GRADE 7 ACCELERATED · UNIT 11 · LESSON 3

One Solution, No Solution, Infinitely Many Solutions

MA.8.AR.2.1

I can tell whether an equation has one solution, no solution or infinitely many solutions.

Warm-Up

1. Solve: $6x - 4 = 2x + 20$
2. Exterior angle 130°, one remote interior 55°. Find the other.
3. Find the distance from (1, 2) to (4, 6).
4. Is $x = 2$ a solution of $3x + 1 = 7$?

Warm-Up

1. Solve: $6x - 4 = 2x + 20$ **$x = 6$**
2. Exterior angle 130°, one remote interior 55°. Find the other.

   75°
3. Find the distance from (1, 2) to (4, 6). **5**
4. Is $x = 2$ a solution of $3x + 1 = 7$? **Yes: $3(2) + 1 = 7$**

Vocabulary

no solution

the equation is never true, whatever number the variable is;

it ends at a false statement, like $5 = 9$

infinitely many solutions

the equation is true for every number; it ends at a true statement, like $5 = 5$

Notes

I. Three endings

$2x + 5 = 3x + 9$ $x = -4$ one solution

$2x + 5 = 2x + 9$ $5 = 9$ never true: no solution

$2x + 5 = 2x + 5$ $5 = 5$ always true: infinitely many

Take 2x from both sides. Read what is left.

Notes

II. See it before the end

$3(x + 2) = 3x + 6$	$3x + 6 = 3x + 6$	infinitely many
$3(x + 2) = 3x + 2$	$3x + 6 = 3x + 2$	no solution

Same x-terms, same constants: infinitely many. Same x-terms, different constants: none. Different x-terms: one.

Notes

III. Zero is a number

$$4x + 7 = 7 - 2x$$

$$6x + 7 = 7$$

$$6x = 0$$

$$x = 0$$

One solution: x = 0. Zero is a number.

Check: $4(0) + 7 = 7$ and $7 - 2(0) = 7$

Example 1

$$4(x - 3) + 2 = 4x - 10$$

How many solutions does it have?

Example 1

$$4(x - 3) + 2 = 4x - 10$$

$$4x - 12 + 2 = 4x - 10$$

$$4x - 10 = 4x - 10$$

$$-10 = -10 \qquad \text{always true}$$

Answer: infinitely many solutions

Your Turn

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

How many solutions? Write the line you end on and what it means.

Your Turn

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

How many solutions? Write the line you end on and what it means.

Distribute: $6x + 3 - 5 = 6x - 2$

Collect: $6x - 2 = 6x - 2$

Take 6x from both sides: $-2 = -2$, always true

Answer: infinitely many solutions

Example 2

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

How many solutions does it have?

Example 2

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

$$6x + 8 = 6x + 5$$

$8 = 5$ never true

Answer: no solution

Your Turn

$$5(2x - 1) = 10x + 3$$

How many solutions? Write the line you end on and what it means.

Your Turn

$$5(2x - 1) = 10x + 3$$

How many solutions? Write the line you end on and what it means.

Distribute: $10x - 5 = 10x + 3$

Take $10x$ from both sides: $-5 = 3$, never true: no solution

Answer: no solution

Whiteboards · Question 1 of 9

$7x + 2 = 7x + 2$

One solution, no solution or infinitely many? If one, find it.

Answer it.

Whiteboards · Question 1 of 9

$7x + 2 = 7x + 2$

One solution, no solution or infinitely many? If one, find it.

Both sides are $7x + 2$

Take $7x$ from both sides: $2 = 2$, always true

Answer: infinitely many solutions

Whiteboards · Question 2 of 9

$3x + 8 = 3x - 1$

One solution, no solution or infinitely many? If one, find it.

Answer it.

Whiteboards · Question 2 of 9

$3x + 8 = 3x - 1$

One solution, no solution or infinitely many? If one, find it.

The x-terms match: $3x$ and $3x$

Take $3x$ from both sides: $8 = -1$, never true: no solution

Answer: no solution

Whiteboards · Question 3 of 9

$5x + 4 = 2x + 4$

One solution, no solution or infinitely many? If one, find it.

Answer it.

Whiteboards · Question 3 of 9

$5x + 4 = 2x + 4$

One solution, no solution or infinitely many? If one, find it.

