

Numerical and Algebraic Expressions: practice solutions, Grade 6 – download the PDF

Written solutions to the chapter problems. Check each step, then correct yourself.

1 Reading exponents



a. $3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$.

b. $2^6 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 64$.

c. $10^5 = 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 100,000$, a 1 followed by five zeros.

d. $7^2 = 7 \cdot 7 = 49$.

2 Order of operations



a. Multiply first: $8 + 18 = 26$.

b. Parentheses first: $14 \cdot 3 = 42$.

c. Divide first: $30 - 3 = 27$.

d. Exponent first: $5 \cdot 4 = 20$.

Notice that (a) and (b) use the same numbers but give different values because of the parentheses.

3 Words to expressions



- a. $n + 9$
- b. $4y$
- c. $k - 6$
- d. $\frac{m}{5}$, or $m \div 5$.

4 Evaluate with one variable



- a. $6 + 9 = 15$.
- b. $4 \cdot 6 = 24$.
- c. $30 - 6 = 24$.
- d. $6 \div 3 = 2$.

5 Name the parts



- a. Three terms, separated by plus signs: $7a$, $3b$, and 12 .
- b. The coefficient of a is 7 and the coefficient of b is 3.
- c. The constant is 12, because it has no variable.

6 Sort the like terms



The x -terms: $5x$ and $2x$. The y -terms: $3y$ and $9y$. The constants: 8 and 4.

Terms are like terms when they have exactly the same variable part, or when none of them has a variable.

7 True or false?



- a. False. $2^3 = 2 \cdot 2 \cdot 2 = 8$.
- b. False. Multiplication comes first: $4 + 6 = 10$.
- c. True. Both sides equal 15, and this is the distributive property.
- d. False. The left side is $8 - 2 = 6$, but the right side is $12 - 2 = 10$. Subtraction goes from left to right.

8 Several operations



- a. $3 + 2 \cdot 3^2 = 3 + 2 \cdot 9 = 3 + 18 = 21$.
- b. $48 \div 8 + 20 = 6 + 20 = 26$.
- c. $8^2 \div 16 = 64 \div 16 = 4$.

9 Pizza party



- a. Each pizza gives 8 slices, so the expression is $8p$.
- b. $8 \cdot 3 = 24$, $8 \cdot 5 = 40$, and $8 \cdot 12 = 96$ slices.
- c. For $p = 8$: $8 \cdot 8 = 64$, too few. For $p = 9$: $8 \cdot 9 = 72$. The party should order 9 pizzas.

10 Saving money



- a. She saves $15w$ dollars and starts with 40, so the expression is $15w + 40$.
- b. For $w = 8$: $15 \cdot 8 + 40 = 120 + 40 = 160$ dollars. For $w = 12$: $180 + 40 = 220$ dollars.
- c. The coefficient of w is 15 (dollars saved per week) and the constant is 40 (dollars at the start).

11 Two variables



a. $2(5) + 4(3) = 10 + 12 = 22$.

b. $5^2 - 3^2 = 25 - 9 = 16$.

c. $3(5 + 3) = 3 \cdot 8 = 24$.

12 Expand with the distributive property



a. $6 \cdot x + 6 \cdot 4 = 6x + 24$.

b. $3 \cdot 2y + 3 \cdot 5 = 6y + 15$.

c. $7 \cdot n - 7 \cdot 2 = 7n - 14$.

13 Combine like terms



a. $(7 + 3)x = 10x$.

b. $(9 - 4)y + 2 = 5y + 2$.

c. $(5a + 3a) + (2b + b) = 8a + 3b$, because $b = 1b$.

14 Equivalent or not?



a. $3(6) = 18$ but $3(4) + 2 = 14$. The values differ, so they are **not** equivalent. (The 3 must multiply the 2 as well.)

b. Both give 15. Since $2x + x = (2 + 1)x = 3x$, they are equivalent.

c. Both give 44. By the distributive property $4(x + 1) = 4x + 4$, so they are equivalent.

One matching value is not a proof; the property is.

15 Factor out the common factor



- a. The GCF of 12 and 18 is 6: $12x + 18 = 6(2x + 3)$.
- b. The GCF of 20 and 30 is 10: $20y + 30 = 10(2y + 3)$.
- c. The GCF of 35 and 14 is 7: $35 + 14 = 7(5 + 2) = 7 \cdot 7 = 49$.

16 Phone plan



- a. The expression is $20 + 4g$.
- b. $g = 0$: 20 dollars. $g = 3$: $20 + 12 = 32$ dollars. $g = 6$: $20 + 24 = 44$ dollars.
- c. The cost grows by 4 dollars per gigabyte. From 44 dollars at $g = 6$ we need 4 more dollars, so try $g = 7$: $20 + 4 \cdot 7 = 20 + 28 = 48$. The plan used 7 extra gigabytes.

17 Expand, then simplify



Distribute: $5(x + 2) = 5x + 10$, so the expression becomes $5x + 10 + 3x - 4$. Combine the like terms: $5x + 3x = 8x$ and $10 - 4 = 6$. The simplified expression is $8x + 6$.

Check with $x = 3$: the original gives $5(5) + 9 - 4 = 30$, and $8(3) + 6 = 30$. The results match.

18 Area and perimeter of a rectangle



- a. Area: $3(x + 5) = 3x + 15$ square feet. Perimeter:
 $2(x + 5) + 2 \cdot 3 = 2x + 10 + 6 = 2x + 16$ feet.
- b. For $x = 4$ the length is 9 feet. Area: $3 \cdot 9 = 27$ and $3(4) + 15 = 27$ square feet.
Perimeter: $2 \cdot 9 + 6 = 24$ and $2(4) + 16 = 24$ feet.

19 Find the errors



- a. He forgot to multiply the 3 by 4. Correct: $4(x + 3) = 4x + 12$.
- b. He multiplied the base by the exponent. Correct: $2^4 = 2 \cdot 2 \cdot 2 \cdot 2 = 16$.
- c. He combined unlike terms. With $x = 2$, $5 + 2x = 9$ but $7x = 14$. The expression $5 + 2x$ cannot be simplified.

20 Prove an equivalence



Table: for $x = 1$ the first expression is $2(7) - 2 = 12$ and the second is $4 + 8 = 12$. For $x = 2$: $2(10) - 4 = 16$ and $8 + 8 = 16$. For $x = 3$: $2(13) - 6 = 20$ and $12 + 8 = 20$.

Reason: $2(3x + 4) - 2x = 6x + 8 - 2x = 4x + 8$. The expressions are equivalent.

21 Complex phrases



- a. $3(n + 8) - 5$. For $n = 4$: $3 \cdot 12 - 5 = 36 - 5 = 31$.
- b. $m^2 + 2m$. For $m = 5$: $25 + 10 = 35$.
- c. $\frac{a + 10}{2}$. For $a = 6$: $16 \div 2 = 8$.



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