Rewriting Expressions to Solve Problems

Explore ideas and representations

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 club buys $x+3$ items at \$4.00 each plus \$2.00 shipping. Rewrite $4(x+3)+2$ and evaluate at $x=1$. Identify the variable unit cost and the fixed total.

2. A club buys $x+2$ items at \$5.00 each plus \$3.00 shipping. Rewrite $5(x+2)+3$ and evaluate at $x=2$. Rewrite the rule as a repeated-group model and explain each part.

3. A club buys $x+4$ items at \$3.00 each plus \$1.00 shipping. Rewrite $3(x+4)+1$ and evaluate at $x=3$. Determine how much the cost changes when x increases by 2.

4. A club buys $x+2$ items at \$6.00 each plus \$4.00 shipping. Rewrite $6(x+2)+4$ and evaluate at $x=4$. Find the value when $x=0$ and explain why it is not zero.

5. A club buys $x+5$ items at \$2.00 each plus \$3.00 shipping. Rewrite $2(x+5)+3$ and evaluate at $x=5$. Construct a two-row input-output table for $x=1,3$.

6. An order has $x+3$ items at 7 dollars each and one shipping fee. The expanded rule is $7x+23$. Find the fee. Then evaluate the cost at $x=6$.

7. Supply package: rewrite $3(2x+5)$, then evaluate the rewritten expression at $x=2$.

8. Ticket bundle: $4(3x+2)=12x+k$. Find k, then write the simplified expression.

Answer Key

1. $4x + 14$; \$18.00. Variable cost 4 dollars per extra item; fixed total 14 dollars.
2. $5x + 13$; \$23.00. There are $x + 2$ groups of 5 dollars, one group per item. Shipping adds a single 3 dollars after that subtotal.
3. $3x + 13$; \$22.00. Change $= 2(3) = 6$ dollars.
4. $6x + 16$; \$40.00. At $x = 0$, the 2 base items still cost $6(2) = 12$ dollars. Shipping adds 4 dollars, giving 16 dollars.
5. $2x + 13$; \$23.00. Table $(1, 15), (3, 19)$.
6. Shipping 2 dollars; cost 65 dollars.
7. $6x + 15$; value 27.
8. $k = 8$; $12x + 8$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Distribute: $4(x + 3) = 4x + 12$.
2. Add the fee: $12 + 2 = 14$, so the rule is $4x + 14$.
3. At $x = 1$, $4(1) + 14 = 18$ dollars.
4. Variable cost 4 dollars per extra item; fixed total 14 dollars.

Problem 2

1. Distribute: $5(x + 2) = 5x + 10$.
2. Add the fee: $10 + 3 = 13$, so the rule is $5x + 13$.
3. At $x = 2$, $5(2) + 13 = 23$ 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: $3(x + 4) = 3x + 12$.
2. Add the fee: $12 + 1 = 13$, so the rule is $3x + 13$.
3. At $x = 3$, $3(3) + 13 = 22$ dollars.
4. Change $= 2(3) = 6$ dollars.

Problem 4

1. Distribute: $6(x + 2) = 6x + 12$.
2. Add the fee: $12 + 4 = 16$, so the rule is $6x + 16$.
3. At $x = 4$, $6(4) + 16 = 40$ 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: $2(x + 5) = 2x + 10$.
2. Add the fee: $10 + 3 = 13$, so the rule is $2x + 13$.
3. At $x = 5$, $2(5) + 13 = 23$ 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. The base items cost $7(3) = 21$ dollars, so the grouped subtotal is $7(x + 3) = 7x + 21$.
2. The expanded constant is 23, so shipping is $23 - 21 = 2$ dollars.
3. At $x = 6$, use the rewritten rule: $7(6) + 23 = 42 + 23 = 65$ dollars.

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 $x = 2$: $6(2) + (15) = 27$.

Problem 8

1. Multiply the variable term: $4(3x) = 12x$.
2. Multiply the constant too: $4(2) = 8$.
3. Combine the two products: $12x + 8$.
4. The variable terms match, so the missing constant is $k = 8$.

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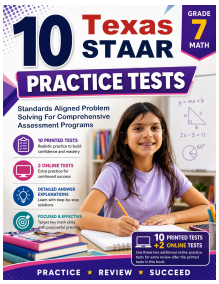

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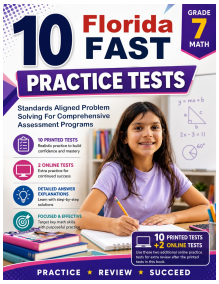

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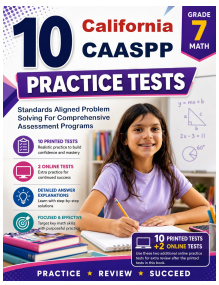

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