

1-2 Study Guide and Intervention

Order of Operations

Evaluate Numerical Expressions Numerical expressions often contain more than one operation. To evaluate them, use the rules for order of operations shown below.

Order of Operations	<p>Step 1 Evaluate expressions inside grouping symbols.</p> <p>Step 2 Evaluate all powers.</p> <p>Step 3 Do all multiplication and/or division from left to right.</p> <p>Step 4 Do all addition and/or subtraction from left to right.</p>
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Example 1 Evaluate each expression.

- a. 3^4**
 $3^4 = 3 \cdot 3 \cdot 3 \cdot 3$ Use 3 as a factor 4 times.
 $= 81$ Multiply.
- b. 6^3**
 $6^3 = 6 \cdot 6 \cdot 6$ Use 6 as a factor 3 times.
 $= 216$ Multiply.

Example 2 Evaluate each expression.

- a. $3[2 + (12 \div 3)^2]$**
 $3[2 + (12 \div 3)^2] = 3(2 + 4^2)$ Divide 12 by 3.
 $= 3(2 + 16)$ Find 4 squared.
 $= 3(18)$ Add 2 and 16.
 $= 54$ Multiply 3 and 18.
- b. $\frac{3 + 2^3}{4^2 \cdot 3}$**
 $\frac{3 + 2^3}{4^2 \cdot 3} = \frac{3 + 8}{4^2 \cdot 3}$ Evaluate power in numerator.
 $= \frac{11}{4^2 \cdot 3}$ Add 3 and 8 in the numerator.
 $= \frac{11}{16 \cdot 3}$ Evaluate power in denominator.
 $= \frac{11}{48}$ Multiply.

Exercises

Evaluate each expression.

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|--|---|------------------------------------|
| 1. 5^2 | 2. 3^3 | 3. 10^4 |
| 4. 12^2 | 5. 8^3 | 6. 2^8 |
| 7. $(8 - 4) \cdot 2$ | 8. $(12 + 4) \cdot 6$ | 9. $10 + 8 \cdot 1$ |
| 10. $15 - 12 \div 4$ | 11. $12(20 - 17) - 3 \cdot 6$ | 12. $24 \div 3 \cdot 2 - 3^2$ |
| 13. $3^2 \div 3 + 2^2 \cdot 7 - 20 \div 5$ | 14. $\frac{4 + 3^2}{12 + 1}$ | 15. $250 \div [5(3 \cdot 7 + 4)]$ |
| 16. $\frac{2 \cdot 4^2 - 8 \div 2}{(5 + 2) \cdot 2}$ | 17. $\frac{4(5^2) - 4 \cdot 3}{4(4 \cdot 5 + 2)}$ | 18. $\frac{5^2 - 3}{20(3) + 2(3)}$ |

1-2 Study Guide and Intervention *(continued)*

Order of Operations

Evaluate Algebraic Expressions Algebraic expressions may contain more than one operation. Algebraic expressions can be evaluated if the values of the variables are known. First, replace the variables with their values. Then use the order of operations to calculate the value of the resulting numerical expression.

Example

Evaluate $x^3 + 5(y - 3)$ if $x = 2$ and $y = 12$.

$x^3 + 5(y - 3)$	$= 2^3 + 5(12 - 3)$	Replace x with 2 and y with 12.
	$= 8 + 5(12 - 3)$	Evaluate 2^3 .
	$= 8 + 5(9)$	Subtract 3 from 12.
	$= 8 + 45$	Multiply 5 and 9.
	$= 53$	Add 8 and 45.

The solution is 53.

Exercises

Evaluate each expression if $x = 2$, $y = 3$, $z = 4$, $a = \frac{4}{5}$, and $b = \frac{3}{5}$.

1. $x + 7$

2. $3x - 5$

3. $x + y^2$

4. $x^3 + y + z^2$

5. $6a + 8b$

6. $23 - (a + b)$

7. $\frac{y^2}{x^2}$

8. $2xyz + 5$

9. $x(2y + 3z)$

10. $(10x)^2 + 100a$

11. $\frac{3xy - 4}{7x}$

12. $a^2 + 2b$

13. $\frac{z^2 - y^2}{x^2}$

14. $6xz + 5xy$

15. $\frac{(z - y)^2}{x}$

16. $\frac{25ab + y}{xz}$

17. $\frac{5a^2b}{y}$

18. $(z \div x)^2 + ax$

19. $\left(\frac{x}{z}\right)^2 + \left(\frac{y}{z}\right)^2$

20. $\frac{x + z}{y + 2z}$

21. $\left(\frac{z \div x}{y}\right) + \left(\frac{y \div x}{z}\right)$