MULTIPLE CHOICE

1. $|3x + 5| = 8$. Find all values of x which make this equation true.

   a. $\{1, -4\frac{1}{3}\}$ c. $\{4\frac{1}{3}, -1\}$

   b. $\{1, -1\}$ d. $\{4\frac{1}{3}, -4\frac{1}{3}\}$

   ANS: A
   $|3x + 5| = 8$ means that $3x + 5 = 8$ ***or*** $3x + 5 = -8$.
   ("or" means "both answers make the equation true")

   Each of these equations requires a two-step solution.

   1. $3x + 5 = 8$

   $$\left.\begin{aligned} 3x &= 8 - 5 \\ 3x &= 3 \end{aligned}\right\} \text{ this is the first step}$$

   $$\left.\begin{aligned} x &= \frac{3}{3} \end{aligned}\right\} \text{ this is the second step}$$

   So, $x = 1$ is one answer.

   2. $3x + 5 = -8$

   $$3x = -8 - 5$$

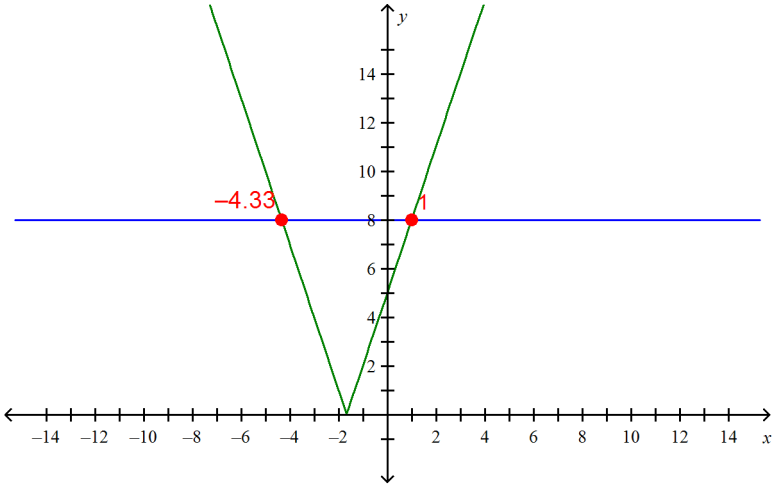
   $$3x = -13$$

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

   So, $x = -4\frac{1}{3}$ is another answer.

   ANSWER: The solution set is: $\{1, -4\frac{1}{3}\}$

   Geometrically,



PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | equations MSC: Dynamic

2. $|2x - 11| = 3$. Find all values of x which make this equation true.

a. {7,4}
c. {−4,−7}
b. {7,−7}
d. {−4,4}

ANS: A

$|2x - 11| = 3$ means that $2x - 11 = 3$ ***or*** $2x - 11 = -3$.

("or" means "both answers make the equation true")

Each of these equations requires a two-step solution.

1. $2x - 11 = 3$

$$\left.\begin{aligned} 2x &= 3 + 11 \\ 2x &= 14 \end{aligned}\right\} \text{ this is the first step}$$

$$\left.\begin{aligned} x &= \frac{14}{2} \end{aligned}\right\} \text{ this is the second step}$$

So, $x = 7$ is one answer.

2. $2x - 11 = -3$

$$2x = -3 + 11$$

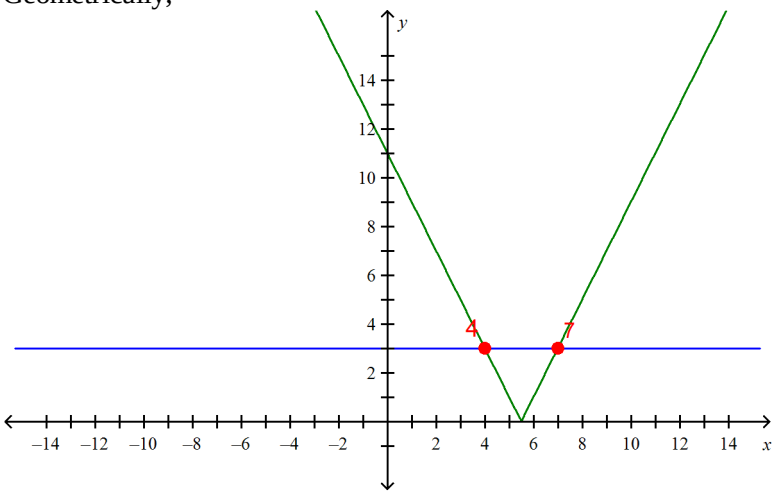
$$2x = 8$$

$$x = \frac{8}{2}$$

So, $x = 4$ is another answer.

