GRADE 7 ACCELERATED · UNIT 11 · LESSON 2

Equations with Variables on Both Sides

MA.8.AR.2.1

I can solve an equation that has the variable on both sides, and check the solution in both sides.

Warm-Up

1. Solve: $3(x + 2) + x = 26$
2. Remote interior angles: 50° and 65°. Find the exterior angle.
3. A right triangle: hypotenuse 13, one leg 5. Find the other leg.
4. Simplify: $2x - 5x$

Warm-Up

1. Solve: $3(x + 2) + x = 26$ **$x = 5$**
2. Remote interior angles: 50° and 65°. Find the exterior angle.

   115°
3. A right triangle: hypotenuse 13, one leg 5. Find the other leg.

   12
4. Simplify: $2x - 5x$ **$-3x$**

Vocabulary

variable term

a term with a variable in it, like $5x$ or $-3x$

solution

the number that makes the two sides of an equation equal

Notes

I. Subtraction property of equality: same term from both sides

$$5x + 2 = 3x + 10$$

$$5x + 2 - 3x = 3x + 10 - 3x$$

$$2x + 2 = 10$$

$$2x = 8$$

$$x = 4$$

Check: $5(4) + 2 = 22$ and $3(4) + 10 = 22$

Notes

II. Either side works

$$2x + 9 = 6x - 11$$

$$9 = 4x - 11$$

$$20 = 4x$$

$$x = 5$$

Take the smaller x-term: it stays positive. Taking 6x also works.

Plan 1: \$12 plus \$3 a visit. Plan 2: \$5 a visit. The same cost: $12 + 3v = 5v$

Notes

III. Simplify each side first

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

$$3x + 12 = 5x - 2$$

$$12 = 2x - 2$$

$$14 = 2x$$

$$x = 7$$

Check: $3(7 + 4) = 33$ and $5(7) - 2 = 33$

Example 1

$$7x - 5 = 4x + 13$$

Solve it, then check in both sides.

Example 1

$$7x - 5 = 4x + 13$$

$$3x - 5 = 13$$

$$3x = 18$$

$$x = 6$$

Check: $7(6) - 5 = 37$ $\quad 4(6) + 13 = 37$

Answer: $x = 6$

Your Turn

$$8x - 9 = 5x + 15$$

Solve it, then check in both sides.

Your Turn

$$8x - 9 = 5x + 15$$

Solve it, then check in both sides.

Take $5x$ from both sides: $3x - 9 = 15$

Add 9: $3x = 24$

Divide by 3: $x = 8$

Check: $8(8) - 9 = 55$ and $5(8) + 15 = 55$

Answer: $x = 8$

Example 2

$$2(3x - 1) = 4x + 9$$

Solve it, then check in both sides.

Example 2

$$2(3x - 1) = 4x + 9$$

$$6x - 2 = 4x + 9$$

$$2x - 2 = 9$$

$$2x = 11$$

$$x = 5.5$$

Check: $2(15.5) = 31$ $\quad 4(5.5) + 9 = 31$

Answer: $x = 5.5$

Your Turn

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

Solve it, then check in both sides.

Your Turn

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

Solve it, then check in both sides.

Distribute: $4(2x - 3) = 8x - 12$

Take 6x from both sides: $2x - 12 = 1$

Add 12: $2x = 13$

Divide by 2: $x = 6.5$

Check: $4(13 - 3) = 40$ and $6(6.5) + 1 = 40$

Answer: $x = 6.5$

Whiteboards · Question 1 of 9

$$6x = 2x + 28$$

Answer it.

Whiteboards · Question 1 of 9

$$6x = 2x + 28$$

Take 2x from both sides: $4x = 28$

Divide by 4: $x = 7$

Check: $6(7) = 42$ and $2(7) + 28 = 42$

Answer: $x = 7$

Whiteboards · Question 2 of 9

$$9x + 4 = 5x + 40$$

Answer it.

Whiteboards · Question 2 of 9

$$9x + 4 = 5x + 40$$

Take 5x from both sides: $4x + 4 = 40$

Subtract 4: $4x = 36$

Divide by 4: $x = 9$

Check: $9(9) + 4 = 85$ and $5(9) + 40 = 85$

Answer: $x = 9$

Whiteboards · Question 3 of 9

$$3n - 8 = 7n + 12$$

Answer it.

