

*Part A: Absolute Value Equations***Practice 1**

1.

$$\left|\frac{3}{4}x\right| = 5$$

$$\frac{3}{4}x = 5 \quad \text{OR} \quad -\left(\frac{3}{4}x\right) = 5$$

$$\frac{3}{4}x = -5$$

$$x = \frac{20}{3} \quad \text{OR} \quad x = -\frac{20}{3}$$

2.

$$|5x + 7| = 22$$

$$5x + 7 = 22 \quad \text{OR} \quad -(5x + 7) = 22$$

$$5x + 7 = -22$$

$$5x = 15 \quad \text{OR} \quad 5x = -29$$

$$x = 3 \quad \text{OR} \quad x = -\frac{29}{5}$$

3.

$$|3x - 6| = 4$$

$$3x - 6 = 4 \quad \text{OR} \quad -(3x - 6) = 4$$

$$3x = 10 \quad \quad \quad 3x - 6 = -4$$

$$x = \frac{10}{3} \quad \quad \quad 3x = 2$$

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

4.

$$4 = 5|v - 5|$$

$$\frac{4}{5} = |v - 5|$$

$$\frac{4}{5} = v - 5 \quad \text{OR} \quad \frac{4}{5} = -(v - 5)$$

$$\text{OR} \quad -\frac{4}{5} = v - 5$$

$$\frac{29}{5} = v \quad \text{OR} \quad \frac{21}{5} = v$$

5.

$$2|k - 2| = 8$$

$$|k - 2| = 4$$

$$k - 2 = 4 \quad \text{OR} \quad -(k - 2) = 4$$

$$\text{OR} \quad k - 2 = -4$$

$$k = 6 \quad \text{OR} \quad k = -2$$

6.

$$\left| \frac{2}{3}x - 1 \right| = 10$$

$$\frac{2}{3}x - 1 = 10 \quad \text{OR} \quad -\left(\frac{2}{3}x - 1\right) = 10$$

$$\frac{2}{3}x = 11 \qquad \qquad \frac{2}{3}x - 1 = -10$$

$$x = \frac{33}{2} \qquad \qquad \frac{2}{3}x = -9$$

$$x = -\frac{27}{2}$$

7.

$$3 = |x + 10|$$

$$3 = x + 10 \quad \text{OR} \quad 3 = -(x + 10)$$

$$-7 = x \qquad \qquad -3 = x + 10$$

$$-13 = x$$

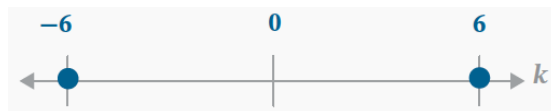


8.

$$\left| \frac{3}{2}k \right| = 9$$

$$\frac{3}{2}k = 9 \quad \text{OR} \quad -\frac{3}{2}k = 9$$

$$k = 6 \qquad \qquad k = -6$$



9.

$$4|w + 6| = 8$$

$$|w + 6| = 2$$

$$w + 6 = 2 \quad \text{OR} \quad -(w + 6) = 2$$

$$\text{OR} \quad w + 6 = -2$$

$$w = -4 \quad \text{OR} \quad w = -8$$

Midpoint:

$$\frac{(-4 + -8)}{2} = -\frac{12}{2} = -6$$



10.

$$|2x + 6| = 9$$

$$2x + 6 = 9 \quad \text{OR} \quad -(2x + 6) = 9$$

$$\text{OR} \quad 2x + 6 = -9$$

$$2x = 3 \quad \text{OR} \quad 2x = -15$$

$$x = \frac{3}{2} \quad \text{OR} \quad x = -\frac{15}{2}$$

Midpoint:

$$\frac{\left(\frac{3}{2} + \frac{-15}{2}\right)}{2} = \frac{\left(\frac{-12}{2}\right)}{2} = -\frac{6}{2} = -3$$



11.

