

## 3.4 Getting the Calculation Right

### Expressions and Order of Operations

The equation  $p = 50 + 10n$  represents the relationship between the Wild World admission price  $p$  in dollars and the number of people  $n$  in a group. The right side of the equation  $50 + 10n$  is an algebraic expression. It represents the value of the dependent variable,  $p$ . It involves two operations, addition and multiplication.

The critical question is, 'Which operation comes first?'

Theo wants to find the admission price for an Ocean Bike Tours group with 17 members. He first works from left to right:

$$\begin{aligned} 50 + 10 \times 17 \\ = 60 \times 17 \\ = 1,020 \end{aligned}$$

He gets a number that seems too large.

Then Theo enters the same expression on his calculator and gets:

$$50 + 10 * 17 = 220$$

He is puzzled by the difference in results. Then Theo remembers that there are rules for evaluating expressions.

- Which is the correct answer? Why?

Here are the rules known as the Order of Operations:

1. Work within **parentheses**.
2. Write numbers written with **exponents** in standard form.
3. Do all **multiplication and division** in order from left to right.
4. Do all **addition and subtraction** in order from left to right.

Use the Order of Operations with  $7 + (6 \times 4 - 9) \div 3$ .

$$\begin{aligned} 7 + (6 \times 4 - 9) \div 3 &= 7 + (24 - 9) \div 3 \\ &= 7 + (15) \div 3 \\ &= 7 + 5 \\ &= 12 \end{aligned}$$

### Problem 3.4



Practice the Order of Operations rules on these examples.

- A** The group admission price at Wild World is given by the equation  $p = 50 + 10n$ . Find the prices for groups with 5, 11, and 23 members.
- B** The equation  $b = 100 - 6r$  gives the number of points left on a Wild World bonus card after  $r$  rides. Find the numbers of points left after 3, 7, and 14 rides.
- C** Celia makes plans for the van ride home to Atlantic City from Williamsburg. She plans for a 2-hour stop in Baltimore, Maryland. To predict trip time  $t$  from average driving speed  $s$ , she writes the equation

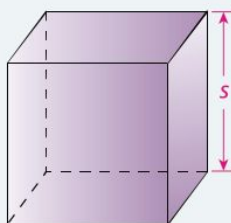
$$t = 2 + \frac{350}{s}$$

Find the predicted trip times for average driving speeds of 45, 55, and 65 miles per hour.

- D** Sidney writes two equations:  $I = 350n$  and  $E = 150n + 1000$ . The equations relate income  $I$  and operating expenses  $E$  to number of customers.

Sidney writes the equation  $P = 350n - (150n + 1000)$  to show how tour profit  $P$  depends on the number of customers  $n$ . Use the rule to find profits  $P$  for 8, 12, 20, and 30 customers.

- E** The Ocean Bike Tours partners have an Atlantic City workshop in the shape of a cube. The formula for the surface area of a cube is  $A = 6s^2$ . The formula for the volume of a cube is  $V = s^3$ .



$$\begin{aligned} \text{Area} &= 6s^2 \\ \text{Volume} &= s^3 \end{aligned}$$

1. If each edge of the cubical workshop is 4.25 meters long, what is the total surface area of the floor, walls, and ceiling?
2. What is the volume of the workshop?

**A C E** Homework starts on page 76.