GRADE 7 ACCELERATED · UNIT 11 · LESSON 4

Multi-Step Equations

MA.8.AR.2.1

I can solve a multi-step equation with fraction or decimal coefficients and check it.

Warm-Up

1. How many solutions does $2(x + 3) = 2x + 6$ have?
2. Solve: $9x - 7 = 4x + 18$
3. A triangle has sides 5, 9 and x. Between which numbers is x?
4. Find $\frac{2}{3}$ of 9.

Warm-Up

1. How many solutions does $2(x + 3) = 2x + 6$ have?

   Infinitely many solutions

2. Solve: $9x - 7 = 4x + 18$ **$x = 5$**

3. A triangle has sides 5, 9 and x. Between which numbers is x?

   Between 4 and 14

4. Find $\frac{2}{3}$ of 9. **6**

Vocabulary

common denominator

a number that every denominator divides evenly: 6 is a common denominator of $\frac{x}{2}$ and $\frac{x}{3}$

rational coefficient

a coefficient that is a fraction or a decimal, like $\frac{1}{3}$ in $\frac{1}{3}x$ or 0.5 in 0.5x

Notes

I. One order for every equation

$$3(2x - 4) + 5 = 2(x + 6) + 1$$

$$6x - 12 + 5 = 2x + 12 + 1$$

$$6x - 7 = 2x + 13$$

$$4x - 7 = 13$$

$$4x = 20$$

$x = 5$ Check: $3(6) + 5 = 23$ $2(11) + 1 = 23$

Notes

II. A fraction outside: every term, and its sign

$$-\frac{1}{2}(4x - 10) = x - 1$$

$$-2x + 5 = x - 1$$

$$5 = 3x - 1$$

$$6 = 3x$$

$$x = 2$$

Notes

III. Decimals: the decimal multiplies both terms

$$-2.4(5x - 3) = -40.8$$

$$-12x + 7.2 = -40.8$$

$$-12x = -48$$

$$x = 4$$

$-2.4(-3) = 7.2$ Check: $-2.4(20 - 3) = -40.8$

Example 1

$$0.2(10x - 15) = x + 4$$

Solve it, then check in both sides.

Example 1

$$0.2(10x - 15) = x + 4$$

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

$$x - 3 = 4$$

$$x = 7$$

Check: $0.2(70 - 15) = 11$ $\quad 7 + 4 = 11$

Answer: $x = 7$

Your Turn

$$0.6(10x - 5) = 4x + 5$$

Solve it, then check in both sides.

Your Turn

$$0.6(10x - 5) = 4x + 5$$

Solve it, then check in both sides.

Distribute: $0.6(10x - 5) = 6x - 3$

Take 4x from both sides: $2x - 3 = 5$

Add 3: $2x = 8$

Divide by 2: $x = 4$

Check: $0.6(40 - 5) = 21$ and $4(4) + 5 = 21$

Answer: $x = 4$

Example 2

$$\frac{x}{2} + 3 = \frac{x}{3} + 5$$

Solve it, then check in both sides.

Example 2

$$\frac{x}{2} + 3 = \frac{x}{3} + 5$$

$$6\left(\frac{x}{2}\right) + 6(3) = 6\left(\frac{x}{3}\right) + 6(5)$$

$$3x + 18 = 2x + 30$$

Example 2

$$3x + 18 = 2x + 30$$

$$x + 18 = 30$$

$$x = 12$$

Check: $12 \div 2 + 3 = 9$ $12 \div 3 + 5 = 9$

Answer: $x = 12$

Your Turn

$$\frac{x}{4} - 1 = \frac{x}{6} + 1$$

Solve it, then check in both sides.

Your Turn

$$\frac{x}{4} - 1 = \frac{x}{6} + 1$$

Solve it, then check in both sides.

Every term times 12: $3x - 12 = 2x + 12$

Take 2x from both sides: $x - 12 = 12$

Add 12: $x = 24$

Check: $24 \div 4 - 1 = 5$ and $24 \div 6 + 1 = 5$

Answer: $x = 24$

Whiteboards · Question 1 of 9

$$5(x - 2) + 3 = 2x + 11$$

Answer it.

Whiteboards · Question 1 of 9

$$5(x - 2) + 3 = 2x + 11$$

Distribute: $5(x - 2) + 3 = 5x - 10 + 3$

Collect: $5x - 10 + 3 = 5x - 7$

Take 2x from both sides: $3x - 7 = 11$

Add 7: $3x = 18$

Divide by 3: $x = 6$

Answer: $x = 6$

Whiteboards · Question 2 of 9

$$-\frac{1}{3}(6x - 9) = x - 6$$

Answer it.

