Adding and Subtracting Linear Expressions

Name: _____	Date: _____	Score: _____ / 17

Adding and subtracting linear expressions is really just a like-terms game with some careful sign work! When you add two expressions, collect all the like terms and combine them. When you *subtract*, the trick is to distribute the negative sign to every term in the second expression *before* you combine. Nail this habit now and you will fly through equation solving and formula work later on!

Key Concepts & Quick Review

Adding: $(3x + 4) + (5x - 2) = 3x + 4 + 5x - 2 = 8x + 2$.

Subtracting: $(3x + 4) - (5x - 2)$: distribute the minus sign first: $3x + 4 - 5x + 2 = -2x + 6$. Never drop the sign of the second term!

Examples

① Add: $(6x - 3) + (-2x + 9)$.

Think It Through: Because the two expressions are being added, you can remove the parentheses without changing the signs: $6x - 3 - 2x + 9$. Now combine like terms. The variable terms give $6x - 2x = 4x$, and the constants give $-3 + 9 = 6$. So the sum is $4x + 6$.

Answer: $4x + 6$

② A rectangle's perimeter is the sum of all four sides. Two sides have length $(3x + 5)\ cm$ and two sides have length $(x - 2)\ cm$. Write and simplify an expression for the perimeter.

Think It Through: A rectangle has two pairs of equal sides, so add each side length twice: $2(3x + 5) + 2(x - 2)$. Distribute first to get $6x + 10 + 2x - 4$. Then combine like terms: $6x + 2x = 8x$ and $10 - 4 = 6$. The perimeter simplifies to $8x + 6\ cm$.

Answer: $8x + 6\ cm$

Practice Problems

Add or subtract the linear expressions and simplify.

1. $(2x + 5) + (3x - 1)$ _____
2. $(7y - 3) + (y + 6)$ _____
3. $(4a + 2) - (a - 5)$ _____
4. $(9n - 4) - (3n + 2)$ _____
5. $(5x + 8) + (-2x - 3)$ _____
6. $(6m - 1) - (6m - 1)$ _____
7. $(3k + 7) + (2k - 7)$ _____
8. $(8p - 5) - (p + 4)$ _____
9. $(x + 9) + (4x - 9)$ _____
10. $(2y + 3) - (-y + 6)$ _____
11. $(5a - 2b) + (3a + b)$ _____
12. $(4x + 3y) - (x - 2y)$ _____

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13. $(7n + 1) + (2 - 3n)$ _____

14. $(\frac{1}{2}x + 4) + (x - 1)$ _____

15. $(6t - 3) - (2t + 5)$ _____

Study Tips

- Subtraction means **add the opposite**. Rewrite $(A) - (B)$ as $(A) + (-B)$ and flip every sign in B.
- A term with no written coefficient has coefficient 1: subtracting $(x + 3)$ changes to $(-x - 3)$.
- After distributing the negative, **cross out the original** second expression and rewrite it — this eliminates sign-chasing errors.

Word Problems

16. Two rival lemonade stands set up at a school fair. Stand A earns $(8x + 12)$ dollars over the day, where x is the number of pitchers sold. Stand B earns $(5x - 3)$ dollars. Write and simplify an expression for their *combined* earnings. Then write and simplify an expression showing how much *more* Stand A earned than Stand B. If $x = 10$, evaluate both expressions. _____

17. A hiking trail has three segments. The first segment is $(4x - 1)$ mi long, the second is $(2x + 3)$ mi, and the third is $(x + 2)$ mi. A shortcut removes the third segment. Write an expression for the original trail length and for the shortcut trail length. How much shorter is the shortcut when $x = 6$? _____

Answer Keys

1) $5x + 4$
2) $8y + 3$
3) $3a + 7$
4) $6n - 6$
5) $3x + 5$
6) 0
7) $5k$
8) $7p - 9$
9) $5x$
10) $3y - 3$
11) $8a - b$
12) $3x + 5y$
13) $4n + 3$
14) $\frac{3}{2}x + 3$
15) $4t - 8$
16) Combined: $13x + 9$; difference: $3x + 15$; at x=10: \$139 and \$45.
17) Original: $7x + 4$; shortcut: $6x + 2$; difference: $x + 2$; at x=6: $8\ mi$ shorter.

Step-by-Step Explanations

Strategy: For Finding the Whole Given a Part and Percent, divide the known part by the percent rate because the whole is the unknown starting amount. Students should hear the sentence as part equals percent times whole, then solve for the missing whole.

Practice 1: 9 is 30% of W **Answer:** 30

For the first sample, divide the part by its percent written as a decimal; that backs up to the whole.

Practice 15: 36 is 90% of W **Answer:** 40

Late in the set, use part divided by rate again, with the rate written as 0.25.

Word-problem notes:

16. Answer: Total: $\frac{84}{0.35} = 240$ students; non-fiction: $240 - 84 = 156$ students.

Here 84 students is only part of the whole group, and that part is 35% of the total. To find the whole, divide part by percent in decimal form: $84 \div 0.35 = 240$. So 240 students were surveyed altogether. To find how many do not prefer fiction, subtract the fiction group from the total: $240 - 84 = 156$. Whenever the problem gives you a part and a percent, division helps you recover the whole.

17. Answer: Original: \$45,000; raise: \$9,000. Second employee: ≈ \$40,000.

After a 20% raise, the employee earns 120% of the original salary. In decimal form, that is 1.20. So the original salary is $54{,}000 \div 1.20 = 45{,}000$ dollars. The raise amount is $54{,}000 - 45{,}000 = 9{,}000$ dollars. For the second employee, a 15% raise means the new salary is $115\% = 1.15$ times the original, so $46{,}000 \div 1.15 \approx 40{,}000$. The key idea is that after a raise, you divide by the new percent of the original, not just by the raise percent itself.

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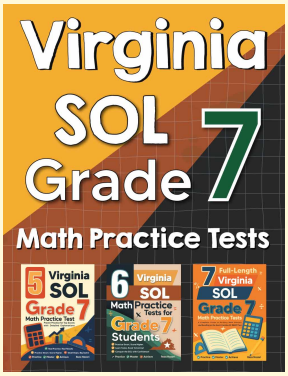

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