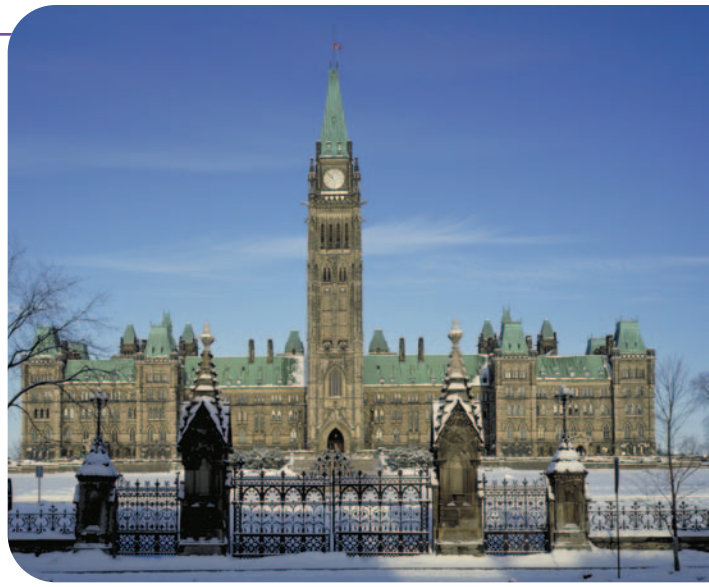
8.3 Creating and Evaluating Expressions

You will need
- a calculator

GOAL
Translate statements into algebraic expressions, and evaluate the expressions.

Learn about the Math



Colin is helping to organize a school trip to Ottawa. He needs to figure out the cost of transportation and choose the least expensive bus company. A total of 260 students are going on the trip. He has prices from three bus companies for the cost of seven buses:

- CarryAll Bus Company charges $350 per bus.
- School Bus Transport charges $7 per student.
- Zim Transport charges $500 to cover the cost for the drivers plus $6 per student.

? Which bus company should Colin choose?

First Colin calculated the cost of using the CarryAll Bus Company.

$\$350 \times 7 = \$2450$

Then he calculated the cost of using School Bus Transport and Zim Transport.

Communication Tip

- Use brackets to show when you have substituted a number for a variable. This will help prevent errors caused by accidentally running numbers together. For example, to evaluate the expression $2a$, when $a = 10$, write 2(10).
- Write each step in a calculation directly under the previous step, and line up the equal signs one under the other. This makes the calculation easier to read and check later. For example,

$$\begin{aligned} & 2a + 5 \\ &= 2(10) + 5 \\ &= 20 + 5 \\ &= 25 \end{aligned}$$

Example 1: Evaluating an algebraic expression with one step

Create an algebraic expression to represent School Bus Transport's cost for any number of students. Evaluate the expression for 260 students.

Colin's Solution

My expression for School Bus Transport's cost:	I used the variable s to represent the number of students going on the trip.
$7s$	I wrote an expression to represent multiplying s by \$7 (the charge per student).
$= 7(260)$ $= 1820$	I substituted 260 for s because 260 is the number of students going on the trip. Then I multiplied 7 by 260.
School Bus Transport would charge \$1820 for the buses.	

Example 2: Evaluating an algebraic expression with several steps

Create an algebraic expression to represent Zim Transport's cost for any number of students. Evaluate the expression for 260 students.

Colin's Solution

My expression for Zim Transport's cost:	I used the variable s to represent the number of students going on the trip.
$500 + 6s$	I wrote an expression to represent multiplying s by \$6 (the charge per student) and then adding \$500 (the cost of the drivers).
$= 500 + 6(260)$	I substituted 260 for s because 260 is the number of students going on the trip.
$= 500 + 1560$ $= 2060$	I used the order of operations to evaluate the expression.
Zim Transport would charge \$2060 for the buses.	

Colin chose School Bus Transport because it is the least expensive.

Reflecting

1. Why do you think Colin did not use a table of values to find the cost for School Bus Transport or Zim Transport?
2. Why do you think Colin did not use a scatter plot to find the cost for School Bus Transport or Zim Transport?
3. Explain how to create and evaluate an algebraic expression.

