GRADE 7 · UNIT 10 · LESSON 5

Solving Two-Step Equations Using Properties of Equality

MA.7.AR.2.2

I can name the parts of a two-step equation, show it with tiles or a bar diagram, and solve it with the properties of equality.

Warm-Up

1. Solve: $-0.5x > 4$
2. Solve: $y + 3.5 \geq 1$
3. Name the coefficient and the constant in $7x - 3$.
4. Solve: $4x = -28$

Warm-Up

1. Solve: $-0.5x > 4$ **$x < -8$**
2. Solve: $y + 3.5 \geq 1$ **$y \geq -2.5$**
3. Name the coefficient and the constant in $7x - 3$.

   coefficient 7; constant –3
4. Solve: $4x = -28$ $x = -7$

Vocabulary

two-step equation

an equation solved with two inverse operations: $3x + 4 = 22$ takes a subtraction, then a division

coefficient

the number that multiplies the variable: 3 in $3x + 4 = 22$

constant

a number added or subtracted, with no variable: 4 in $3x + 4 = 22$

properties of equality

add, subtract, multiply or divide both sides by the same number (not dividing by 0), and the equation stays true

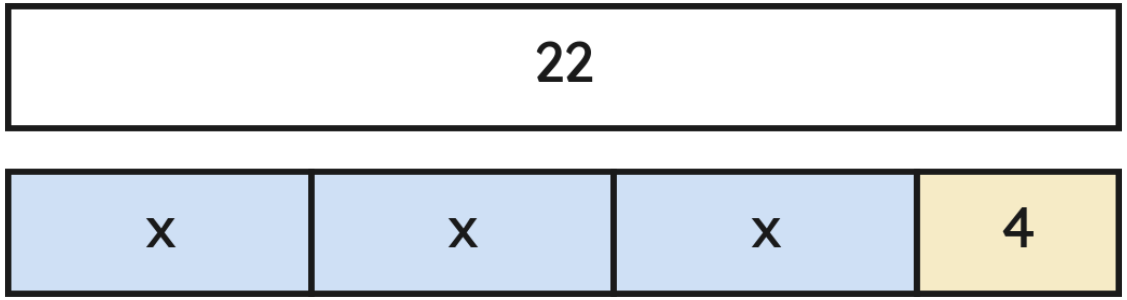
Notes

I. The parts of a two-step equation

$3x + 4 = 22$: x is the variable, 3 is its coefficient, 4 is the constant.

The coefficient multiplies x; the constant is added on.

The bar diagram: three equal pieces x and a 4 make the whole, 22.



Notes

II. Undo in reverse: the properties of equality

$3x + 4 = 22$: the 4 was added last, so it comes off first.

Subtract 4 from both sides — the subtraction property of equality: $3x = 18$

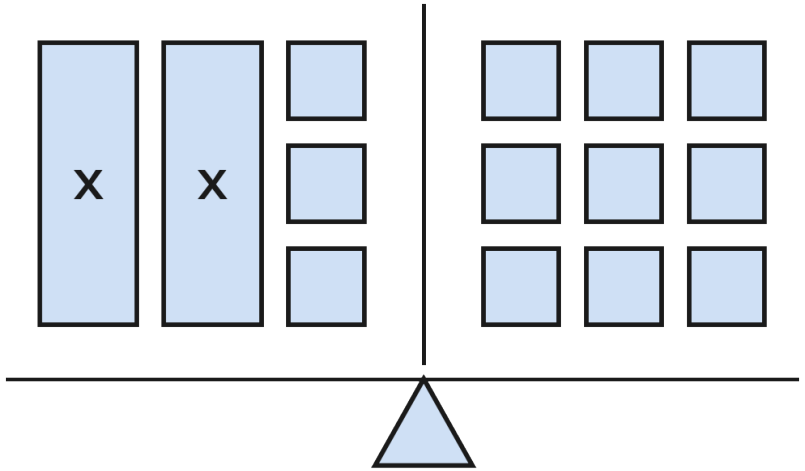
Divide both sides by 3 — the division property of equality: $x = 6$

Check: $3(6) + 4 = 22$.

Notes

III. Algebra tiles on a balance make the same two moves

$2x + 3 = 9$: two x-tiles and three unit tiles balance nine unit tiles.



Take 3 off each side: $2x = 6$. Share the 6 between the two x-tiles: $x = 3$.

Example 1

$$4x - 7 = 21$$

Solve it. Name the property you use at each step, then check.

