GRADE 7 · UNIT 10 · LESSON 6

Solving Two-Step Equations

MA.7.AR.2.2

I can solve $px \pm q = r$ when the numbers are fractions, decimals or negatives, with the variable on either side, and check my answer.

Warm-Up

1. Solve: $3x + 7 = 25$
2. Solve: $-4x < 10$
3. Find the value: $-4.8 \div 0.6$
4. What is the reciprocal of $\frac{2}{5}$?

Warm-Up

1. Solve: $3x + 7 = 25$ $x = 6$
2. Solve: $-4x < 10$ $x > -2.5$
3. Find the value: $-4.8 \div 0.6$ -8
4. What is the reciprocal of $\frac{2}{5}$? $\frac{5}{2}$

Vocabulary

reciprocal

the number to multiply by to get 1: multiplying by 5/3 undoes a coefficient of 3/5

symmetric property of equality

an equation read the other way round is still true: $-4.6 = 1.2 + 0.8w$ says $1.2 + 0.8w = -4.6$

check

put the answer back into the original equation and see that both sides match

Notes

I. A negative coefficient: its sign goes with it

$$-4x + 3 = 23$$

Subtract 3 from both sides: $-4x = 20$

Divide both sides by -4, sign and all: $x = -5$

Check: $-4(-5) + 3 = 20 + 3 = 23$.

Notes

II. A fraction coefficient: multiply by its reciprocal

$$\frac{3}{5}x - 2 = 7$$

Add 2 to both sides: $\frac{3}{5}x = 9$

Multiply both sides by $\frac{5}{3}$, the reciprocal: $x = 15$

Check: $\frac{3}{5}(15) - 2 = 9 - 2 = 7$.

Notes

III. The variable on the right, with decimals

$$-4.6 = 1.2 + 0.8w$$

Subtract 1.2 from both sides: $-5.8 = 0.8w$

Divide both sides by 0.8: $-7.25 = w$, so $w = -7.25$.

Example 1

$$\frac{3}{4}m + 5 = -4$$

Solve it. Then check.

Example 1

$$\frac{3}{4}m + 5 = -4$$

Subtract 5 from both sides: (3/4)m = −4 − 5 = −9.

Multiply both sides by 4/3, the reciprocal: m = −9 × 4/3 = −12.

Check: 3/4 × (−12) + 5 = −9 + 5 = −4.

Answer: m = −12

Your Turn

$$\frac{2}{5}n + 3 = -5$$

Solve it. Then check.

Your Turn

$$\frac{2}{5}n + 3 = -5$$

Solve it. Then check.

Subtract 3 from both sides: $-5 - 3 = -8$, so $\frac{2}{5}n = -8$

Multiply both sides by $\frac{5}{2}$: $-8 \times \frac{5}{2} = -20$, so $n = -20$

Check: $\frac{2}{5}(-20) + 3 = -8 + 3 = -5$

Answer: $n = -20$

Example 2

$$7.4 = 2.6 - 1.2y$$

Solve it. Write the answer with the variable first.

Example 2

$$7.4 = 2.6 - 1.2y$$

Subtract 2.6 from both sides: $7.4 - 2.6 = 4.8$, so $4.8 = -1.2y$.

Divide both sides by -1.2: $4.8 \div (-1.2) = -4$, so $-4 = y$.

Read it from the variable — the symmetric property: $y = -4$.

Answer: $y = -4$

Your Turn

$$9.1 = 3.5 - 0.7k$$

Solve it. Write the answer with the variable first.

Your Turn

$$9.1 = 3.5 - 0.7k$$

Solve it. Write the answer with the variable first.

Subtract 3.5 from both sides: $9.1 - 3.5 = 5.6$, so $5.6 = -0.7k$

Divide both sides by –0.7: $5.6 \div (-0.7) = -8$, so $k = -8$

Answer: $k = -8$

Whiteboards · Question 1 of 9

$-3x + 5 = 23$

Solve it.

Answer it.

Whiteboards · Question 1 of 9

$-3x + 5 = 23$

Solve it.

Subtract 5 from both sides: $23 - 5 = 18$, so $-3x = 18$

Divide both sides by −3: $18 \div (-3) = -6$, so $x = -6$

Answer: $x = -6$

Whiteboards · Question 2 of 9

$-3x - 5 = 23$

Solve it.

Answer it.

Whiteboards · Question 2 of 9

$-3x - 5 = 23$

Solve it.

