

**Completion Example Answers**

8.  $9(-1+4)-7-6\cdot 4$ ;  $9(3)-7-6\cdot 4$ ;  $27-7-6\cdot 4$ ;  $27-7-24$ ;  $20-24$ ;  $-4$

**Margin Exercise Answers**1. a.  $100^3 = 1,000,000$  b.  $2^4 = 16$  c.  $1^3 = 1$  d.  $8^2 = 64$  2. a. 81 b. 32 c. 625 3. a. -10 b. 4  
4. a. 81 b. -81 5. 5 6. -3 7. -6 8. -12 9.  $9^\circ\text{F}$  10. a. 116,800 cars b. 393,300 cars

# 1.1 Exercises

## Concept Check

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

- The set of whole numbers consists of the natural numbers and the number \_\_\_\_.
- Exponents are used to represent repeated \_\_\_\_\_.
- In  $2^4$  the “2” is called the \_\_\_\_\_ and the “4” is called the \_\_\_\_\_.
- If there are multiple grouping symbols to be simplified, begin with the \_\_\_\_\_ group.
- The last operations to be performed are \_\_\_\_\_ and \_\_\_\_\_.
- The \_\_\_\_\_ of a set of integers is found by dividing the sum of the integers by the number of integers in the set.

**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.)

- Zero is its own opposite.
- Nine squared is equal to eighteen.
- According to the order of operations, multiplication is always performed before division.

## Practice

Rewrite each product by using exponents. See Example 1.

- |  |   |
|--|---|
| 1. $11 \cdot 11 \cdot 11$              | 6. $2 \cdot 2 \cdot 5 \cdot 5 \cdot 5$                              |
| 2. $13 \cdot 13 \cdot 13$              | 7. $5 \cdot 5 \cdot 5 \cdot 7 \cdot 7$                              |
| 3. $7 \cdot 7 \cdot 7 \cdot 7$         | 8. $3 \cdot 3 \cdot 3 \cdot 7 \cdot 7 \cdot 7$                      |
| 4. $6 \cdot 6 \cdot 6 \cdot 6 \cdot 6$ | 9. $2 \cdot 3 \cdot 3 \cdot 11 \cdot 11$                            |
| 5. $2 \cdot 2 \cdot 2 \cdot 3 \cdot 3$ | 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 Example 2.

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 each expression using the order of operations. See Example 4.

39.  $-8^2$

40.  $-4^2$

41.  $(-4)^2$

42.  $(-8)^2$

43.  $-4^3$

44.  $-5^3$

45.  $(-5)^3$

46.  $(-4)^3$

Simplify each expression using the order of operations. See Examples 3 through 8.

47.  $\frac{18+9}{-9}$

48.  $\frac{27+9}{-9}$

49.  $\frac{25-4^2}{3}$

50.  $\frac{50-6^2}{2}$

51.  $15 \div (-5) \cdot 2 - 8$

52.  $16 \div (-4) \cdot 2 - 9$

53.  $3^3 \div (-9) \cdot 4 + 5(-2)$

54.  $20 \cdot 2 \div (-10) + 5(-4)$

55.  $-6^2 + 7(12) - 3^2$

56.  $-10^2 - 4(-8) - 5^2$

57.  $4^2 \div (-8)(-2) + 6(-15 + 3 \cdot 5)$

58.  $5^2 \div (-5)(-3) - 2(4 \cdot 3)$

59.  $[15 + 5(-2^3 - 7)] \div 10$

60.  $[20 - 4(-3^2 - 6)] \div 8$

61.  $5^2 - 6 \cdot |-3| + 2(5 + 2^3)$

62.  $(-6)^2 - 4 \cdot |-2| + 5(7 - 3^2)$

63.  $-27 \div (-|3|) - 14 - 4(-2)^3$

64.  $-32 \div (-|4|) + 16 - 2(-3)^3$

65.  $7 \cdot 2^3 + 3^2 - 4^2 - 4(6 - 2 \cdot 3)$


$$66. 5 \cdot 2^4 + 5^2 - 6^2 - 7(12 - 3 \cdot 4)$$

$$67. 13 - |-2| \left[ (19 - 14) \div 5 + 3(-4) - 5 \right]$$

$$68. 2 - |-5| \left[ (-10) \div (-5) \cdot 2 - 35 \right]$$

$$69. -|2 - 5| \left[ 49 \div (-7) + 4 \cdot 3 - 6 \cdot 2 + 10 \right]$$

$$70. -|9 - 11| \left[ (-10)^2 \cdot 2 + 6(-5)^2 - 10^3 \right]$$

 Use a calculator to simplify each expression.