ANSWER: The solution set is: {7,4}

Geometrically,



PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | equations MSC: Dynamic

3. $|2 - 2x| = 14$. Find all values of x which make this equation true.

a. {8,–6}
c. {6,–8}
b. {8,–8}
d. {6,–6}

ANS: A

$|2 - 2x| = 14$ is the same as $|2x - 2| = 14$ (why?) and this absolute value equation is easier to work with. (Of course, you can work with the first absolute value equation and you MUST get the same answers.)

$|2x - 2| = 14$ means that $2x - 2 = 14$ ***or*** $2x - 2 = -14$.
("or" means "both answers make the equation true")

Each of these equations requires a two-step solution.

1. $2x - 2 = 14$

$$\left.\begin{aligned} 2x &= 14 + 2 \\ 2x &= 16 \end{aligned}\right\} \text{ this is the first step}$$

$$\left.\begin{aligned} x &= \frac{16}{2} \end{aligned}\right\} \text{ this is the second step}$$

So, $x = 8$ is one answer.

2. $2x - 2 = -14$

$$2x = -14 + 2$$

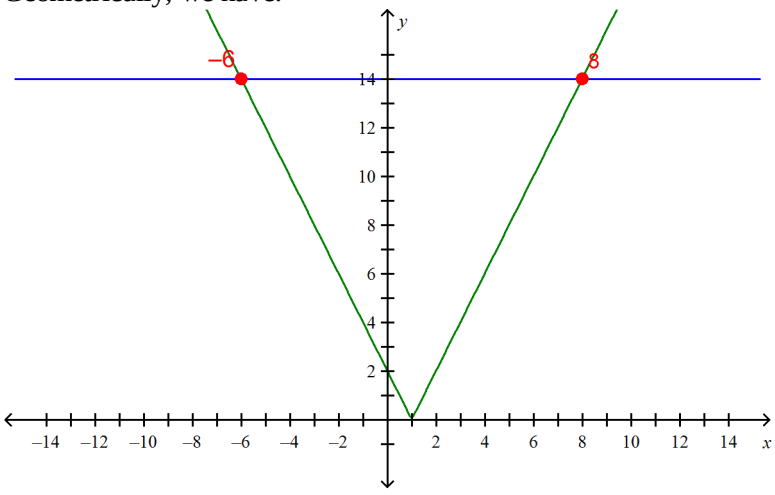
$$2x = -12$$

$$x = \frac{-12}{2}$$

So, $x = -6$ is another answer.

ANSWER: The solution set is: {8,–6}

Geometrically, we have:



PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | equations MSC: Dynamic

4. $2|x + 3| = 12$. Find all values of x which make this equation true.

a. {3,–9}
c. {9,–3}
b. {3,–3}
d. {9,–9}

ANS: A

$2|x + 3| = 12$ is the same as: $|x + 3| = 6$.

For x to make this true: $x + 3 = 6$ ***or*** $x + 3 = -6$

Each of these equations can be solved in one-step.

1. $x + 3 = 6$

$x = 6 - 3$
$x = 3$ } this is the only step

So, $x = 3$ is one answer.

