Rewriting Expressions to Solve Problems

Spot mistakes, reason, and work backward

Name _____ **Date** _____ **Score** _____ / 8

QUICK REVIEW

Equivalent expressions reveal different information. $8(x+2)+5=8x+21$ shows an 8-dollar cost per extra item and a fixed total of 21 dollars. The distributive property preserves the value for every allowed input, not only for one example.

Worked example

A club pays 9 dollars for each of $x+2$ items and one 4-dollar fee. Rewrite the bill and find the total at $x=3$.

1. The grouped bill is $9(x+2)+4$.
2. Distribute and add the one-time fee: $9x+18+4=9x+22$.
3. At $x=3$, the rewritten rule gives $9(3)+22=49$ dollars.
Answer: $9x+22$ dollars; 49 dollars at $x=3$.

Practice Problems

Show your thinking.

1. A receipt rule is $4x+14$. Recover the equivalent grouped rule $4(x+c)+2$ by finding c; verify at $x=1$. Identify the variable unit cost and the fixed total.

2. A receipt rule is $5x+13$. Recover the equivalent grouped rule $5(x+c)+3$ by finding c; verify at $x=2$. Rewrite the rule as a repeated-group model and explain each part.

3. A receipt rule is $3x+13$. Recover the equivalent grouped rule $3(x+c)+1$ by finding c; verify at $x=3$. Determine how much the cost changes when x increases by 2.

4. A receipt rule is $6x+16$. Recover the equivalent grouped rule $6(x+c)+4$ by finding c; verify at $x=4$. Find the value when $x=0$ and explain why it is not zero.

5. A receipt rule is $2x+13$. Recover the equivalent grouped rule $2(x+c)+3$ by finding c; verify at $x=5$. Construct a two-row input-output table for $x=1,3$.

6. A receipt rule is $7x+23$. Recover the equivalent grouped rule $7(x+c)+2$ by finding c; verify at $x=6$. Then identify the two parts of the expanded constant.

7. Supply package: a student claims $3(2x+5)=6x+16$. Correct the constant term and verify at $x=2$.

8. Ticket bundle: an equivalent form of $4(3x+2)$ has coefficient q on x and constant r. Find (q,r) and then write the resulting expression.

Answer Key

1. $c = 3$; value \$18.00. Variable cost 4 dollars per extra item; fixed total 14 dollars.
2. $c = 2$; value \$23.00. There are $x + 2$ groups of 5 dollars, one group per item. Shipping adds a single 3 dollars after that subtotal.
3. $c = 4$; value \$22.00. Change $= 2(3) = 6$ dollars.
4. $c = 2$; value \$40.00. At $x = 0$, the 2 base items still cost $6(2) = 12$ dollars. Shipping adds 4 dollars, giving 16 dollars.
5. $c = 5$; value \$23.00. Table $(1, 15), (3, 19)$.
6. $c = 3$; at $x = 6$, 65 dollars. The fixed total is $21 + 2 = 23$ dollars.
7. Correct form $6x + 15$; correct value 27, not 28.
8. $(q, r) = (12, 8)$; $12x + 8$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Distribute the unknown group size: $4(x + c) + 2 = 4x + 4c + 2$.
2. Match constant terms: $4c + 2 = 14$, so $c = (14 - 2)/4 = 3$.
3. At $x = 1$, grouped $4(1 + 3) + 2 = 18$ and expanded $4(1) + 14 = 18$ dollars.
4. Variable cost 4 dollars per extra item; fixed total 14 dollars.

Problem 2

1. Distribute the unknown group size: $5(x + c) + 3 = 5x + 5c + 3$.
2. Match constant terms: $5c + 3 = 13$, so $c = (13 - 3)/5 = 2$.
3. At $x = 2$, grouped $5(2 + 2) + 3 = 23$ and expanded $5(2) + 13 = 23$ dollars.
4. There are $x + 2$ groups of 5 dollars, one group per item. Shipping adds a single 3 dollars after that subtotal.

Problem 3

1. Distribute the unknown group size: $3(x + c) + 1 = 3x + 3c + 1$.
2. Match constant terms: $3c + 1 = 13$, so $c = (13 - 1)/3 = 4$.
3. At $x = 3$, grouped $3(3 + 4) + 1 = 22$ and expanded $3(3) + 13 = 22$ dollars.
4. Change $= 2(3) = 6$ dollars.

Problem 4

1. Distribute the unknown group size: $6(x + c) + 4 = 6x + 6c + 4$.
2. Match constant terms: $6c + 4 = 16$, so $c = (16 - 4)/6 = 2$.
3. At $x = 4$, grouped $6(4 + 2) + 4 = 40$ and expanded $6(4) + 16 = 40$ dollars.
4. At $x = 0$, the 2 base items still cost $6(2) = 12$ dollars. Shipping adds 4 dollars, giving 16 dollars.

Problem 5

1. Distribute the unknown group size: $2(x + c) + 3 = 2x + 2c + 3$.
2. Match constant terms: $2c + 3 = 13$, so $c = (13 - 3)/2 = 5$.
3. At $x = 5$, grouped $2(5 + 5) + 3 = 23$ and expanded $2(5) + 13 = 23$ dollars.
4. At $x = 1$: $2(1) + 13 = 15$. At $x = 3$: $2(3) + 13 = 19$.

x	Cost (dollars)
1	15
3	19

Problem 6

1. Distribute the unknown group size: $7(x + c) + 2 = 7x + 7c + 2$.
2. Match constant terms: $7c + 2 = 23$, so $c = (23 - 2)/7 = 3$.
3. At $x = 6$, grouped $7(6 + 3) + 2 = 65$ and expanded $7(6) + 23 = 65$ dollars.
4. The 23 fixed total is $7(3) = 21$ dollars for base items plus 2 dollars for shipping.

Problem 7

1. Multiply the variable term: $3(2x) = 6x$.
2. Multiply the constant too: $3(5) = 15$.
3. Combine the two products: $6x + 15$.
4. At $x = 2$, the correct value is $6(2) + (15) = 27$; the claim gives 28.

Problem 8

1. Multiply the variable term: $4(3x) = 12x$.
2. Multiply the constant too: $4(2) = 8$.
3. Combine the two products: $12x + 8$.

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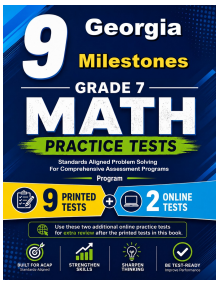

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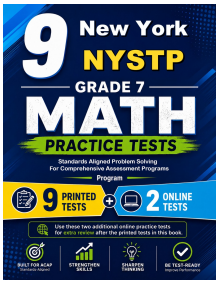

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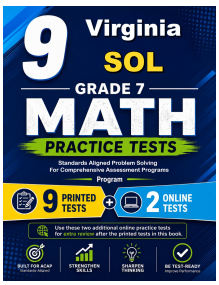

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