

Name _____

Unit 3: Expressions Study Guide

Vocabulary:

- Term**: A number, variable, product, or quotient in an expression. A term is not a sum or difference.
- numerical expression**: A mathematical statement including numbers and operations.
- algebraic expression**: A group of numbers, symbols, and variables that express an operation or a series of operations.
- coefficient**: A numerical factor in a term of an algebraic expression.
- Distributive Property**: $a \times (b + c) = (a \times b) + (a \times c)$ and $a \times (b - c) = (a \times b) - (a \times c)$, where a, b, and c stand for any real numbers.
- Exponent**: The number that tells how many equal factors there are.
- Expression**: A variable or combination of variables, numbers, and symbols that represents a mathematical relationship.
- Variable**: A quantity that changes or can have different values. A symbol, usually a letter, that can stand for a variable quantity.
- Constant**: A number with a value that is always the same.
- Order of Operations**: Rules describing what sequence to use in evaluating expressions. (1) Evaluate within grouping symbols. (2) Do powers or roots. (3) Multiply or divide left to right. (4) Add or subtract left to right.
- Like Terms**: Terms whose variables (and their exponents such as the 2 in x^2) are the same.
- Substitution**: The replacement of the letters in an algebraic expression with known values.

Part A: Exponents

Evaluate each expression.

13. $(-2)^6$ **64** 14. -1^8 **-1** 15. $(-3)^1$ **-3**
16. -8^2 **-64** 17. 12^0 **1** 18. $(-6)^2$ **36**
19. 0^0 **undefined** 20. $(-1)^8$ **1** 21. 0^5 **0**

Write in exponential form.

22. $(-5x)(-5x)(-5x)$ **$(-5x)^3$** 23. $-(c \cdot c \cdot c \cdot c)$ **$-c^4$**
24. $y \cdot w \cdot 2 \cdot y \cdot 6 \cdot w \cdot w$ **$12w^3y^2$** 25. $a \cdot (-4) \cdot a \cdot a \cdot 9 \cdot a \cdot a \cdot b$ **$-36a^5b$**

Part B: Numerical Expressions & Order of Operations

Simplify each expression. Show work.

26. $-6^2 + 5 \cdot 3^3$ **99** 27. $(25 - 5^2) - (9^2 - 4^3)$ **-17**
28. $5 \cdot 6 + [37 - 18 \div (4 - 7)]$ **73** 29. $[9 - (7^2 + 15) \div (-3)]^0$ **1**
30. $3(2 + 7 - 8) + 16$ **19** 31. $2\{2[2(3) + 1] + 1\} + 1$ **31**

Name _____

Part C: Writing & Evaluating Expressions

32. Write an algebraic expression for the following situation:
There are x frogs and 2 lizards. What is the total? $X + 2$

33. There are 16 children on the bus. C of them got off the bus at the first stop. Write an algebraic expression to represent the total number of children left on the bus. $16 - c$

34. Johnny's mother exercises on a stair-step machine. She exercises at the same rate for the entire time. For every minute she exercises, she burns 9 calories. Write an expression to represent the number of calories she burns after x minutes. $9x$

35. Write an algebraic expression for the following.

- a) nine less than g $g - 9$
- b) k divided by five $k/5$
- c) twenty more than twice c $20 + 2c$
- d) The product of 5 and the sum of y and 2 $5(y + 2)$

36. Write the expression in words for the following. **Answers may vary**

- e) $7z$ **The product of 7 and z**
- f) $n - 3$ **Three less than n**
- g) $36 \div m$ **The quotient of 36 and m**
- h) $100 \div (6 + w)$ **100 divided by the sum of 6 and w**
- i) $8k - 14$ **14 less than the product of 8 and k**

Use the expression below to answer the following.

$$7x^2 - 4xy + 10y - 3$$

37. How many terms are in the expression? **4**

38. Name the terms. **$7x^2$, $-4xy$, $10y$, -3**

39. Identify the constant. **-3**

40. Identify the variable(s). **x and y**

41. Identify the exponent. **2**

42. Identify the coefficient(s). **7, -4 , 10**

Evaluate the expression to find the missing values in the table.

43.

$y =$	$y^2 + 3$
1	4
2	7
3	12
4	19
5	28

Name _____

Evaluate each expression for the given values of the variables. Show substitutions and work.

44. $x^2 - y^2$ if $x = 4, y = -5$ **-9**

45. $\frac{4ab^3}{(3b)^2}$ if $a = 2, b = -2$ **-16/9 or -1 7/9**

46. $(5a)^3$, for $a = -1$ **-125**

47. $-n^6$, for $n = 2$ **-64**

48. $(e - 7)^3$, for $e = 4$ **-27**

49. $x^2 + 3x - 7$, for $x = -4$ **-3**

50. $-(2g)^2$, for $g = 5$ **-100**

51. $(6 + h^2)^2$, $h = -3$ **225**

52. Complete the table. Substitute the value on the left for the variable in the expression at the top of each column. Then evaluate each expression.

	$t + 2$	$2t - 1$	$2(t - 1)$	$2(2t)$
$t = 1.7$	3.7	2.4	1.4	6.8
$t = 2.04$	4.04	3.08	2.08	8.16

53. In the algebraic expression $7 \div y$, what is the coefficient of y ? Explain
1, every variable that stands alone is understood to have a coefficient of 1.