2. $x + 3 = -6$

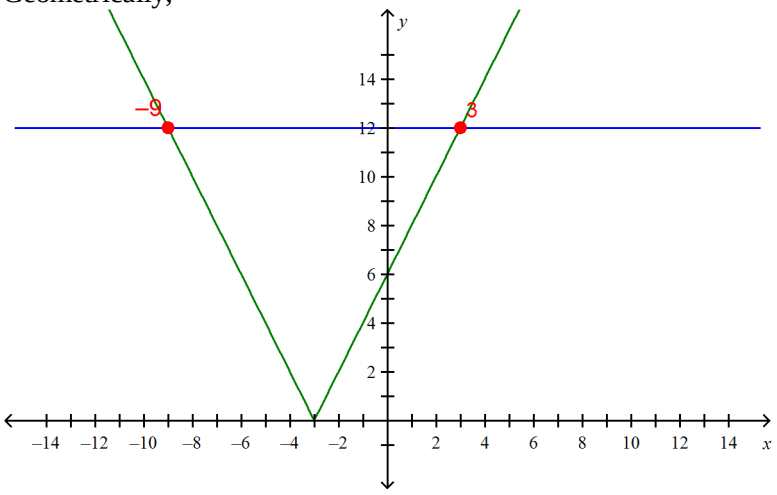
$x = -6 - 3$

$x = -9$

So, $x = -9$ is another answer.

ANSWER: The solution set is: {3,–9}

Geometrically,



PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | equations MSC: Dynamic

5. $9|x-3| = 9$. Find all values of x which make this equation true.

a. {4,2}
c. {–2,–4}
b. {–2,2}
d. {4,–4}

ANS: A

$9|x-3| = 9$ is the same as: $|x-3| = 1$.

For x to make this true: $x + 3 = 1$ ***or*** $x + 3 = -1$

Each of these equations can be solved in one-step.

1. $x - 3 = 1$

$x = 1 + 3$
$x = 4$ } this is the only step

So, $x = 4$ is one answer.

2. $x - 3 = -1$

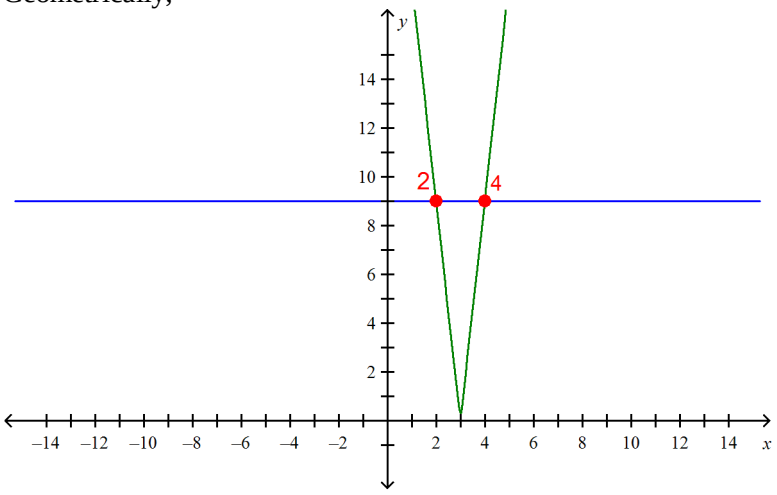
$x = -1 + 3$

$x = 2$

So, $x = 2$ is another answer.

ANSWER: The solution set is: {2,4}

Geometrically,



PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | equations MSC: Dynamic

6. $\frac{1}{3}|x+8| = 6$. Find all values of x which make this equation true.

a. {10,–26}
b. {10,–10}
c. {26,–10}
d. {26,–26}

ANS: A

$\frac{1}{3}|x+8| = 6$ is the same as: $|x+8| = 18$.

For x to make this true: $x + 8 = 18$ ***or*** $x + 8 = -18$

Each of these equations can be solved in one-step.

1. $x + 8 = 18$

$x = 18 - 8$
$x = 10$
} this is the only step

So, $x = 10$ is one answer.

2. $x + 8 = -18$

$x = -18 - 8$

$x = -26$

So, $x = -26$ is another answer.

ANSWER: The solution set is: {10,–26}

PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | equations MSC: Dynamic

7. $\frac{1}{9}|x-7| = 7$. Find all values of x which make this equation true.

a. {70,–56}
b. {56,–56}
c. {56,–70}
d. {70,–70}

ANS: A

$\frac{1}{9}|x-7| = 7$ is the same as: $|x-7| = 63$.

For x to make this true: $x + 7 = 63$ ***or*** $x + 7 = -63$

Each of these equations can be solved in one-step.