Let  $w$  = weight of the eggs in oz

$$|w - 25.5| = 1.5$$

$$w - 25.5 = 1.5 \quad \text{OR} \quad -(w - 25.5) = 1.5$$

$$\text{OR} \quad w - 25.5 = 1.5$$

$$w = 27 \quad \text{OR} \quad w = 24$$

The maximum weight allowed is 27 oz.

The minimum weight allowed is 24 oz.



12.

 $p$ : points per game

$$|p - 9.5| = 1.5$$

$$p - 9.5 = 1.5$$

$$p = 11$$

OR

$$-(p - 9.5) = 1.5$$

$$p - 9.5 = -1.5$$

$$p = 8$$

Malek scored 8 points or 11 points in a game this season.

**Practice 2**

1.

$$|-d| = 2$$

$$-d = 2 \quad \text{OR} \quad -(-d) = 2$$

$$d = -2 \quad \text{OR} \quad d = 2$$

2.

$$\left|\frac{1}{2}x + 6\right| = 3$$

$$\frac{1}{2}x + 6 = 3$$

$$\frac{1}{2}x = -3$$

$$x = -6$$

OR

$$-\left(\frac{1}{2}x + 6\right) = 3$$

$$\frac{1}{2}x + 6 = -3$$

$$\frac{1}{2}x = -9$$

$$x = -18$$

3.

$$|2r - 7| = 3$$

$$2r - 7 = 3 \quad \text{OR} \quad -(2r - 7) = 3$$

$$\text{OR} \quad 2r - 7 = -3$$

$$2r = 10 \quad \text{OR} \quad 2r = 4$$

$$r = 5 \quad \text{OR} \quad r = 2$$

4.

$$3|x - 6| = 4$$

$$|x - 6| = \frac{4}{3}$$

$$x - 6 = \frac{4}{3}$$

$$x = \frac{22}{3}$$

OR

$$-(x - 6) = \frac{4}{3}$$

$$x - 6 = -\frac{4}{3}$$

$$x = \frac{14}{3}$$

5.

$$4|z + 5| = 16$$

$$|z + 5| = 4$$

$$z + 5 = 4 \quad \text{OR} \quad -(z + 5) = 4$$

$$\text{OR} \quad z + 5 = -4$$

$$z = -1 \quad \text{OR} \quad z = -9$$

6.

$$\left| \frac{5}{4}x + 3 \right| = 0$$

$$\frac{5}{4}x + 3 = 0$$

$$\frac{5}{4}x = -3$$

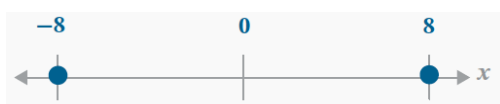
$$x = -\frac{12}{5}$$

The equation has one solution because the opposite of 0 is 0.

7.  $6 = \left| \frac{3}{4}x \right|$

$$6 = \frac{3}{4}x \quad \text{OR} \quad 6 = -\frac{3}{4}x$$

$$8 = x \quad \quad \quad -8 = x$$



8.

$$|x - (-1)| = 1$$

$$x - (-1) = 1 \quad \text{OR} \quad -[x - (-1)] = 1$$

$$x + 1 = 1 \quad \quad \quad x + 1 = -1$$

$$x = 0 \quad \quad \quad x = -2$$



9.

$$|-2x - 1| = 5$$

$$-2x - 1 = 5 \quad \text{OR} \quad -(-2x - 1) = 5$$

$$\text{OR} \quad -2x - 1 = -5$$

$$-2x = 6 \quad \text{OR} \quad -2x = -4$$

$$x = -3 \quad \text{OR} \quad x = 2$$

Midpoint:

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



10.

$$|4x + 3| = 7$$

$$4x + 3 = 7$$

$$4x = 4$$

$$x = 1$$

OR

$$-(4x + 3) = 7$$

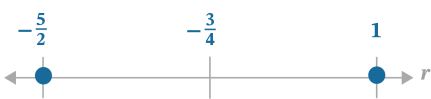
$$4x + 3 = -7$$

$$4x = -10$$

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

Midpoint:

$$\frac{(1 + -\frac{5}{2})}{2} = \frac{(-\frac{3}{2})}{2} = -\frac{3}{4}$$



11.