Part D: Simplifying Expressions

Use the Distributive Property to simplify the following. Watch signs and don't forget about M&Ms!!! ☺

54. $8(x - 4)$ **$8x - 32$**

55. $-3(y + 5)$ **$-3y - 15$**

56. $(m + 3)7$ **$7m + 21$**

57. $-(n - 2)$ **$-n + 2$**

58. $6(3x + 7)$ **$18x + 42$**

59. $-2(5x - 9)$ **$-10x + 18$**

60. $-5(-4m + 2)$ **$20m - 10$**

61. $7(-4n - 1)$ **$-28n - 7$**

Name _____

Identify the like terms in the following expressions.

62. $7x + 12x - 7$ $7x, 12x$

63. $21 - 10t + 9 - 2t$ $-10t, -2t$ and $21, 9$

64. $-d + b + 2t - 4$ no like terms

65. $-3 + x - 4x + 9$ $x, -4x$ and $-3, 9$

66. $-6k + 10 - 4k$ $-6k, -4k$

Simplify each expression.

67. $-10x + 4x$ $-6x$

68. $7x - 9 - 3x^2 + 2x + 4 - 5x^2$ $-8x^2 + 9x - 5$

69. $x + 3(x - 4) + 2x$ $6x - 12$

70. $8x - (3x - 4)$ $5x + 4$

71. $11 - (3x - 6) + 2(4x + 5) - x$ $4x + 27$

72. $5x + 3(4 - x)$ $2x + 12$

73. $12(x + 3) + 4(2x - 5)$ $20x + 16$

74. $-7(-v + 4)$ $7v - 28$

75. Explain why you should perform the distributive property in the expression $4x + 3(2x + 1)$ before simplifying it any other way. Then simplify. **You can't follow GEMDAS because you don't know the value of x. You must perform the distributive property to reveal the like terms.**
 $10x + 3$

76. Are these two expressions equivalent for each of the following? Explain your answer.

a. $4(x + 8)$ and $4x + 18 + 14$ **yes, they both equal $4x + 32$**

b. $7(x + 2y)$ and $14x + 14y$ **no, $7(x + 2y) = 7x + 14y$ not $14x + 14$**

c. $3c - 9d$ and $3(c - 3d)$ **yes, they both equal $3c - 9d$**

Name _____

77. Use the GCF to write an equivalent expression for each expression.

a. $2y + 4$ $2(y + 2)$

b. $10c - 15$ $5(2c - 3)$

c. $24x - 40y$ $8(3x - 5y)$

78. Prove that the two expressions in the table are equivalent using the given values of x .

Value of x	Value of expression $3(x + 4)$	Value of expression $3x + 12$
0	$3(0+4) = 3(4) = 12$	$3(0) + 12 = 0 + 12 = 12$
1	$3(1+4) = 3(5) = 15$	$3(1) + 12 = 3 + 12 = 15$
2	$3(2+4) = 3(6) = 18$	$3(2) + 12 = 6 + 12 = 18$
3	$3(3+4) = 3(7) = 21$	$3(3) + 12 = 9 + 12 = 21$

Part E: Open-Ended

79. Elena and Jorge have similar problems and find the same answer. Each determines that the solution to their problem is 24.

Elena: $(14 + 42) \div 7 + 4^2$

Jorge: $14 + (42 \div 7) + 4^2$

a. Evaluate each expression to determine if both Elena and Jorge are correct.

Elena: $(14 + 42) \div 7 + 4^2$
 $(14 + 42) \div 7 + 16$
 $56 \div 7 + 16$
 $8 + 16$
24

Jorge: $14 + (42 \div 7) + 4^2$
 $14 + (42 \div 7) + 16$
 $14 + 6 + 16$
 $20 + 16$
36

Elena is correct

b. Why would each find the solution of 24? What mistakes were made, if any?

On the step $14 + (42 \div 7) + 16$ Jorge worked from left to right instead of evaluating the grouping symbols first.

Name _____

80. To improve in basketball, Ivan's coach told him that he needs to take four times as many free throws and four times as many jump shots every day. If f represents the number of free throws and j represents the number of jump shots Ivan shoots daily, write an expression to show how many shots he will need to take in order to improve in basketball.

$$4f + 4j$$

81. Are the following expressions equivalent? **Explain** how you know.

$$2x + 3 = 5x$$

No they are not equivalent b/c $2x$ and 3 are not like terms so they cannot be combined. 3 is a constant and can only be combined with other constants.

82. Are the following expressions equivalent? **Explain** how you know.

$$3 + 4y = y + 3y + 3$$

Yes, they are equivalent b/c y and $3y$ are like terms and can be combined. y is understood to have a coefficient of 1 so $1y + 3y = 4y$

83. A grocery store has advertised a sale on ice cream. Each carton of any flavor of ice cream costs \$3.97.

a. If Millie buys 2 cartons of strawberry ice cream and 4 cartons of chocolate ice cream, write an expression that represents the total cost of buying the ice cream.

$$2(3.97) + 4(3.97)$$

b. Write an equivalent expression for your answer in part (a).

$$6(3.97)$$

c. **Explain** how the expressions are equivalent.

In the expression $2(3.97) + 4(3.97)$ the 2 and 4 can be combined and added b/c they are both being multiplied by 3.97

84. Trey goes to the movies with his family. Each family member buys a ticket and two boxes of popcorn. If there are five members of his family, let t represent the cost of a ticket and p represent the cost of a box of popcorn. Write **two different** expressions that represent the total amount his family spent. **Explain** how each expression describes the situation in a different way.

$$5(t + 2p) \text{ or } 5t + 10p$$

The two expressions are equivalent b/c of the distributive property. $5(t + 2p)$ is taking the total cost for one person and then multiplying by 5. $5t + 10p$ is taking each individual item and multiplying by 5 and then adding the ticket cost and popcorn cost together.

Name _____