1. $x - 7 = 63$

$x = 63 + 7$
$x = 70$ } this is the only step

So, $x = 70$ is one answer.

2. $x - 7 = -63$

$x = -63 + 7$

$x = -56$

So, $x = -56$ is another answer.

ANSWER: The solution set is: {56,–70}

PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | equations MSC: Dynamic

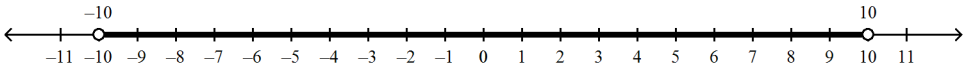
8. $|x+3| < 10$. Find all values of x which make this inequality true.

a. $\{x|\, x \in (-13,7)\}$
b. $\{x|\, x \in (-7,13)\}$
c. $\{x|\, x \in (-13,13)\}$
d. $\{x|\, x \in (-7,7)\}$

ANS: A

$|x+3| < 10$

Below on the number line are all the numbers a such that $|a| < 10$. That is, $-10 < a < 10$.



For x to make $|x+3| < 10$ true, we must have: $-10 < x+3 < 10$.

We write this statement as: $x+3 > -10$ ***and*** $x+3 < 10$. That is, x must satisfy both inequalities.

Each of these inequalities can be solved in one-step.

1. $x+3 > -10$

$x > -10-3$
$x > -13$ } this is the only step

So, $x > 7$ is one condition for x (green line).

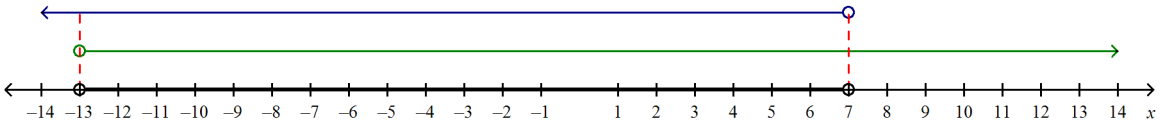
2. $x+3 < 10$

$x < 10-3$

$x < 7$

So, $x < -13$ is the other condition for x (blue line).

We need the ***intersection*** of these two intervals.



ANSWER: The solution set is: $\{x|x \in (-13,7)\}$ **(black line)**.

PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | inequality MSC: Dynamic

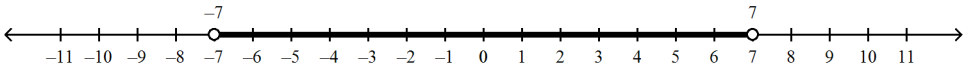
9. $|x-4|<7$. Find all values of x which make this inequality true.

a. $\{x|\, x \in (-3,11)\}$
b. $\{x|\, x \in (-3,3)\}$
c. $\{x|\, x \in (-11,11)\}$
d. $\{x|\, x \in (-11,3)\}$

ANS: A

$|x-4|<7$

Below on the number line are all the numbers a such that $|a|<7$. That is, $-7<a<7$.



This means that for $|x-4|<7$ to be true, we must have: $-7<x-4<7$.

We write this statement as: $x-4>-7$ ***and*** $x-4<7$. That is, x must satisfy both inequalities.

Each of these inequalities can be solved in one-step.

1. $x-4>-7$

$$\left.\begin{array}{l} x>-7+4 \\ x>-3 \end{array}\right\} \text{ this is the only step}$$

So, $x>-3$ is one condition for x (green line).

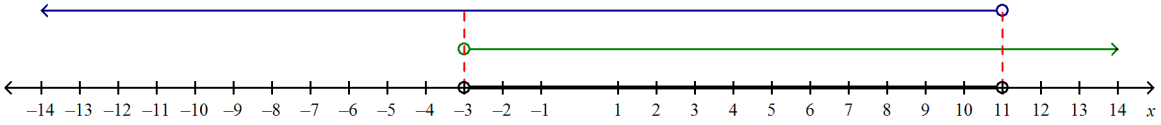
2. $x-4<7$

$$x<7+4$$

$$x<11$$

So, $x<11$ is the other condition for x (blue line).

We need the ***intersection*** of these two intervals.



ANSWER: The solution set is: $\{x|x \in (-11,3)\}$ **(black line)**.

PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | inequality MSC: Dynamic

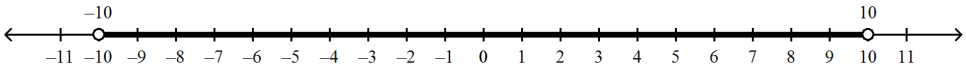
10. $|3-x| < 10$. Find all values of x which make this inequality true.

a. $\{x|\, x \in (-7,13)\}$
b. $\{x|\, x \in (-7,7)\}$
c. $\{x|\, x \in (-13,13)\}$
d. $\{x|\, x \in (-13,7)\}$

ANS: A

$|3-x| < 10$ is the same as $|x-3| < 10$, which is easier to solve.

Below on the number line are all the numbers a such that $|a| < 10$. That is, $-10 < a < 10$.



This means that for $|x-3| < 10$ to be true, we must have: $-10 < x-3 < 10$.

We write this statement as: $x-3 > -10$ ***and*** $x-3 < 10$. That is, x must satisfy both inequalities.

Each of these inequalities can be solved in one-step.

1. $x-3 > -10$

$$\left.\begin{array}{l} x > -10+3 \\ x > -7 \end{array}\right\} \text{ this is the only step}$$

So, $x > -7$ is one condition for x (green line).

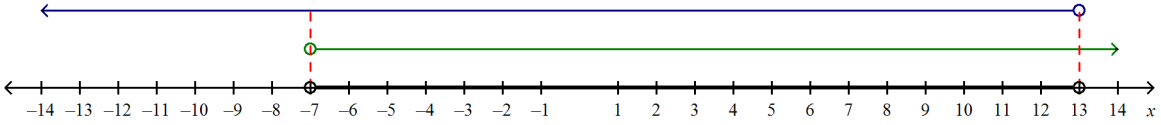
2. $x-3 < 10$

$$x < 10+3$$

$$x < 13$$

So, $x < 13$ is the other condition for x (blue line).

We need the ***intersection*** of these two intervals.



ANSWER: The solution set is: $\{x|x \in (-13,7)\}$ **(black line)**.

PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | inequality MSC: Dynamic

11. $|x + 11| \geq 2$. Find all values of x which make this inequality true.

a. $\{x|\, x \in (-\infty, -13] \cup [-9, \infty)\}$

b. $\{x|\, x \in (-\infty, 9] \cup [13, \infty)\}$

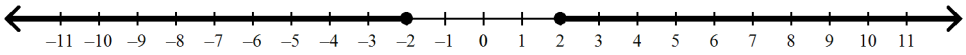
c. $\{x|\, x \in (-\infty, -13] \cup [13, \infty)\}$

d. $\{x|x \in (-\infty, -9] \cup [9, \infty)\}$

ANS: A

$|x + 11| \geq 2$

Below on the number line are all the numbers a such that $|a| \geq 2$. That is, $a \leq -2$ ***or*** $a \geq 2$.



For x to make $|x + 11| \geq 2$ true, we must have: $x + 11 \leq -2$ ***or*** $x + 11 \geq 2$.
That is, x must satisfy at least one of these inequalities.

Each of these inequalities can be solved in one-step.

1. $x + 11 \leq -2$

$x \leq -2 - 11$
$x \leq -13$
} this is the only step

So, if $x \leq -9$ the inequality in the question is true (green line).

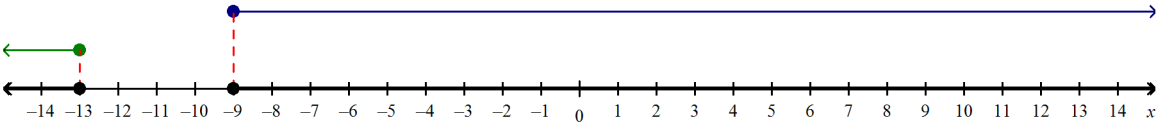
2. $x + 11 \geq 2$

$x \geq 2 - 11$

$x \geq -9$

So, if $x \geq -13$ the inequality in the question is also true (blue line).

We need the ***union*** of these two intervals.



ANSWER: The solution set is: $\{x|\, x \leq -13$ ***or*** $x \geq -9\}$ **(black line)**.