Let  $w$  = the weight of the fish

$$|w - 23| = 2$$

$$w - 23 = 2 \quad \text{OR} \quad -(w - 23) = 2$$

$$\text{OR} \quad w - 23 = -2$$

$$w = 25 \quad \text{OR} \quad w = 21$$

The minimum weight is 21 pounds and the maximum weight is 25 pounds.

12.

Let  $g$  = the golf score

$$|g - 65| = 7$$

$$g - 65 = 7 \quad \text{OR} \quad -(g - 65) = 7$$

$$\text{OR} \quad g - 65 = -7$$

$$g = 72 \quad \text{OR} \quad g = 58$$

Susanna's score was either 58 or 72.

*Part B: Multi-Step Absolute Value Equations***Practice 1**

1.

$$|3x - 7| + 5 = 11$$

$$|3x - 7| = 6$$

$$3x - 7 = 6$$

$$3x = 13$$

$$x = \frac{13}{3}$$

OR

$$-(3x - 7) = 6$$

$$3x - 7 = -6$$

$$3x = 1$$

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

2.

$$-\left|\frac{4}{5}x + 8\right| = -1$$

$$\left|\frac{4}{5}x + 8\right| = 1$$

$$\frac{4}{5}x + 8 = 1$$

$$\frac{4}{5}x = -7$$

$$x = \frac{-35}{4}$$

OR

$$-\left(\frac{4}{5}x + 8\right) = 1$$

$$\frac{4}{5}x + 8 = -1$$

$$\frac{4}{5}x = -9$$

$$x = \frac{-45}{4}$$

3.

$$\frac{1}{2}|3x - 4| + 5 = 6$$

$$\frac{1}{2}|3x - 4| = 1$$

$$|3x - 4| = 2$$

$$3x - 4 = 2$$

$$3x = 6$$

$$x = 2$$

OR

$$-(3x - 4) = 2$$

$$3x - 4 = -2$$

$$3x = 2$$

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

4.

$$-2\left|\frac{3}{2}x - 5 - \frac{1}{2}x\right| = -8$$

$$\left|\frac{3}{2}x - 5 - \frac{1}{2}x\right| = 4$$

$$|x - 5| = 4$$

$$x - 5 = 4$$

$$x = 9$$

OR

$$-(x - 5) = 4$$

$$x - 5 = -4$$

$$x = 1$$

midpoint:

$$\frac{(9 + 1)}{2} = 5$$



5.

$$-\frac{1}{2}|q + 8 + 3q - 2| = -6$$

$$-\frac{1}{2}|4q + 6| = -6$$

$$|4q + 6| = 12$$

$$4q + 6 = 12 \quad \text{OR} \quad -(4q + 6) = 12$$

$$\text{OR} \quad 4q + 6 = -12$$

$$4q = 6 \quad \text{OR} \quad 4q = -18$$

$$q = \frac{3}{2} \quad \text{OR} \quad q = -\frac{9}{2}$$



6.

 $h$ : height

$$5 \text{ ft } 11 \text{ in} = 71 \text{ inches}$$

$$|h - 71| = 3$$

$$h - 71 = 3$$

$$h = 74$$

OR

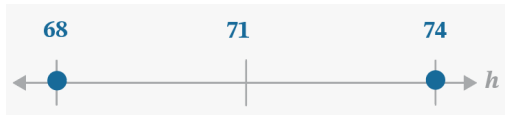
$$-(h - 71) = 3$$

$$h - 71 = -3$$

$$h = 68$$

The shortest the sons can be is 68 inches or 5 ft 8 inches.

The tallest is 74 inches or 6 ft 2 inches.