Example 1

$$4x - 7 = 21$$

Add 7 to both sides — the addition property of equality: $4x = 28$.

Divide both sides by 4 — the division property of equality: $x = 7$.

Check: $4(7) - 7 = 28 - 7 = 21$.

Answer: $x = 7$

Your Turn

$$5y - 4 = 26$$

Solve it. Name the property you use at each step, then check.

Your Turn

$$5y - 4 = 26$$

Solve it. Name the property you use at each step, then check.

Add 4 to both sides (addition property): $26 + 4 = 30$, so $5y = 30$

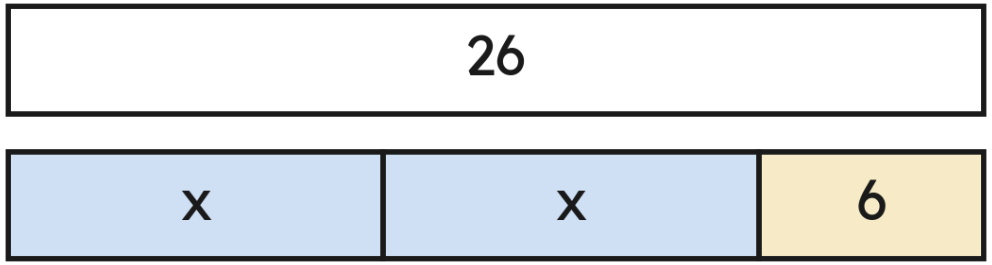
Divide both sides by 5 (division property): $30 \div 5 = 6$, so $y = 6$

Check: $5(6) - 4 = 26$

Answer: $y = 6$

Example 2

Write the equation the bar diagram shows. Then solve it.



Example 2

Two equal pieces x and a 6 make the whole, 26:

$$2x + 6 = 26$$

Subtract 6 from both sides: $2x = 20$. Divide both sides by 2: $x = 10$.

Answer: $2x + 6 = 26$, so $x = 10$

Your Turn

A bar diagram shows a whole of 23 above three equal pieces x and a piece of 2.

Write its equation. Then solve it.

Your Turn

A bar diagram shows a whole of 23 above three equal pieces x and a piece of 2.

Write its equation. Then solve it.

Three x's and a 2 make 23: $3x + 2 = 23$

Subtract 2, then divide by 3: $21 \div 3 = 7$, so $x = 7$

Answer: $3x + 2 = 23$, so $x = 7$

Whiteboards · Question 1 of 9

$6n + 11 = 47$

Which is the coefficient?

A. 11

B. 6

C. 6n

D. n

Answer it.

Whiteboards · Question 1 of 9

$6n + 11 = 47$

Which is the coefficient?

The coefficient multiplies the variable: 6 times n

11 is the constant; 47 is what the left side equals

Answer: B — 6

Whiteboards · Question 2 of 9

$6n + 11 = 47$

Solve it. Name each property.

Answer it.

Whiteboards · Question 2 of 9

$6n + 11 = 47$

Solve it. Name each property.

Subtraction property, 11 off both sides: $47 - 11 = 36$

Division property, both sides divided by 6: $36 \div 6 = 6$, so $n = 6$

Answer: $n = 6$

Whiteboards · Question 3 of 9

$3x - 8 = 13$

Solve it.

A. $x = 7$

B. $x = 12\frac{1}{3}$

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

D. $x = 63$

Answer it.

Whiteboards · Question 3 of 9

$3x - 8 = 13$

Solve it.

Add 8 to both sides: $13 + 8 = 21$, so $3x = 21$

Divide both sides by 3: $21 \div 3 = 7$, so $x = 7$

Answer: A — $x = 7$

Whiteboards · Question 4 of 9

$$\frac{x}{4} + 3 = 10$$

Solve it.

Answer it.

Whiteboards · Question 4 of 9

$\frac{x}{4} + 3 = 10$

Solve it.

Subtract 3 from both sides: $10 - 3 = 7$, so $\frac{x}{4} = 7$

Multiply both sides by 4: $7 \times 4 = 28$, so $x = 28$

Answer: $x = 28$

Whiteboards · Question 5 of 9

$$\frac{x}{4} - 3 = 10$$

Solve it.

Answer it.

Whiteboards · Question 5 of 9

$\frac{x}{4} - 3 = 10$

Solve it.

Add 3 to both sides: $10 + 3 = 13$, so $\frac{x}{4} = 13$

Multiply both sides by 4: $13 \times 4 = 52$, so $x = 52$

Answer: $x = 52$

Whiteboards · Question 6 of 9

$5x + 12 = -8$

Which value of x makes the equation true?