Whiteboards · Question 2 of 9

$$-\frac{1}{3}(6x - 9) = x - 6$$

Distribute: $-\frac{1}{3}(6x - 9) = -2x + 3$

Add 2x to both sides: $3 = 3x - 6$

Add 6: $9 = 3x$

Divide by 3: $x = 3$

Answer: $x = 3$

Whiteboards · Question 3 of 9

$$0.6(3x + 4) = 1.2x + 5.1$$

Answer it.

Whiteboards · Question 3 of 9

$$0.6(3x + 4) = 1.2x + 5.1$$

Distribute: $0.6(3x + 4) = 1.8x + 2.4$

Take 1.2x from both sides: $0.6x + 2.4 = 5.1$

Subtract 2.4: $0.6x = 2.7$

Divide by 0.6: $x = 4.5$

Answer: $x = 4.5$

Whiteboards · Question 4 of 9

$$-1.5(2x - 6) = x - 11$$

A. $x = 5$

B. $x = -10$

C. $x = 1.25$

D. $x = 0.5$

Answer it.

Whiteboards · Question 4 of 9

$$-1.5(2x - 6) = x - 11$$

Distribute the −1.5: $-1.5(2x - 6) = -3x + 9$

Add 3x to both sides: $9 = 4x - 11$

Add 11: $20 = 4x$

Divide by 4: $x = 5$

Answer: A — x = 5

Whiteboards · Question 5 of 9

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

Answer it.

Whiteboards · Question 5 of 9

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

Left times 15: $15\left(\frac{x}{3} - 1\right) = 5x - 15$

Right times 15: $15\left(\frac{x}{5} + 1\right) = 3x + 15$

Take 3x from both sides: $2x - 15 = 15$

Add 15: $2x = 30$

Divide by 2: $x = 15$

Answer: x = 15

Whiteboards · Question 6 of 9

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

How many solutions does it have?

A. no solution

B. one solution, $x = -2$

C. infinitely many solutions

D. one solution, $x = 0$

Answer it.

Whiteboards · Question 6 of 9

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

How many solutions does it have?

Left: $\frac{1}{2}(6x - 4) = 3x - 2$. Right: $3(x - 1) + 1 = 3x - 2$

Take 3x from both sides: $-2 = -2$, always true

Answer: C — infinitely many solutions

Whiteboards · Question 7 of 9

Shop A rents a bike for $12 plus $4.50 an hour.

Shop B, 3 blocks away, charges $7.50 an hour.

For how many hours do the two shops cost the same?

Answer it.

Whiteboards · Question 7 of 9

Shop A rents a bike for $12 plus $4.50 an hour.

Shop B, 3 blocks away, charges $7.50 an hour.

For how many hours do the two shops cost the same?

h hours at the same cost: $12 + 4.5h = 7.5h$

Take 4.5h from both sides: $12 = 3h$

Divide by 3: $h = 4$

Check: $12 + 4.5(4) = 30$ and $7.5(4) = 30$

Answer: 4 hours (h = 4)

Whiteboards · Question 8 of 9

$x = 2$ is the solution of $3(x + \square) = 2x + 20$.

What number goes in the box?

Answer it.

Whiteboards · Question 8 of 9

$x = 2$ is the solution of $3(x + \square) = 2x + 20$.

What number goes in the box?

Put 2 in for x: $2(2) + 20 = 24$, so $3(2 + \square) = 24$

$24 \div 3 = 8$, and $8 - 2 = 6$

Answer: 6

Whiteboards · Question 9 of 9

Solve $1.5(4x - 2) + x = 2(x + 6)$.

Then check your solution in both sides.

Write your answer in sentences.

Whiteboards · Question 9 of 9

Solve $1.5(4x - 2) + x = 2(x + 6)$.

Then check your solution in both sides.

Left: $1.5(4x - 2) + x = 7x - 3$. Right: $2(x + 6) = 2x + 12$

Take $2x$ from both sides: $5x - 3 = 12$

Add 3: $5x = 15$

Divide by 5: $x = 3$

Check: $1.5(4 \cdot 3 - 2) + 3 = 18$ and $2(3 + 6) = 18$

Answer: $x = 3$; both sides are 18

Independent Set

1. Solve: $-\frac{3}{4}(8w - 12) = 2w - 23$

2. Solve: $\frac{2}{5}(10n - 5) = 3n + 4$

3. Solve: $\frac{m}{2} - 3 = \frac{m}{5} + 3$

4. Solve: $-2.5(2k - 4) = k - 8$

5. How many solutions does $\frac{1}{4}(8v + 12) = 2v - 1$ have? If one, find it.

6. A kayak rental costs \$15 plus \$6.50 an hour. A second shop charges \$9 an hour. For how many hours do the two cost the same?

IXL

1. Open IXL and start today's skills.
2. Work on paper where the question needs work. The answer box does not show it.
3. Every skill listed is required, to a SmartScore of 67. Due by the Unit 11 test.

Today's skills — all required

Solve multi-step equations — 55K
Solve multi-step equations: complete the solution — PGH
Solve equations: mixed review — HZZ