7.

one solution

8.

identity

9.

no solution

10.

$$4|z + 5| + 2 = 18$$

$$4|z + 5| = 16$$

$$|z + 5| = 4$$

$$z + 5 = 4 \quad \text{OR} \quad -(z + 5) = 4$$

$$\text{OR} \quad z + 5 = -4$$

$$z = -1 \quad \text{OR} \quad z = -9$$

two solutions

11.

$$12 = -5|y| + 7$$

$$5 = -5|y|$$

$$-1 = |y|$$

no solution

12.

$$-|x + 15| = 26$$

$$|x + 15| = -26$$

no solution

13.

$$3|7 - 2x + 2x - 3| - 1 = 11$$

$$3|7 + 0x - 3| - 1 = 11$$

$$3|7 + 0 - 3| - 1 = 11$$

$$3|4| - 1 = 11$$

$$12 - 1 = 11$$

$$11 = 11$$

identity or all real numbers,  $\mathcal{R}$ 

14.

The variable simplifies out of the absolute value bars (additive inverse) making the equation  $|4| = 4$ , which is always true regardless of the value of the variable.

**Practice 2**

1.

$$-\frac{2}{3}\left|\frac{1}{4}x + 2\right| = -2$$

$$\left|\frac{1}{4}x + 2\right| = 3$$

$$\frac{1}{4}x + 2 = 3 \quad \text{OR} \quad -\left(\frac{1}{4}x + 2\right) = 3$$

$$\text{OR} \quad \frac{1}{4}x + 2 = -3$$

$$\frac{1}{4}x = 1 \quad \text{OR} \quad \frac{1}{4}x = -5$$

$$x = 4 \quad \text{OR} \quad x = -20$$

2.

$$-|8x - 3| = -13$$

$$|8x - 3| = 13$$

$$8x - 3 = 13$$

$$8x = 16$$

$$x = 2$$

OR

$$-(8x - 3) = 13$$

$$8x - 3 = -13$$

$$8x = -10$$

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

3.

$$\frac{1}{10}|9 - 2x| - 3 = 0$$

$$\frac{1}{10}|9 - 2x| = 3$$

$$|9 - 2x| = 30$$

$$9 - 2x = 30$$

$$-2x = 21$$

$$x = -\frac{21}{2}$$

OR

$$-(9 - 2x) = 30$$

$$9 - 2x = -30$$

$$-2x = -39$$

$$x = \frac{39}{2}$$

4.

$$|2x - 3 - 6x + 1| = 2$$

$$|-4x - 2| = 2 \quad \text{OR} \quad -(-4x - 2) = 2$$

$$-4x - 2 = 2$$

$$-4x - 2 = -2$$

$$-4x = 4$$

$$-4x = 0$$

$$x = -1$$

$$x = 0$$

Midpoint:

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



5.

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

$$-\frac{3}{2}|5 - 3x| = -3$$

$$|5 - 3x| = 2$$

$$5 - 3x = 2$$

$$-3x = -3$$

$$x = 1$$

OR

$$-(5 - 3x) = 2$$

$$5 - 3x = -2$$

$$-3x = -7$$

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

$$\text{Midpoint} = \frac{(1 + \frac{7}{3})}{2} = \frac{5}{3}$$



6.

 $m$ : minutes reading

$$|m - 4 \text{ hr } 35 \text{ min}| = 23 \text{ min}$$

$$m - 4 \text{ hr } 35 \text{ min} = 23 \text{ min}$$

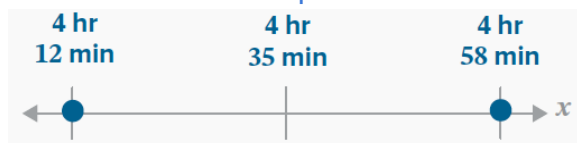
$$m = 23 \text{ min} + 4 \text{ hr } 35 \text{ min} = 4 \text{ hr } 58 \text{ min}$$

OR

$$-(m - 4 \text{ hr } 35 \text{ min}) = 23 \text{ min}$$

$$m - 4 \text{ hr } 35 \text{ min} = -23 \text{ min}$$

$$m = 4 \text{ hr } 12 \text{ min}$$



7.

