Solving One-Step Equations

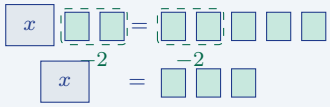
Name: _____	Date: _____	Score: _____ / 17

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** ÷ **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

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

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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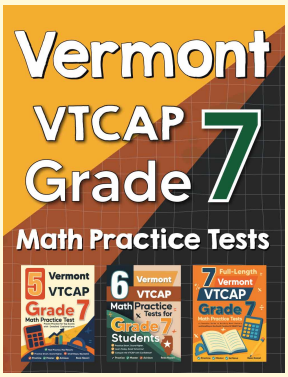

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