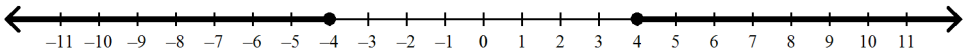
PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | inequality MSC: Dynamic

12. $|x - 5| \geq 4$. Find all values of x which make this equation true.

a. $\{x|\, x \leq 1$ ***or*** $x \geq 9\}$
b. $\{x|\, x \leq -1$ ***or*** $x \geq 1\}$
c. $\{x|\, x \leq -9$ ***or*** $x \geq 9\}$
d. $\{x|\, x \leq -9$ ***or*** $x \geq -1\}$

ANS: A
$|x - 5| \geq 4$

Below on the number line are all the numbers a such that $|a| \geq 4$. That is, $a \leq -4$ ***or*** $a \geq 4$.



For x to make $|x - 5| \geq 4$ true, we must have: $x - 5 \leq -4$ ***or*** $x - 5 \geq 4$.
That is, x must satisfy at least one of these inequalities.

Each of these inequalities can be solved in one-step.

1. $x - 5 \leq -4$

$x \leq -4 + 5$
$x \leq 1$
} this is the only step

So, if $x \leq 1$ the inequality in the question is also true (green line).

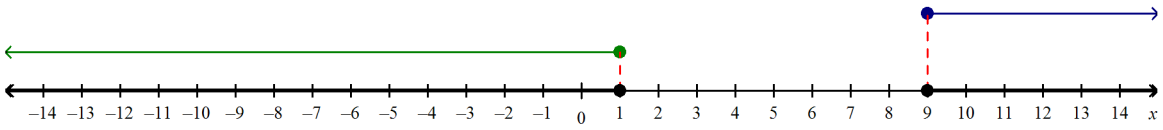
2. $x - 5 \geq 4$

$x \geq 4 + 5$

$x \geq 9$

So, if $x \geq 9$ the inequality in the question is also true (blue line).

We need the ***union*** of these two intervals.



ANSWER: The solution set is: $\{x|\, x \leq 1$ ***or*** $x \geq 9\}$ **(black line)**.

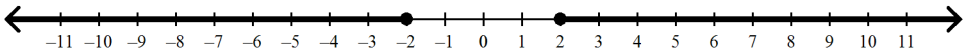
PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | inequality MSC: Dynamic

13. $|6 - x| \geq 2$. Find all values of x which make this equation true.

a. $\{x|\, x \leq 4$ ***or*** $x \geq 8\}$
b. $\{x|\, x \leq -4$ ***or*** $x \geq 4\}$
c. $\{x|\, x \leq -8$ ***or*** $x \geq 8\}$
d. $\{x|\, x \leq -8$ ***or*** $x \geq -4\}$

ANS: A
$|6 - x| \geq 2$ is the same as $|x - 6| \geq 2$, which is easier to solve.

Below on the number line are all the numbers a such that $|a| \geq 2$. That is, $a \leq -2$ ***or*** $a \geq 2$.



For x to make $|x - 6| \geq 2$ true, we must have: $x - 6 \leq -2$ ***or*** $x - 6 \geq 2$.
That is, x must satisfy at least one of these inequalities.

Each of these inequalities can be solved in one-step.

1. $x - 6 \leq -2$

$x \leq -2 + 6$
$x \leq 4$
} this is the only step

So, if $x \leq 4$ the inequality in the question is also true (green line).

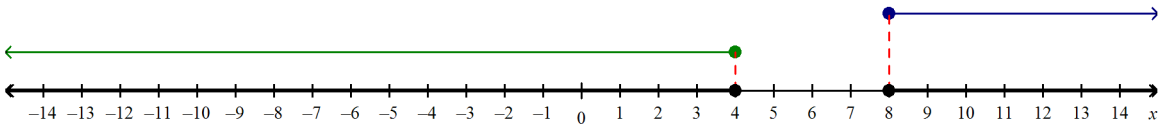
2. $x - 6 \geq 2$

$x \geq 2 + 6$

$x \geq 8$

So, if $x \geq 8$ the inequality in the question is also true (blue line).