Identity

8.

two solutions

9.

no solution

10.

$$9|2q - 2q| - 4 = -4$$

$$9|0| - 4 = -4$$

$$9(0) - 4 = -4$$

$$0 - 4 = -4$$

$$-4 = -4$$

identity or all real numbers

11.

$$3|2x + 3 - x| + 4 = 3 - 2$$

$$3|x + 3| + 4 = 1$$

$$3|x + 3| = -3$$

$$|x + 3| = -1$$

no solution

12.

$$|2r - 7| = 5$$

$$2r - 7 = 5 \quad \text{OR} \quad -(2r - 7) = 5$$

$$\text{OR} \quad 2r - 7 = -5$$

$$2r = 12 \quad \text{OR} \quad 2r = 2$$

$$r = 6 \quad \text{OR} \quad r = 1$$

13.

$$-\frac{1}{2}|q + 6 + 3q| + 3 = 6$$

$$-\frac{1}{2}|4q + 6| + 3 = 6$$

$$-\frac{1}{2}|4q + 6| = 3$$

$$|4q + 6| = -6$$

no solution

14.

The equation has no solution because an absolute value equation cannot equal a negative value since distance is always positive.

**Targeted Review**

Problem	1	2	3	4	5	6	7	8	9	10	11	12
Lesson Origin	2	2	2	2	2	2	1	1	PA	PA	1	2

1.

$$25 = 9 - 8(x - 9)$$

$$25 = 9 - 8x + 72$$

$$25 = 81 - 8x$$

$$-56 = -8x$$

$$x = 7$$

one solution

2.

$$\frac{2}{3}(x + 9) = 3x - (2x - 6)$$

$$\frac{2}{3}x + 6 = 3x - 2x + 6$$

$$3\left(\frac{2}{3}x + 6\right) = 3(x + 6)$$

$$2x + 18 = 3x + 18$$

$$x = 0$$

one solution

3.

$$\frac{1}{2}(12x - 8) = 6x + 3$$

$$6x - 4 = 6x + 3$$

$$-4 = 3$$

no solution

4.

$$\frac{1}{4}x + 5 = \frac{2}{5}x - 1$$

$$20\left(\frac{1}{4}x + 5 = \frac{2}{5}x - 1\right)$$

$$5x + 100 = 8x - 20$$

$$120 = 3x$$

$$x = 40$$

one solution

5.

$$V = \frac{lwh}{3}; w$$

$$3V = lwh$$

$$w = \frac{3V}{lh}$$

6.

$$3w + 2 = 9.05$$

$$3w + 2 = 9.05$$

$$3w = 7.05$$

$$w = 2.35$$

Each bottle of water cost \$2.35.

7.

$$= \frac{(0.3 \times 100)}{(0.05 \times 100)}$$

$$= \frac{30}{5}$$

$$= 6$$

6 is natural, whole, integer, rational, real or  $\{\mathcal{N}, \mathcal{W}, \mathcal{Z}, \mathcal{Q}, \mathcal{R}\}$ 

8.

$$-\sqrt{(4)(4)} = -4$$

-4 is integer, rational, real or  $\{\mathcal{Z}, \mathcal{Q}, \mathcal{R}\}$ 

9.

-2, 0, 2

10.

1

11. A

A)  $\pi$ B)  $\sqrt{5}$  The square root of 5 squared is equal to 5.C)  $\frac{\sqrt{3}}{2}$  This number squared is  $\frac{3}{4}$ .D)  $\frac{\sqrt{7}}{\sqrt{3}}$  This number squared is  $\frac{7}{3}$ .

12. D

$$8x - 6x + 3 = \frac{1}{4}(8x + 12)$$

$$2x + 3 = 2x + 3$$

$$3 = 3$$

A) no solution This happens when an equation has no variables and unequal numbers.

B) one solution The coefficients of the variables are equal on both sides so 1 solution is not possible.

C) two solutions This is not possible for the given equation.

D) all real numbers