Work with the Math

Example 3: Creating and evaluating an algebraic expression

A cafeteria charges $250 plus $5 per meal after the first 140 students.
Create an algebraic expression to calculate the cafeteria bill for 260 students.
Evaluate the expression.

Rana's Solution

	I used the variable m to represent the total number of meals served.
$250 + 5(m - 140)$	The charge of $5 per meal is only for the number of meals greater than 140. I found this number by using $m - 140$.
$= 250 + 5((260) - 140)$	I substituted 260 for m, and then did the calculations in the correct order.
$= 250 + 5(120)$	
$= 250 + 600$	
$= 850$	

The cafeteria bill is $850.

A Checking

4. A bowl of chili costs $4. Which expression represents the cost of buying chili for b people?

a) $7b - 4$ **b)** $b + 4$ **c)** $4b$

5. Evaluate each expression when $d = 5$.

a) $6d$
b) $5d - 1$
c) $d + 1$
d) $3(d + 2)$

6. Write an algebraic expression to represent the cost of renting a sleigh for $12 per hour plus $35.

B Practising

7. Asha skated the length of a frozen canal t times, except the last time she stopped 2 km from the end. The canal is 7 km long.

a) Write an algebraic expression that represents how far Asha skated in kilometres.

b) Suppose that $t = 4$. Use your expression to calculate the distance Asha skated.

8. Evaluate each algebraic expression when $a = 3$ and $b = 5$.

a) $3a$
b) $8b$
c) $9a$
d) $2(b - 1)$
e) $3a + 2$
f) $4b - 6$
g) $5b + 7$
h) $5(a + 5)$

9. Evaluate $6(b - 1) + 3$ when $b = 4$. Show and explain all the steps.

10. Write an algebraic expression for each cost.

a) $4 a pair for skate sharpening

b) hamburgers at $3 per person

c) $2 per hour plus $5 for renting skates

d) hats on sale for $10 each

e) cost of a pizza shared equally by four students

11. Samantha works in the snack bar at a community centre. She earns $8 an hour. On her last day, she is paid a bonus of $50.

a) Choose a variable to represent the number of hours Samantha works.

b) Write an algebraic expression that describes Samantha's earnings.

c) Use your expression to calculate how much Samantha would earn if she works 15 h and receives the bonus. Show your work.

12. Jerry sells toques at a kiosk. He is paid $25 a day plus $2 for each toque he sells.

a) What part of his salary never changes, no matter how many toques he sells?

b) Write an algebraic expression that describes Jerry's daily salary.

c) Use your algebraic expression to calculate how much Jerry will earn in one day if he sells 17 toques.

13. Winnie can use up to 10 coupons when buying a box of DVDs. Each coupon is worth $3. She bought a box of DVDs for $56 less the value of her coupons.

a) Choose a variable to represent the number of coupons.

b) Write an algebraic expression that describes the amount Winnie paid for the box of DVDs.

c) Use your expression to calculate how much Winnie would pay if she had 5 coupons.

14. In some parts of question 5, you needed to use the order of operations. Show how you could have made a mistake if you had not used the correct order of operations.

15. Create a problem, based on a real-life situation, that can be represented using the algebraic expression $2x + 6$. Solve your problem.

C Extending

16. Write an algebraic expression for each description.

a) the cost of pizza at $4 per student added to the cost of drinks at $2 per student plus $200 for the bus

b) four times the combined number of apples and pears

c) the cost of hot chocolate for six people plus the cost of muffins for eight people

17. Popcorn and drinks are sold at the school's movie night. Popcorn is $0.75 per bag, and drinks are $1.25 each.

a) Write an algebraic expression that represents the total amount of money received by selling popcorn and drinks.

b) Predict which of the three movie nights received the most money for selling popcorn and drinks.

Movie night	Number of bags of popcorn sold	Number of drinks sold
in November	103	76
in February	70	85
in April	68	75

c) Calculate the amounts received to check your prediction.