

Exponents and Order of Operations

Name: _____ Date: _____ Score: _____ / 24

Q 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 | _____ | 11. $4^2 + 5$ | _____ |
| 2. 2^4 | _____ | 12. $30 - 2^3$ | _____ |
| 3. 5^3 | _____ | 13. $(6 - 2)^2$ | _____ |
| 4. 10^2 | _____ | 14. $12 + 8 \div 4$ | _____ |
| 5. 1^6 | _____ | 15. $3 \times (2 + 4)^2$ | _____ |
| 6. $6 + 2 \times 3$ | _____ | 16. $50 - 3 \times 4^2$ | _____ |
| 7. $20 - 4 \times 3$ | _____ | 17. $100 \div (5 + 5) + 6$ | _____ |
| 8. $(4 + 5) \times 2$ | _____ | 18. $2^3 + 4 \times 5$ | _____ |
| 9. $18 \div 3 + 7$ | _____ | 19. $(8 + 2) \times (9 - 4)$ | _____ |
| 10. 2×3^2 | _____ | 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. _____



Answer Keys

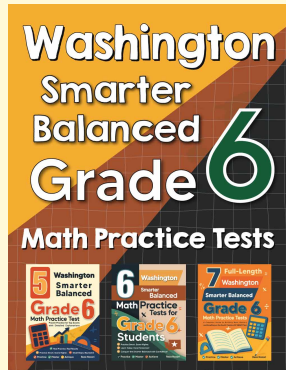
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|--------|--------------------|
| 1. 9 | 13. 16 |
| 2. 16 | 14. 14 |
| 3. 125 | 15. 108 |
| 4. 100 | 16. 2 |
| 5. 1 | 17. 16 |
| 6. 12 | 18. 28 |
| 7. 8 | 19. 50 |
| 8. 18 | 20. 23 |
| 9. 13 | 21. 81 square feet |
| 10. 18 | 22. 19 markers |
| 11.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

Step-by-Step Explanations

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