We need the ***union*** of these two intervals.



ANSWER: The solution set is: $\{x|\, x \leq 4$ ***or*** $x \geq 8\}$ **(black line)**.

PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | inequality MSC: Dynamic

14. $2|2x + 10| + 4 \geq 10$. Find all values of x which make this inequality true.

a. $\{x|\, x \leq -6.5$ ***or*** $x \geq -3.5\}$
b. $\{x|\, x \leq -3.5$ ***or*** $x \geq 3.5\}$
c. $\{x|\, x \leq -6.5$ ***or*** $x \geq 6.5\}$
d. $\{x|\, x \leq 3.5$ ***or*** $x \geq 6.5\}$

ANS: A

The first step is to reduce $2|2x + 10| + 4 \geq 10$ to a simple absolute value inequality.

$2|2x + 10| + 4 \geq 10$

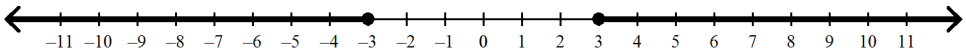
$2|2x + 10| \geq 10 - 4$

$2|2x + 10| \geq 6$

$|2x + 10| \geq \frac{6}{2}$

$|2x + 10| \geq 3$

Below on the number line are all the numbers a such that $|a| \geq 3$. That is, $a \leq -3$ ***or*** $a \geq 3$.



For x to make $|2x + 10| \geq 3$ true, we must have: $2x + 10 \leq -3$ ***or*** $2x + 10 \geq 3$.
That is, x must satisfy at least one of these inequalities.

Each of these inequalities can be solved in two-steps.

1. $2x + 10 \leq -3$

$2x \leq -3 - 10$

$2x \leq -13$

$x \leq \frac{-13}{2}$

So, if $x \leq -6.5$ the inequality in the question is true (green line).

2. $2x + 10 \geq 3$

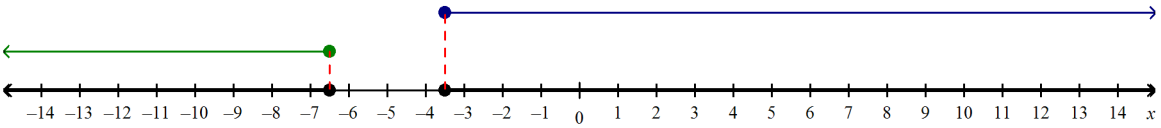
$2x \geq 3 - 10$

$2x \geq -7$

$x \geq \frac{-7}{2}$

So, if $x \geq -3.5$ the inequality in the question is also true (blue line).

We need the ***union*** of these two intervals.



ANSWER: The solution set is: $\{x|\, x \leq -6.5$ ***or*** $x \geq -3.5\}$ **(black line)**.

PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.

TOP: Algebra I KEY: absolute values | inequality MSC: Dynamic

15. $7 - 3|4x + 7| \le -2$. Find all values of x which make this inequality true.

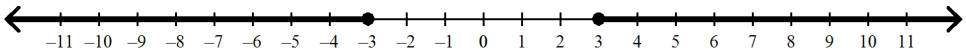
a. $\{x|\, x \le -2.5$ ***or*** $x \ge -1\}$
b. $\{x|\, x \le -1$ ***or*** $x \ge 1\}$
c. $\{x|\, x \le -2.5$ ***or*** $x \ge 2.5\}$
d. $\{x|\, x \le 1$ ***or*** $x \ge 2.5\}$

ANS: A

The first step is to reduce $7 - 3|4x + 7| \le -2$ to a simple absolute value inequality. Notice the change in the inequality when we divide by the negative coefficient -3.

$$7 - 3|4x + 7| \le -2$$
$$-3|4x + 7| \le -2 - 7$$
$$-3|4x + 7| \le -9$$
$$|4x + 7| \ge \frac{-9}{-3}$$
$$|4x + 7| \ge 3$$

Below on the number line are all the numbers a such that $|a| \ge 3$. That is, $a \le -3$ ***or*** $a \ge 3$.



For x to make $|4x + 7| \ge 3$ true, we must have: $4x + 7 \le -3$ ***or*** $4x + 7 \ge 3$.
That is, x must satisfy at least one of these inequalities.

