calculator displays 22, it did not follow the rules for order of operations and you will need to be extra careful when evaluating expressions. You will need to break down the expression into smaller steps or add parentheses to force the calculator to perform the operations in the correct order.

To evaluate an expression with parentheses, you will use the parentheses buttons, [(] and [)]. To evaluate the expression $(6+2)+(8+1)\div 9$ (assuming your calculator follows the order of operations), press the keys

[(] [6] [+] [2] [)] [+] [(] [8] [+] [1] [)] [÷] [9].

Then press [=]. The display will read 9.

Completion Example Answers

10. $3(2+4)-6-3\cdot 4=3(6)-6-3\cdot 4=18-6-12=12-12=0$

11. $(14-10)[(5+9)\div 2+5]=(14-10)[(14)\div 2+5]=(4)(7+5)=(4)(12)=48$

Margin Exercise Answers

1. a. base: 8; exponent: 3 **b.** base: 14; exponent: 6 **2. a.** $100^3=1{,}000{,}000$ **b.** $2^4=16$ **c.** $1^3=1$ **d.** $8^2=64$ **3. a.** 81 **b.** 32 **c.** 625 **4. a.** 1 **b.** 1 **c.** 813 **d.** 1 **5.** 8 **6.** 5 **7.** 11 **8.** 32 **9.** 11 **10.** 19 **11.** 36

1.7 Exercises

Concept Check

Fill-in-the-Blank. Complete each sentence using information found in this section.

1. When an expression has an exponent of 3, the base is said to be _____.
2. Exponents are used to represent repeated _____.
3. In 2^4 the "2" is called the _____ and the "4" is called the _____.
4. 10 squared is equal to _____.
5. If any nonzero number has an exponent of 0, the value is always _____.
6. If there are multiple grouping symbols to be simplified, begin with the _____ group.

True/False. Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

7. Nine squared is equal to eighteen.
8. $2^7=128$
9. 7^0 is undefined.
10. According to the order of operations, multiplication is always performed before division.

Practice

Rewrite each product by using exponents. See Example 2.

1. $11 \cdot 11 \cdot 11$

2. $13 \cdot 13 \cdot 13$

3. $7 \cdot 7 \cdot 7 \cdot 7$

4. $6 \cdot 6 \cdot 6 \cdot 6 \cdot 6$

5. $2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$

6. $2 \cdot 2 \cdot 5 \cdot 5 \cdot 5$

7. $5 \cdot 5 \cdot 5 \cdot 7 \cdot 7$

8. $3 \cdot 3 \cdot 3 \cdot 7 \cdot 7 \cdot 7$

9. $2 \cdot 3 \cdot 3 \cdot 11 \cdot 11$

10. $2 \cdot 2 \cdot 2 \cdot 2 \cdot 11 \cdot 11 \cdot 13 \cdot 13$

For each exponential expression **a.** identify the base, **b.** identify the exponent, and **c.** evaluate the exponential expression. See Examples 1 through 4.

11. 4^2

12. 6^2

13. 2^3

14. 3^3

15. 1^6

16. 1^5

17. 5^3

18. 4^3

19. 2^4

20. 2^6

21. 9^2

22. 11^2

23. 7^2

24. 7^3

25. 3^5

26. 4^5

27. 30^2

28. 40^2

29. 20^3

30. 15^2

31. 1^{57}

32. 1^{99}

33. 4^0

34. 19^0

35. 13^1

36. 24^1

37. 22^0

38. 99^0

Simplify. See Examples 5 through 11.

39. $6 + 5 \cdot 3$

40. $18 + 2 \cdot 5$

41. $20 - 4 \div 4$

42. $6 - 15 \div 3$

43. $32 - 14 + 10$

44. $25 - 10 + 11$

45. $15 \div 15 + 10 \cdot 2$

46. $12 - 3 \cdot 4 \div 2$

47. $18 \div 2 - 1 - 3 \cdot 2$

48. $2 + 3 \cdot 7 - 10 \div 2$

49. $6 \cdot 2 \div 3 - 5 + 13$

50. $12 - 4 \cdot 3 \div 3 + 1$

51. $14 \cdot 2 \div 7 \div 2 + 10$

52. $3 \cdot 8 \div 4 + 1 \cdot 2$

53. $19-5(3-1)$

54. $(7-2)\cdot 6-10$

55. $(2+3\cdot 4)\div 7-2$

56. $(2+3)\cdot 4\div 5-4$

57. $15(2+3)-65-5$

58. $13(10-7)-20-19$

59. $2\cdot 5^2-8\div 2$

60. $4^2\div 2+9\div 3$

61. $4\div 2^2+3\cdot 2^2$

62. $16\div 2^4+9\div 3^2$

63. $(4+3)^2+(2+3)^2$

64. $(2+1)^2+(4+1)^2$

65. $(2^3+2)\div 5+7^2\div 7$

66. $30\div 2-11+2(5-1)^3$

67. $(10+1)\left[(5-2)^2+3(4-3)\right]$

68. $(12-2)\left[4(6-3)+(4-3)^2\right]$

69. $75+3\left[2(3+6)^2-10^2\right]$

70. $100+2\left[3(4^2-6)+2^3\right]$

71. $16+3\left[17+2^3\div 2^2-4\right]$

72. $21-(15-4^3\div 2^4+1)\div 3$

73. $10^3-2\left[(13+3)\div 2^4+18\div 3^2\right]$

74. $5^2\left[6^2\div 9\cdot(2+3)\div 2^2\right]-10^2$

Applications

Solve.

75. Neville bought 15 boxes of trading cards. Each box has 10 packs of trading cards. Each pack of trading cards contains 20 cards. He adds 132 cards that he already owns to the newly purchased cards. Then, Neville evenly distributes all of the cards to 6 of his friends. How many trading cards would each person get?

a. If you simplify the expression $15 \cdot 10 \cdot 20 + 132 \div 6$ using the order of operations, will you get the correct answer? If not, explain what is wrong with the expression.

b. What is the answer? If necessary, write the corrected expression to get the correct results when following the order of operations.

76. Robert is purchasing shirts for his weekend soccer team. The shirts he wants to buy are normally \$25 each but are on sale for \$10 off. His team has a total of 11 players. How much will he spend to buy the shirts?

a. If you simplify the expression $\$25 - \$10 \cdot 11$ using the order of operations, will you get the correct answer? If not, explain what is wrong with the expression.

b. What is the answer? If necessary, write the corrected expression to get the correct results when following the order of operations.

77. Camila is a seamstress and is creating wedding dresses. She has 126 yards of silk fabric. For each dress, the skirt requires 4 yards of silk and the bodice requires 2 yards of silk. How many dresses can she make with the amount of silk she has?

a. If you simplify the expression $126 \div 4 + 2$ using the order of operations, will you get the correct answer? If not, explain what is wrong with the expression.

b. What is the answer? If necessary, write the corrected expression to get the correct results when following the order of operations.

Writing & Thinking

78. Use your calculator to find the following values and discuss, in your own words, any pattern that you notice.

a. 86^0

b. 623^0

c. 9072^0

79. Give one example where addition should be completed before multiplication.

80. Explain how someone might think that $1 + 3^2 = 16$. Then, explain why this would not be correct.

Collaborative Learning

81. In groups of three to four students, use a calculator to evaluate 20^{10} and 10^{20}. Discuss what you think is the meaning of the notation on the display.

(**Note:** The notation is a form of a notation called scientific notation and is discussed in detail in Chapter 12. Different calculators may use slightly different forms.)