3(-x+8) = 2x+7$$

$$-3x+24 = 2x+7$$

$$-5x = -17$$

$$x = \frac{17}{5}$$

$$3\left|-\frac{17}{5}+8\right| = 2\left(\frac{17}{5}\right)+7$$

$$13.8 = 13.8$$

✓

$$d. |2x-8|-2 = 4x$$

$$-2x+8-2 = 4x$$

$$6 = 6x$$

$$x = 1$$

verify.

$$|2(1)-8|-2 = 4(1)$$

$$|-6|-2 = 4$$

$$6-2 = 4$$

$$4 = 4$$

✓

$$x = 1$$

$$|2x-8|-2 = 4x$$

$$-10 = 2x$$

$$x = -5$$

$$|2(-5)-8|-2 = 4(-5)$$

$$|-10-8|-2 = -20$$

$$18-2 = -20$$

$$16 = -20$$

no

$$e. |x^2-26| = 10$$

$$x^2-26 = 10$$

$$x^2 = 36$$

$$x = \pm 6$$

$$-x^2+26 = 10$$

$$-x^2 = -16$$

$$x^2 = 16$$

$$x = \pm 4$$

$$|6^2-26| = 10$$

$$10 = 10$$

$$|(-6)^2-26| = 10$$

$$10 = 10$$

$$|(-(-4))^2+26| = 10$$

$$|-16+26| = 10$$

$$10 = 10$$

$$|-(4)^2+26| = 10$$

$$|-16+26| = 10$$

$$10 = 10$$

$$x = \pm 4, \pm 6$$

$$f. |x^2+10x+15| = 6$$

$$x^2+10x+15 = 6$$

$$x^2+10x+9 = 0$$

$$(x+9)(x+1) = 0$$

$$x = -9, -1$$

verify  $x = -9$

$$|(-9)^2+10(-9)+15| = 6$$

$$|81-90+15| = 6$$

$$6 = 6 \checkmark$$

verify  $x = -1$

$$|(-1)^2+10(-1)+15| = 6$$

$$6 = 6 \checkmark$$

$$x = -9, -1, -3, -7$$

$$-x^2-10x-15 = 6$$

$$x^2+10x+21 = 0$$

$$(x+3)(x+7) = 0$$

$$x = -3, -7$$

verify  $x = -3$

$$|(-3)^2+10(-3)+15| = 6$$

$$|9+(-30)+15| = 6$$

$$6 = 6 \checkmark$$

verify  $x = -7$

$$|(-7)^2+10(-7)+15| = 6$$

$$|49-70+15| = 6$$

$$6 = 6$$

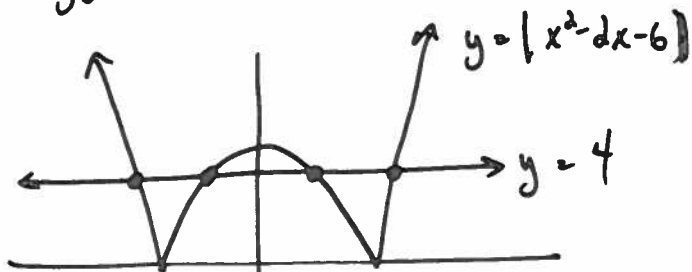
5. Use a graphing calculator to solve, to the nearest tenth, the absolute value equations. Sketch and label the graphs.

a.  $|x^2 - 2x - 6| = 4$

$y_1 = |x^2 - 2x - 6|$

$y_2 = 4$

intersect feature

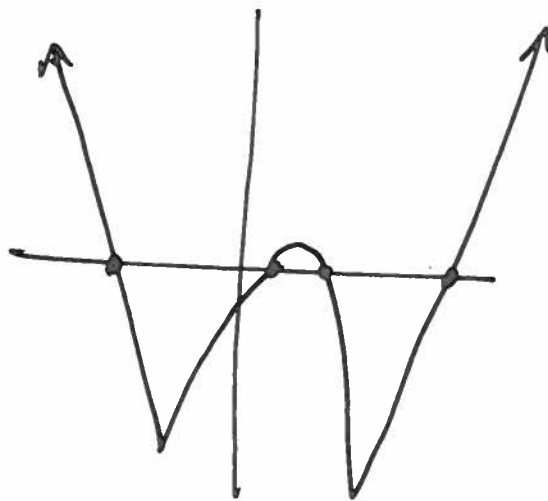


$x = -2.3, -0.7, 2.7, 4.3$

b.  $|12 + 3x - x^2| - 14 = 0$

$|12 + 3x - x^2| - 14 = 0$

zero feature



$x = -3.8, 1.0, 2.0, 6.8$

6. Solve  $|x^2 + 4x - 15| = 6$  algebraically. Verify.

$x^2 + 4x - 15 = 6$

$x^2 + 4x - 21 = 0$

$(x-3)(x+7) = 0$

$x = 3, -7$

verify 3

$|(3)^2 + 4(3) - 15| = 6$

$|9 + 12 - 15| = 6$

$6 = 6$  ✓

verify -7

$|(-7)^2 + 4(-7) - 15| = 6$

$6 = 6$  ✓✓

$-x^2 - 4x + 15 = 6$

$0 = x^2 + 4x - 9$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(-9)}}{2(1)}$

$x = \frac{-4 \pm \sqrt{52}}{2} = -2 \pm \sqrt{13}$

$x = -2 + \sqrt{13} \sim 1.60555$

$-2 - \sqrt{13} \sim -5.60555$

verify  $-2 + \sqrt{13}$

$|(-2 + \sqrt{13})^2 + 4(-2 + \sqrt{13}) - 15| = 6$

$|-6.000005102| = 6$  ✓

verify  $-2 - \sqrt{13}$

$|(-2 - \sqrt{13})^2 + 4(-2 - \sqrt{13}) - 15| = 6$

$|-5.99999| = 6$  ✓

$x = -7, 3, -2 \pm \sqrt{13}$