MATHEMATICS · GRADES 10-12

Solving systems with fractions

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you sort out two unknowns at once, like splitting a bill where the shares are fractions of the total, by clearing the fractions first so the numbers are easy to work with. Fractions make a system look harder than it is, because every number is a piece of something else. Clearing them turns the problem into plain whole numbers, and from there it is an ordinary two unknown problem. That is how you handle bills, mixtures, or shares where the amounts are given as fractions.



Rule

Solving systems with fractions: clear the fractions first by multiplying each equation by a number that clears its denominators, then solve the system as usual.

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Worked examples

EXAMPLE 1

Q Solve $\frac{x}{2} + y = 5$ and $x + y = 7$.

SOLUTION

Multiply the first equation by 2: $x + 2y = 10$

Subtract the second equation from the first: $(x + 2y) - (x + y) = 10 - 7$, which leaves $y = 3$.

Put $y = 3$ into $x + y = 7$:

$x + 3 = 7$

$x = 4$

Answer: (4, 3)

EXAMPLE 2

Q Solve $\frac{x}{3} + \frac{y}{3} = 2$ and $x - y = 2$.

SOLUTION

Multiply the first equation by 3: $x + y = 6$

Add the second equation to the first: $(x + y) + (x - y) = 6 + 2$, which gives $2x = 8$, so $x = 4$.

Put $x = 4$ into $x + y = 6$:

$4 + y = 6$

$y = 2$

Answer: (4, 2)

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Practice questions

1 Two numbers satisfy $\frac{x}{2} + y = 4$ and $x + y = 6$. Solve the system.

- **A** (4, 2)
- **B** (2, 4)
- **C** (4, 4)
- **D** (2, 2)

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2 Solve $\frac{x}{2} + \frac{y}{3} = 4$ and $x + y = 10$. Solve the system.

- **A** (4, 6)
- **B** (6, 4)
- **C** (2, 8)
- **D** (8, 2)

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3 $\frac{1}{2}$ of Sara's money plus $\frac{1}{2}$ of Tom's money is 3 dollars. Sara has 2 dollars more than Tom. How much money does each of them have? Solve the system.

A (2, 4)

B (4, 4)

C (4, 2)

D (6, 2)

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4 $\frac{1}{3}$ of the red marbles plus all of the blue marbles is 4. There are 6 marbles in the bag altogether. How many red marbles and how many blue marbles are there? Solve the system.

- **A** (3, 4)
- **B** (4, 3)
- **C** (3, 6)
- **D** (3, 3)

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5 A system has fractions in it. What is the first step?

- **A** Add the two equations together
- **B** Multiply each equation by a common denominator
- **C** Solve one equation for x
- **D** Divide each equation by its denominator

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6 $\frac{1}{2}$ of the morning tickets plus $\frac{1}{3}$ of the afternoon tickets is 4. $\frac{1}{4}$ of the morning tickets plus $\frac{1}{2}$ of the afternoon tickets is 3. How many tickets were sold in the morning and how many in the afternoon? Solve the system.

A (6, 3)

B (3, 6)

C (4, 4)

D (6, 6)

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7 $\frac{1}{2}$ of the first number plus the second number is 7. The first number is 5 more than the second. What are the two numbers? Solve the system.

A (3, 8)

B (8, 3)

C (8, 8)

D (5, 3)

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8 $\frac{1}{2}$ of Sara's age plus $\frac{1}{3}$ of Tom's age is 7. Sara is 4 years older than Tom. How old is each of them? Solve the system.

A (10, 6)

B (6, 10)

C (9, 5)

D (12, 8)

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9 $\frac{1}{2}$ of the first number plus the second number is 3. Twice the first number plus the second number is 9. What are the two numbers? Solve the system.

A (1, 4)

B (4, 4)

C (9, 1)

D (4, 1)

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10 **A student clears fractions before solving. Why does that help?**

- **A** Fractions make the answer a whole number
- **B** It changes the solution to (0, 0)
- **C** Whole-number coefficients are easier to add, subtract, and substitute
- **D** It removes one of the equations

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ANSWER KEY

1. (4, 2)

2. (4, 6)

3. (4, 2)

4. (3, 3)

5. Multiply each equation by a common denominator

6. (6, 3)

7. (8, 3)

8. (10, 6)

9. (4, 1)

10. Whole-number coefficients are easier to add, subtract, and substitute

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