$$71. (-72)^2 - 35(16)$$

$$72. (15)^3 - 60 + 13(-5)$$

$$73. (15 - 20)(13 - 14)^2 + 50(-2)$$

$$74. (32 - 50)^2 (15 - 22)^2 (17 - 20)$$

$$75. 6 - 20 \left[ (-15) \cdot |-2| + 4(-5) - 1 \right]$$

$$76. 14^2 - 15 \left[ (-5 - 3)^2 + 7(-6) - |-2| \right]$$

Solve.

77. If the product of  $-15$  and  $-6$  is added to the product of  $-32$  and  $5$ , what is the sum?
78. If the quotient of  $-56$  and  $8$  is subtracted from the product of  $-12$  and  $-3$ , what is the difference.
79. a. What number should be added to  $-5$  to get a sum of  $-22$ ?  
b. What number should be added to  $+5$  to get a sum of  $-22$ ?
80. a. What number should be added to  $-39$  to get a sum of  $-13$ ?  
b. What number should be added to  $+39$  to get a sum of  $-13$ ?

Find the average of each group of integers.

81.  $-10, -20, 14, 34, -18$
82.  $56, -64, -38, 58, -12$
83.  $-6, -8, -7, -4, -4, -5, -6, -8$
84.  $-25, 30, -15, -6, -26, 18$

## Applications

Solve.

85. 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.
86. 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.

87. Alicia bought shares of two companies on the stock market. She paid \$9000 for 90 shares in one company and \$6600 for 110 shares in another company. What was the average price per share for the 200 shares?
88. In a weight lifting program, two men bench pressed 300 pounds, three men bench pressed 350 pounds, and 5 men bench pressed 400 pounds. What was the average number of pounds that these men bench pressed?
89. On an English exam, two students scored 95, six students scored 90, three students scored 80, and one student scored 50. What was the average score for the class?
90. In a speech class, the students graded each other on a particular assignment. On this speech, three students scored 60, three scored 70, five scored 80, five scored 82, and four scored 85. What was the average score on this speech?
91. In the 2022 Masters Tournament, Collin Morikawa shot scores of 73, 70, 74, and 67 in four rounds of play.
- What was his average score in each round?
  - Par was 72 on that course. How many strokes under par was his average score?
92. In the 2022 Masters Tournament, Cameron Champ shot scores of 72, 75, 71, and 70 in four rounds of play.
- What was his average score in each round?
  - Par was 72 on that course. How many strokes under par was his average score?
93. 📊 The temperature readings for 30 days at a ski resort were recorded as follows. (All temperatures were measured in degrees Fahrenheit.)

28	24	22	10	-2	-5
-2	12	10	15	-6	5
20	13	-2	-6	-15	-18
-10	8	-1	7	20	21
32	30	22	12	3	-7

What was the average temperature recorded for the 30 days?

94. 📊 The approximate box office gross income (to the nearest thousand dollars) of the 5 top-grossing movies of 2020 are listed below. Find the average gross income of these 5 movies.

Motion Picture	US Gross (\$)
<i>Bad Boys for Life</i>	204,418,000
<i>1917</i>	157,901,000
<i>Sonic the Hedgehog</i>	146,066,000
<i>Jumanji: The Next Level</i>	124,737,000
<i>Star Wars: Episode IX - The Rise of Skywalker</i>	124,496,000

Source: [www.boxofficemojo.com](http://www.boxofficemojo.com)

## Writing & Thinking

95. Explain how someone might think that  $1 + 3^2 = 16$ . Then, explain why this would not be correct.
96. Explain the potential mistake students may make when using the mnemonic device PEMDAS as their guide for simplifying numerical expressions.