Add 5 to both sides: $23 + 5 = 28$, so $-3x = 28$

Divide both sides by −3: $x = -\frac{28}{3}$ — a fraction, and it stays one

Answer: $x = -\frac{28}{3}$

Whiteboards · Question 3 of 9

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

Solve it.

A. $x = 15$

B. $x = -35$

C. $x = -\frac{3}{5}$

D. $x = -15$

Answer it.

Whiteboards · Question 3 of 9

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

Solve it.

Add 2 to both sides: $-5 + 2 = -3$, so $\frac{x}{5} = -3$

Multiply both sides by 5: $-3 \times 5 = -15$, so $x = -15$

Answer: D — x = –15

Whiteboards · Question 4 of 9

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

Solve it.

Answer it.

Whiteboards · Question 4 of 9

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

Solve it.

Subtract $\frac{1}{2}$ from both sides: $\frac{5}{6} - \frac{3}{6} = \frac{2}{6} = \frac{1}{3}$

Multiply both sides by $\frac{3}{2}$: $\frac{1}{3} \times \frac{3}{2} = \frac{1}{2}$, so $x = \frac{1}{2}$

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

Whiteboards · Question 5 of 9

$0.4y - 1.3 = 2.7$

Solve it.

Answer it.

Whiteboards · Question 5 of 9

$0.4y - 1.3 = 2.7$

Solve it.

Add 1.3 to both sides: $2.7 + 1.3 = 4$, so $0.4y = 4$

Divide both sides by 0.4: $4 \div 0.4 = 10$, so $y = 10$

Answer: $y = 10$

Whiteboards · Question 6 of 9

$$-2.5 = 3 + \frac{w}{2}$$

Solve it. Write the answer with the variable first.

Answer it.

Whiteboards · Question 6 of 9

$$-2.5 = 3 + \frac{w}{2}$$

Solve it. Write the answer with the variable first.

Subtract 3 from both sides: $-2.5 - 3 = -5.5$, so $-5.5 = \frac{w}{2}$

Multiply both sides by 2: $-5.5 \times 2 = -11$, so $w = -11$

Answer: $w = -11$

Whiteboards · Question 7 of 9

$$-\frac{3}{4}k + 2 = 14$$

Solve it.

A. $k = 16$

B. $k = -16$

C. $k = -9$

D. $k = -21\frac{1}{3}$

Answer it.

Whiteboards · Question 7 of 9

$$-\frac{3}{4}k + 2 = 14$$

Solve it.

Subtract 2 from both sides: $14 - 2 = 12$, so $-\frac{3}{4}k = 12$

Multiply both sides by $-\frac{4}{3}$: $12 \times \left(-\frac{4}{3}\right) = -16$, so $k = -16$

Answer: B — k = −16

Whiteboards · Question 8 of 9

A plumber who drove 12 miles charges a $45 fee plus $62.50 an hour, and the bill is $201.25.

How many hours did the plumber work?

Answer it.

Whiteboards · Question 8 of 9

A plumber who drove 12 miles charges a $45 fee plus $62.50 an hour, and the bill is $201.25.

How many hours did the plumber work?

The fee once, plus 62.50 an hour: $62.50h + 45 = 201.25$

Subtract 45, then divide by 62.50: $156.25 \div 62.50 = 2.5$, so $h = 2.5$

Answer: 2.5 hours

Whiteboards · Question 9 of 9

Raj solved $14 = -2x + 6$ and got $x = -10$.

Check Raj's answer. Then find his mistake and solve it.

Write your answer in sentences.

Whiteboards · Question 9 of 9

Raj solved $14 = -2x + 6$ and got $x = -10$.

Check Raj's answer. Then find his mistake and solve it.

Check: $-2(-10) + 6 = 26$, not 14 — so -10 is wrong

Raj added 6; subtract it: $14 - 6 = 8$, so $8 = -2x$ and $x = -4$

Answer: $x = -4$: Raj added 6 instead of subtracting

Independent Practice

1. Solve: $-5x + 4 = 29$
2. Solve: $-5x - 4 = 29$
3. Solve: $\frac{y}{-4} + 1 = 3$
4. Solve: $\frac{3}{8}n - 2 = 4$
5. Solve: $-1.7 = 0.5m + 2.3$
6. Solve: $\frac{1}{2} = \frac{3}{4}k - \frac{1}{4}$

Before You Go

The coefficient's sign goes with it.

A fraction coefficient: multiply by its reciprocal.

Tomorrow: a short check on what we have solved so far, then equations with parentheses.

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 60. Due by the Unit 10 test.

Today's skills — all required

Solve two-step equations without parentheses (CMX)

Solve equations of the form px + q = r with fractions (Y6Q)