Take 2x from both sides: $3x + 4 = 4$

Subtract 4: $3x = 0$

Divide by 3: $x = 0$

Check: $5(0) + 4 = 4$ and $2(0) + 4 = 4$

Answer: one solution: x = 0

Whiteboards · Question 4 of 9

$2(4x + 3) = 8x + 6$

How many solutions does it have?

A. one solution, $x = 0$

B. infinitely many solutions

C. no solution

D. one solution, $x = 6$

Answer it.

Whiteboards · Question 4 of 9

$2(4x + 3) = 8x + 6$

How many solutions does it have?

Distribute: $8x + 6 = 8x + 6$

Take 8x from both sides: $6 = 6$, always true

Answer: B — infinitely many solutions

Whiteboards · Question 5 of 9

$6x - 9 = 3(x - 4)$

One solution, no solution or infinitely many? If one, find it.

Answer it.

Whiteboards · Question 5 of 9

$6x - 9 = 3(x - 4)$

One solution, no solution or infinitely many? If one, find it.

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

Take 3x from both sides: $3x - 9 = -12$

Add 9: $3x = -3$

Divide by 3: $x = -1$

Check: $6(-1) - 9 = -15$ and $3(-1 - 4) = -15$

Answer: one solution: x = –1

Whiteboards · Question 6 of 9

Which equation has no solution?

A. $3x + 1 = x + 1$

B. $3x + 1 = 2x$

C. $3x + 1 = 1 + 3x$

D. $3x + 1 = 3x - 1$

Answer it.

Whiteboards · Question 6 of 9

Which equation has no solution?

$3x + 1$ and $3x - 1$: the same x-terms

Take 3x from both sides: $1 = -1$, never true: no solution

Answer: D — $3x + 1 = 3x - 1$: no solution

Whiteboards · Question 7 of 9

Plan A costs $15 a month plus $3 a gigabyte.

Plan B costs $20 a month plus $3 a gigabyte.

Each plan has an 8 GB limit.

For how many gigabytes do the plans cost the same?

Answer it.

Whiteboards · Question 7 of 9

Plan A costs $15 a month plus $3 a gigabyte.

Plan B costs $20 a month plus $3 a gigabyte.

Each plan has an 8 GB limit.

For how many gigabytes do the plans cost the same?

g gigabytes at the same cost: $15 + 3g = 20 + 3g$

Take 3g from both sides: $15 = 20$, never true: no solution

B always costs $5 more

Answer: never: no solution

Whiteboards · Question 8 of 9

Fill the box so $4(x + 3) = 4x + \square$ has infinitely many solutions.

Then fill the box so $2(3x - 5) = \square x + 1$ has no solution.

Answer it.

Whiteboards · Question 8 of 9

Fill the box so $4(x + 3) = 4x + \square$ has infinitely many solutions.

Then fill the box so $2(3x - 5) = \square x + 1$ has no solution.

$4(x + 3)$ is $4x + 12$: the box is 12

$2(3x - 5)$ is $6x - 10$: the box is 6

With 6 in the box: $6x - 10 = 6x + 1$

Take 6x from both sides: $-10 = 1$, never true: no solution

Answer: 12; then 6 (no solution)

Whiteboards · Question 9 of 9

Mia and Jo both solved $3(x + 4) - 12 = 3x$ and ended at $0 = 0$.

Mia wrote “x = 0”. Jo wrote “no solution”.

Who is right? Explain.

Write your answer in sentences.

Whiteboards · Question 9 of 9

Mia and Jo both solved $3(x + 4) - 12 = 3x$ and ended at $0 = 0$.

Mia wrote "x = 0". Jo wrote "no solution".

Who is right? Explain.

Distribute: $3x + 12 - 12 = 3x$, so $3x = 3x$

Take 3x from both sides: $0 = 0$, always true

Every number works: infinitely many solutions

Answer: Neither: infinitely many solutions

Independent Set

1. How many solutions does $6h - 5 = 2h + 19$ have? If one, find it.
2. How many solutions does $0.5(6n - 4) = 3n + 2$ have? If one, find it.
3. How many solutions does $5(k + 2) - 3 = 5k + 7$ have? If one, find it.
4. How many solutions does $3(2v + 5) = 15 - v$ have? If one, find it.
5. What number goes in the box so that $6(x - 2) + 1 = 6x - \square$ has infinitely many solutions?
6. What number goes in the box so that $3(4x + 1) = \square x + 7$ has no solution?

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

Find the number of solutions — XDE

Create equations with no solutions or infinitely many solutions — 7TY