Whiteboards · Question 3 of 9

$$3n - 8 = 7n + 12$$

Take 3n from both sides: $-8 = 4n + 12$

Subtract 12: $-20 = 4n$

Divide by 4: $n = -5$

Check: $3(-5) - 8 = -23$ and $7(-5) + 12 = -23$

Answer: $n = -5$

Whiteboards · Question 4 of 9

$$5x + 8 = x - 16$$

A. $x = 6$

B. $x = -6$

C. $x = -2$

D. $x = -4$

Answer it.

Whiteboards · Question 4 of 9

$$5x + 8 = x - 16$$

Take x from both sides: $4x + 8 = -16$

Subtract 8: $4x = -24$

Divide by 4: $x = -6$

Check: $5(-6) + 8 = -22$ and $-6 - 16 = -22$

Answer: B — x = −6

Whiteboards · Question 5 of 9

$$2(x + 7) = 5x - 4$$

Answer it.

Whiteboards · Question 5 of 9

$$2(x + 7) = 5x - 4$$

Distribute: $2(x + 7) = 2x + 14$

Take 2x from both sides: $14 = 3x - 4$

Add 4: $18 = 3x$

Divide by 3: $x = 6$

Answer: $x = 6$

Whiteboards · Question 6 of 9

$$4(x - 2) = 2(x + 5)$$

A. $x = 3.5$

B. $x = 1$

C. $x = 9$

D. $x = 3$

Answer it.

Whiteboards · Question 6 of 9

$$4(x - 2) = 2(x + 5)$$

Distribute: $4x - 8 = 2x + 10$

Take 2x from both sides: $2x - 8 = 10$

Add 8: $2x = 18$

Divide by 2: $x = 9$

Check: $4(9 - 2) = 28$ and $2(9 + 5) = 28$

Answer: C — x = 9

Whiteboards · Question 7 of 9

A gym is open 7 days a week. It has two plans:

$30 a month plus $5 a visit, or $8 a visit.

After how many visits in a month do the plans cost the same?

Answer it.

Whiteboards · Question 7 of 9

A gym is open 7 days a week. It has two plans:

$30 a month plus $5 a visit, or $8 a visit.

After how many visits in a month do the plans cost the same?

v visits at the same cost: $30 + 5v = 8v$

Take 5v from both sides: $30 = 3v$

Divide by 3: $v = 10$

Check: $30 + 5(10) = 80$ and $8(10) = 80$

Answer: 10 visits

Whiteboards · Question 8 of 9

$x = 3$ is the solution of $5x + \square = 2x + 16$.

What number goes in the box?

Answer it.

Whiteboards · Question 8 of 9

$x = 3$ is the solution of $5x + \square = 2x + 16$.

What number goes in the box?

Put 3 in for x: $5(3) = 15$ and $2(3) + 16 = 22$

$15 + \square = 22$, so the box is $22 - 15 = 7$

Answer: 7

Whiteboards · Question 9 of 9

$2x + 15 = 6x - 9$

Kai starts by taking 2x from both sides.

Lena starts by taking 6x from both sides.

Solve it both ways. Do they get the same solution?

Write your answer in sentences.

Whiteboards · Question 9 of 9

$2x + 15 = 6x - 9$

Kai starts by taking 2x from both sides.

Lena starts by taking 6x from both sides.

Solve it both ways. Do they get the same solution?

Kai: $15 = 4x - 9$, $24 = 4x$, $x = 6$

Lena: $-4x + 15 = -9$, $-4x = -24$, $x = 6$

Check: $2(6) + 15 = 27$ and $6(6) - 9 = 27$

Answer: Yes: x = 6 both ways

Independent Set

1. Solve: $11w - 7 = 4w + 35$
2. Solve: $3h + 10 = 8h + 45$
3. Solve: $5(p - 3) = 2p + 12$
4. Solve: $3(k + 6) = 5(k - 2)$
5. Solve: $0.5(6t + 4) = t + 9$
6. A skating rink charges \$9 a visit, or \$24 a month plus \$5 a visit. After how many visits in a month do the two plans 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 equations with variables on both sides — ZYL