Evaluating Algebraic Expressions

Reporting Category	Computation and Estimation
Topic	Evaluating algebraic expressions for given replacement values of the variables
Primary SOL	8.4 The student will apply the order of operations to evaluate algebraic expressions for given replacement values of the variables.
Related SOL	8.1a, 8.5a, b

Materials

- Number cubes
- Number Cube Evaluating Problems (attached)
- Student whiteboards and markers
- Evaluation Derby Relay Problems (attached)
- Exit Ticket (attached)

Vocabulary

order of operations, expression, variable, evaluate, substitute, coefficient, base, exponent (earlier grades)

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Display the expression $4x + y^2$. Review and discuss the algebraic vocabulary *coefficient, expression, variable, base,* and *exponent*. Also, review the order of operations.
2. Roll a number cube to determine values for the variables *x* and y. Model how to substitute those values into the expression and evaluate the expression, using the order of operations.
3. Divide the class into small groups, and give each group a copy of the attached Number Cube Evaluating Problems and a number cube. Direct each group to roll the cube to determine values for the variables in each expression and then evaluate the expression.
4. Call one student from each group to the board, and have these students show the evaluation of the same expression, using the different variable values rolled by their groups. Discuss the process used to solve the problem, emphasizing the order of operations. Use this process to review several problems to ensure that students understand how to evaluate an expression.
5. Give each group or team a whiteboard and marker. Assign each team member a number, 1 through 4. Have teams compete in an Evaluation Derby to evaluate expressions, as follows:
   - Display the first of the attached Evaluation Derby Relay Problems.
   - Direct Member 1 in each team to copy the problem and substitute the given values for the variables.
   - Have Member 2 do the first step to evaluate, following the order of operations.
   - Direct Member 3 to do the second step.
   - Finally, have Member 4 check the work and hold up the board when finished.

- The first team to get the correct answer with the work shown and hold up their board wins that race and gets 2 points; other teams that get the correct answer with the work shown get 1 point. A team that gets a wrong answer gets zero points.
- After race one, have team members rotate responsibilities, and continue with race two to solve the next problem. After five races, the team with the highest score wins the derby.

6. At the end of the lesson, give each student a copy of the attached Exit Ticket to complete.

Assessment

- **Questions**
  - What is the value of the expression $4(x + y)^2$, when $x = 3$ and $y = 4$? What happens if the values of x and y are each decreased by 2?
- **Journal/Writing Prompts**
  - Explain a situation in which you would have to evaluate algebraic expressions in real life.

Extensions and Connections (for all students)

- Connect evaluating algebraic expressions to functions and real-life situations (e.g., movie ticket sales totals based on the number of people going to a movie).

Strategies for Differentiation

- Emphasize the correct use of parenthesis when substituting to represent multiplication.
- Have students create their own problems/situations and solve. Then, have them exchange problems with partners and solve each others' problems.
- Start with problems that involve substituting only one variable, and then progress to multiple variables.

Number Cube Evaluating Problems

Name _____ **Date** _____

1. $4x + 2y^3$ $x =$ _____ $y =$ _____

2. $3(x - y) + 5z$ $x =$ _____ $y =$ _____ $z =$ _____

3. $|2x - y| + 7$ $x =$ _____ $y =$ _____

4. $(x + 2)^2 - y$ $x =$ _____ $y =$ _____

5. $3a - 2b + c$ $a =$ _____ $b =$ _____ $c =$ _____

6. $ab - c$ $a =$ _____ $b =$ _____ $c =$ _____

7. $p - 2r + s^2$ $p =$ _____ $r =$ _____ $s =$ _____

8. $\frac{3(x + y)}{2x}$ $x =$ _____ $y =$ _____

Evaluation Derby Relay Problems

Name _____ **Date** _____

1. $4(x + y) - 2$, when $x = 4$ and $y = 5$

2. $3x^2 + 2y$, when $x = 3$ and $y = -3$

3. $-5a + 2b - 6c$, when $a = -6$, $b = 4$, and $c = -2$

4. $\sqrt{5x} + 2y$, when $x = 5$ and $y = -2$

5. $|2x - y|$, when $x = 3$ and $y = 10$

Exit Ticket

Name _____ **Date** _____

1. Jill needs to find the area of a triangle. If the base of the triangle is 4 ft. and the height is 8 ft., what is the area of the triangle? ($A = \frac{1}{2}bh$) Show all work.

2. Explain what is similar and what is different about the two expressions $3x^2$ and $(3x)^2$, when $x = 4$.