Equivalent Expressions

Equivalent expressions: Models and calculations

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QUICK REVIEW

Equivalent expressions have the same value for every allowed input. Distribute $3(x+4)=3x+12$ and combine like terms $2x+5x=7x$. Unlike terms such as $2x+5$ cannot be combined into $7x$. Testing inputs can expose an error; the distributive property explains equality for all inputs.

Worked example

Expand and check at two inputs. Use $3(x+4)$.

1. Distribute: $3(x+4)=3x+3\times 4=3x+12$.
2. At $x=2$, original $3((2)+4)=18$ and rewritten $3(2)+12=18$.
3. At $x=5$, original $3((5)+4)=27$ and rewritten $3(5)+12=27$.
Answer: $3x+12$.

Practice Problems

Show your thinking.

1. Expand. Use $4(x+3)$.

2. Combine like terms. Use $2x+5x+7$.

3. Simplify. Use $3(x+2)+4x$.

4. Explain equivalence by distributing. Use $6(x+2)$.

5. A ticket-cost model has two like terms. Simplify. Use $4x+3x+5$.

6. Write an expanded equivalent expression. Use $2(x+6)+3x$.

7. Expand using two products. Use $5(x+6)$.

8. Model combining seven equal variable groups while keeping the constant. Use $3x+4x+2$.

Answer Key

1. $4x + 12$.
2. $7x + 7$.
3. $7x + 6$.
4. $6x + 12$.
5. $7x + 5$.
6. $5x + 12$.
7. $5x + 30$.
8. $7x + 2$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Distribute: $4(x + 3) = 4x + 4 \times 3 = 4x + 12$.
2. At $x = 2$, original $4((2) + 3) = 20$ and rewritten $4(2) + 12 = 20$.
3. At $x = 5$, original $4((5) + 3) = 32$ and rewritten $4(5) + 12 = 32$.

Problem 2

1. Combine the variable coefficients: $(2 + 5)x + 7 = 7x + 7$.
2. At $x = 2$, original $2(2) + 5(2) + 7 = 21$ and rewritten $7(2) + 7 = 21$.
3. At $x = 5$, original $2(5) + 5(5) + 7 = 42$ and rewritten $7(5) + 7 = 42$.

Problem 3

1. Distribute, then combine: $3x + 6 + 4x = 7x + 6$.
2. At $x = 2$, original $3((2) + 2) + 4(2) = 20$ and rewritten $7(2) + 6 = 20$.
3. At $x = 5$, original $3((5) + 2) + 4(5) = 41$ and rewritten $7(5) + 6 = 41$.

Problem 4

1. Distribute: $6(x + 2) = 6x + 6 \times 2 = 6x + 12$.
2. At $x = 2$, original $6((2) + 2) = 24$ and rewritten $6(2) + 12 = 24$.
3. At $x = 5$, original $6((5) + 2) = 42$ and rewritten $6(5) + 12 = 42$.

Problem 5

1. Combine the variable coefficients: $(4 + 3)x + 5 = 7x + 5$.
2. At $x = 2$, original $4(2) + 3(2) + 5 = 19$ and rewritten $7(2) + 5 = 19$.
3. At $x = 5$, original $4(5) + 3(5) + 5 = 40$ and rewritten $7(5) + 5 = 40$.

Problem 6

1. Distribute, then combine: $2x + 12 + 3x = 5x + 12$.
2. At $x = 2$, original $2((2) + 6) + 3(2) = 22$ and rewritten $5(2) + 12 = 22$.
3. At $x = 5$, original $2((5) + 6) + 3(5) = 37$ and rewritten $5(5) + 12 = 37$.

Problem 7

1. Distribute: $5(x + 6) = 5x + 5 \times 6 = 5x + 30$.
2. At $x = 2$, original $5((2) + 6) = 40$ and rewritten $5(2) + 30 = 40$.
3. At $x = 5$, original $5((5) + 6) = 55$ and rewritten $5(5) + 30 = 55$.

Problem 8

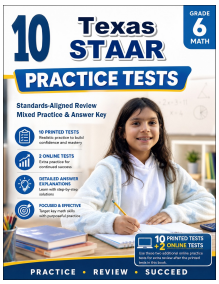
1. Combine the variable coefficients: $(3 + 4)x + 2 = 7x + 2$.
2. At $x = 2$, original $3(2) + 4(2) + 2 = 16$ and rewritten $7(2) + 2 = 16$.
3. At $x = 5$, original $3(5) + 4(5) + 2 = 37$ and rewritten $7(5) + 2 = 37$.

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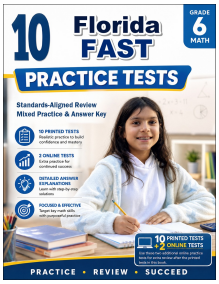
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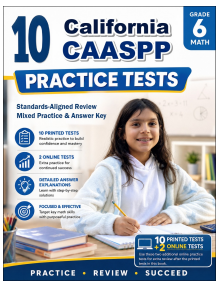
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