

Solving One-Step Equations

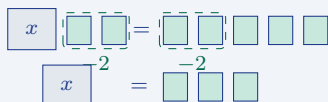
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Think of an equation as a perfectly balanced scale—whatever you do to one side, you must do to the other! In a **one-step equation** the variable is affected by just one operation, so you only need one inverse move to set it free: addition is undone by subtraction, multiplication by division, and so on. Once the idea of *balance and inverse operations* clicks here, every tougher equation you meet later will follow the same logic. This is truly where algebra starts to feel like detective work!

Key Concepts & Quick Review

Addition/Subtraction equations: $x + a = b \Rightarrow x = b - a$; $x - a = b \Rightarrow x = b + a$.

Multiplication/Division equations: $ax = b \Rightarrow x = \frac{b}{a}$; $\frac{x}{a} = b \Rightarrow x = ab$. Always **check** by substituting back into the original equation.



Undo the same amount on both sides.

Examples

① Solve: (a) $x - 9 = -4$ (b) $-6y = 42$

Think It Through: In part (a), undo the subtraction by adding 9 to both sides. That isolates the variable and gives $x = 5$. In part (b), undo the multiplication by dividing both sides by -6 . That gives $y = -7$. A quick check shows both answers work in the original equations, which is a good habit for one-step equations.

Answer: (a) $x = 5$; (b) $y = -7$

② A skateboarder saves the same amount of money each week. After 8 weeks she has saved \$104. Write and solve a one-step equation to find her weekly savings.

Think It Through: Let w represent the amount saved each week. Since the same amount is saved for 8 weeks, write $8w = 104$. Now divide both sides by 8 to isolate w : $w = 13$. So she saves \$13 each week. The structure is “number of weeks times weekly amount equals total saved.”

Answer: $w = \$13$ per week

Practice Problems

Solve each one-step equation.



1. $x + 7 = 15$ _____

2. $n - 4 = -9$ _____

3. $3y = 21$ _____

4. $\frac{m}{5} = 8$ _____

5. $x - 12 = 0$ _____

6. $-4k = 36$ _____

7. $t + (-6) = 10$ _____

8. $\frac{n}{-3} = 7$ _____

9. $9p = -63$ _____

10. $x + \frac{1}{2} = 3$ _____

11. $-8 + m = 2$ _____




12. $6a = -54$ _____

13. $\frac{x}{4} = -5$ _____

14. $y - (-3) = 11$ _____

15. $1.5x = 9$ _____

Study Tips

-  The goal is to get the variable **alone on one side**. Use the *opposite* (inverse) of whatever operation is applied to it.
-  **Always check** by plugging your answer back in. If both sides are equal, you're correct.
-  When dividing both sides, remember: **negative** \div **negative** = **positive**. Keep careful track of signs.

Word Problems

16. A submarine is cruising at a depth of -240 m. The captain orders it to rise to a new depth d by ascending 85 m. Write and solve a one-step equation for the new depth d . Is the submarine still underwater? How many more meters must it ascend to reach the surface? _____
17. An oven is preheating. Its current temperature is $\frac{5}{8}$ of the target temperature of 400°F . Write and solve a one-step equation to find the current temperature. If the oven heats at 20°F per minute, write (but do not yet solve) an equation for how many more minutes m it needs to reach the target. _____



Answer Keys

- | | |
|---|---|
| <p>1) 8</p> <p>2) -5</p> <p>3) 7</p> <p>4) 40</p> <p>5) 12</p> <p>6) -9</p> <p>7) 16</p> <p>8) -21</p> <p>9) -7</p> | <p>10) $\frac{5}{2}$</p> <p>11) 10</p> <p>12) -9</p> <p>13) -20</p> <p>14) 8</p> <p>15) 6</p> <p>16) $d = -155\text{ m}$; still underwater; needs 155 more meters</p> <p>17) Current 250°F; $m = 7.5$ minutes</p> |
|---|---|

Step-by-Step Explanations

Strategy: For Percent Increase and Percent Decrease, compare the change to the original amount, then label whether the quantity went up or down. A percent-change setup should show original, change, and new amount separately.

Practice 1: A value changes from 20 to 28. Find the percent increase or decrease. **Answer:** 40% increase
For the first worked item, compare the change to the original amount, then label the change as an increase.

Practice 15: Find the new value after increasing 500 by 8%. **Answer:** 540
Near the end of this topic, multiply the original amount by the increase factor to get the new value.

Word-problem notes:

16. Answer: Jan→Feb: 15% increase; Feb→Mar: $\approx 7.9\%$ decrease.

For January to February, find the change first: $96,600 - 84,000 = 12,600$. Then divide by the original amount, January's revenue: $\frac{12,600}{84,000} = 0.15 = 15\%$. For February to March, the revenue dropped by $96,600 - 89,000 = 7,600$. Divide that by February's amount because February is the starting value for that change: $\frac{7,600}{96,600} \approx 0.0787$, or about 7.9% decrease. The original amount always goes in the denominator.

17. Answer: % increase: 25%; second student's new score: $75 \times 1.25 = 93.75 \approx 94$.

First find the increase in the first score: $80 - 64 = 16$ points. Now compare that increase to the original score: $\frac{16}{64} = 0.25 = 25\%$. If the second student has the same percent increase, multiply the original score by 1.25 because $100\% + 25\% = 125\% = 1.25$. So $75 \times 1.25 = 93.75$, which rounds to 94. Converting a percent increase into a multiplier is often the quickest method.



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