Each of these inequalities can be solved in two-steps.

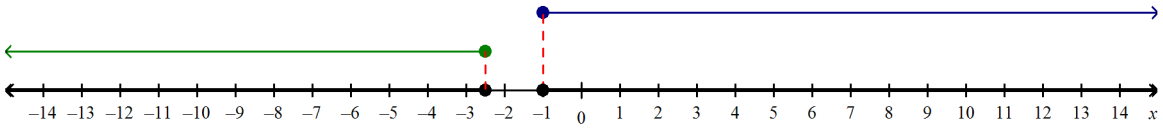
1. $4x + 7 \le -3$
$$4x \le -3 - 7$$
$$4x \le -10$$
$$x \le \frac{-10}{4}$$

So, if $x \le -2.5$ the inequality in the question is true (green line).

2. $4x + 7 \ge 3$
$$4x \ge 3 - 7$$
$$4x \ge -4$$
$$x \ge \frac{-4}{4}$$

So, if $x \ge -1$ the inequality in the question is also true (blue line).

We need the ***union*** of these two intervals.



ANSWER: The solution set is: $\{x|\, x \le -2.5$ ***or*** $x \ge -1\}$ **(black line)**.

PTS: 1 DIF: Grade 8 REF: 1AL1.4

OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | inequality MSC: Dynamic

16. $15 - 3|5x - 6| \geq -9$. Find all values of x which make this inequality true.

a. $\{x|\, x \in (-0.4, 2.8)\}$
c. $\{x|\, x \in (-2.8, 2.8)\}$
b. $\{x|\, x \in (-2.8, 0.4)\}$
d. $\{x|\, x \in (-0.4, 0.4)\}$

ANS: A

Don't let all the minuses throw you. Just work step-by-step!

The first step is to reduce $15 - 3|5x - 6| \leq -9$ to a simple absolute value inequality. Notice the change in the inequality when we divide by the negative coefficient -3.

$15 - 3|5x - 6| \geq -9$

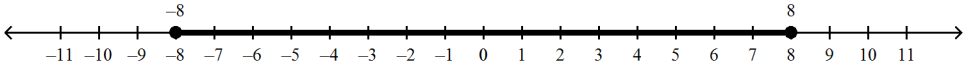
$-3|5x - 6| \geq -9 - 15$

$-3|5x - 6| \geq -24$

$|5x - 6| \leq \frac{-24}{-3}$

$|5x - 6| \leq 8$

Below on the number line are all the numbers a such that $|a| \leq 8$. That is, $-8 \leq a \leq 8$.



This means that for $|5x - 6| \leq 8$ to be true, we must have: $-8 \leq 5x - 6 \leq 8$.

We write this statement as: $5x - 6 \geq -8$ ***and*** $5x - 6 \leq 8$. That is, x must satisfy both inequalities.

Each of these inequalities can be solved in two-steps.

1. $5x - 6 \geq -8$

$5x \geq -8 + 6$

$5x \geq -2$

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

So, $x \geq -0.4$ is one condition for x (green line).

2. $5x - 6 \leq 8$

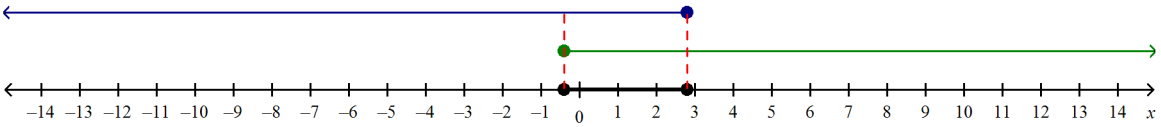
$5x \leq 8 + 6$

$5x \leq 14$

$x \leq \frac{14}{5}$

So, $x \leq 2.8$ is the other condition on x (blue line).

We need the ***intersection*** of these two intervals.



ANSWER: The solution set is: $\{x|\, x \in (-0.4, 2.8)\}$ **(black line)**.

PTS: 1 DIF: Grade 8 REF: 1AL1.4
OBJ: Students solve equations and inequalities involving absolute values.
TOP: Algebra I KEY: absolute values | inequality MSC: Dynamic