Exponents and Order of Operations

Name: _____ Date: _____ Score: _____ / 24

Quick Review

An **exponent** is a shortcut for repeated multiplication. In 4^3, the 4 is the **base** and the 3 is the exponent, so $4^3 = 4 \times 4 \times 4 = 64$. When an expression has several operations, follow the **order of operations**: first do anything inside **parentheses**, then **exponents**, then **multiplication and division** from left to right, and finally **addition and subtraction** from left to right. Working in this order every time keeps your answer correct and consistent.

◇ **Example:** Evaluate $2 + 3 \times 5^2$.

⇒ Let's take it one careful step at a time. There are no parentheses, so we start with the exponent: $5^2 = 25$. Now the expression reads $2 + 3 \times 25$. Next comes multiplication: $3 \times 25 = 75$. Finally we add: $2 + 75 = 77$. The trick is to resist adding the $2 + 3$ first — multiplication and exponents always come before addition.

Answer: 77

PRACTICE

Evaluate each expression. Follow the order of operations.

1. 3^2 _____

2. 2^4 _____

3. 5^3 _____

4. 10^2 _____

5. 1^6 _____

6. $6 + 2 \times 3$ _____

7. $20 - 4 \times 3$ _____

8. $(4 + 5) \times 2$ _____

9. $18 \div 3 + 7$ _____

10. 2×3^2 _____

11. $4^2 + 5$ _____

12. $30 - 2^3$ _____

13. $(6 - 2)^2$ _____

14. $12 + 8 \div 4$ _____

15. $3 \times (2 + 4)^2$ _____

16. $50 - 3 \times 4^2$ _____

17. $100 \div (5 + 5) + 6$ _____

18. $2^3 + 4 \times 5$ _____

19. $(8 + 2) \times (9 - 4)$ _____

20. $7 + 2 \times (3^2 - 1)$ _____

Word Problems

21. A square garden has sides of 9 feet. Its area is the side length squared. What is the area of the garden? _____

22. Maria buys 3 packs of markers with 8 markers each, then gives away 5 markers. Write and evaluate $3 \times 8 - 5$ to find how many she has left. _____

23. A theater has 6 rows with 4 seats each on the left and the same on the right. Evaluate $2 \times (6 \times 4)$ to find the total number of seats. _____

24. A bacteria sample doubles each hour. After 4 hours it has multiplied by 2^4. If it started with 5 cells, evaluate 5×2^4 to find how many cells there are. _____

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Answer Keys

1. 9
2. 16
3. 125
4. 100
5. 1
6. 12
7. 8
8. 18
9. 13
10. 18
11. 21
12. 22
13. 16
14. 14
15. 108
16. 2
17. 16
18. 28
19. 50
20. 23
21. 81 square feet
22. 19 markers
23. 48 seats
24. 80 cells

Step-by-Step Explanations

1. 3^2 means 3×3, which equals 9.
2. $2^4 = 2 \times 2 \times 2 \times 2 = 16$.
3. $5^3 = 5 \times 5 \times 5 = 125$.
4. $10^2 = 10 \times 10 = 100$.
5. One multiplied by itself any number of times is still 1.
6. Multiply first: $2 \times 3 = 6$, then add $6 + 6 = 12$.
7. Multiplication before subtraction: $4 \times 3 = 12$, then $20 - 12 = 8$.
8. Parentheses first: $4 + 5 = 9$, then $9 \times 2 = 18$.
9. Divide first: $18 \div 3 = 6$, then add $6 + 7 = 13$.
10. Exponent first: $3^2 = 9$, then $2 \times 9 = 18$.
11. $4^2 = 16$, then $16 + 5 = 21$.
12. $2^3 = 8$, then $30 - 8 = 22$.
13. Parentheses first: $6 - 2 = 4$, then $4^2 = 16$.
14. Divide before adding: $8 \div 4 = 2$, then $12 + 2 = 14$.
15. Parentheses: $2 + 4 = 6$. Exponent: $6^2 = 36$. Multiply: $3 \times 36 = 108$.
16. Exponent: $4^2 = 16$. Multiply: $3 \times 16 = 48$. Subtract: $50 - 48 = 2$.
17. Parentheses: $5 + 5 = 10$. Divide: $100 \div 10 = 10$. Add: $10 + 6 = 16$.
18. $2^3 = 8$ and $4 \times 5 = 20$, so $8 + 20 = 28$.
19. Each set of parentheses first: 10 and 5, then $10 \times 5 = 50$.
20. Exponent inside: $3^2 = 9$, then $9 - 1 = 8$. Multiply: $2 \times 8 = 16$. Add: $7 + 16 = 23$.
21. Area of a square is side squared: $9^2 = 9 \times 9 = 81$. So the garden covers 81 square feet.
22. Multiply before subtracting: $3 \times 8 = 24$, then $24 - 5 = 19$. Maria keeps 19 markers.
23. Inside the parentheses first: $6 \times 4 = 24$. Then $2 \times 24 = 48$, so there are 48 seats in all.
24. Exponent first: $2^4 = 16$. Then $5 \times 16 = 80$, so the sample has 80 cells after 4 hours.

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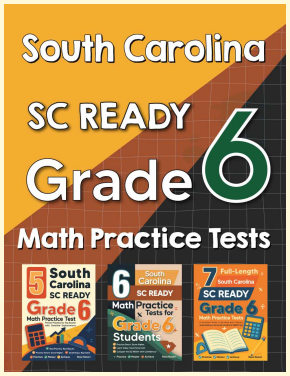

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