A. 0.8

B. 4

C. −20

D. −4

Answer it.

Whiteboards · Question 6 of 9

$5x + 12 = -8$

Which value of x makes the equation true?

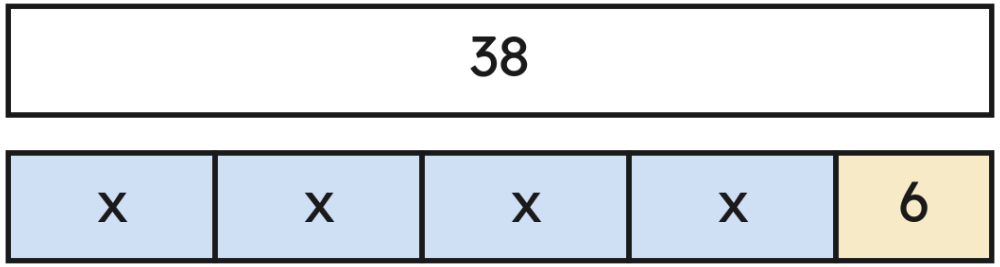
Test -4: $5(-4) + 12 = -20 + 12 = -8$

Or solve: $-8 - 12 = -20$, and $-20 \div 5 = -4$

Answer: D — −4

Whiteboards · Question 7 of 9

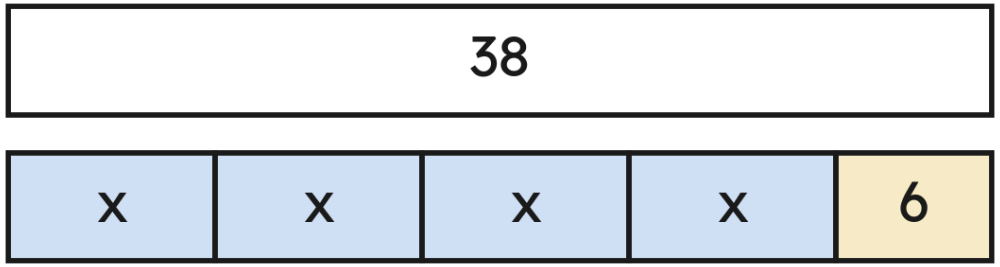
Write the equation the bar diagram shows. Then solve it.



Answer it.

Whiteboards · Question 7 of 9

Write the equation the bar diagram shows. Then solve it.



Four equal pieces x and a 6 make the whole, 38: $4x + 6 = 38$

Subtract 6, then divide by 4: $32 \div 4 = 8$, so $x = 8$

Answer: $4x + 6 = 38$, so $x = 8$

Whiteboards · Question 8 of 9

A music app charges an $8 fee plus $11 a month, and Rosa has paid $107 and listens 2 hours a day.

For how many months has she paid?

Answer it.

Whiteboards · Question 8 of 9

A music app charges an $8 fee plus $11 a month, and Rosa has paid $107 and listens 2 hours a day.

For how many months has she paid?

The fee once, plus 11 a month: $11m + 8 = 107$

Subtract 8, then divide by 11: $99 \div 11 = 9$, so $m = 9$

Answer: 9 months

Whiteboards · Question 9 of 9

Ana solved $2x + 7 = 31$ and wrote $2x = 31$, so $x = 15.5$.

What did Ana do wrong? Solve it correctly.

Write your answer in sentences.

Whiteboards · Question 9 of 9

Ana solved $2x + 7 = 31$ and wrote $2x = 31$, so $x = 15.5$.

What did Ana do wrong? Solve it correctly.

Ana took the 7 off the left side only; it comes off both sides

$31 - 7 = 24$, so $2x = 24$ and $x = 12$

Answer: She took 7 off one side only: x = 12

Independent Practice

1. Solve: $7x + 5 = 40$
2. Solve: $7x - 5 = 44$
3. Solve: $\frac{y}{3} + 4 = 9$
4. Solve: $12 + 5n = 52$
5. In $9k - 4 = 50$, name the coefficient and the constant. Then solve it.
6. Which value satisfies $4m + 9 = -11$: -5, 5 or -0.5?

Before You Go

Undo in reverse order: the constant first, then the coefficient.

Do the same to both sides of the equal sign.

Thursday: fractions, decimals and negatives.

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: complete the solution (X2L)
Which x satisfies an equation? (DJS)
Solve two-step equations using algebra tiles (R9E)