

Evaluating Algebraic Expressions

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| Strand: | Patterns, Functions, and Algebra |
| Topic: | Evaluating algebraic expressions for given replacement values of the variables |
| Primary SOL: | 8.14 The student will a) evaluate an algebraic expression for given replacement values of the variable |
| Related SOL: | 8.5a, b |

Materials

- Number cubes
- Number Cube Evaluating Problems activity sheet (attached)
- Evaluation Derby Relay Problems activity sheet (attached)
- Exit Ticket (attached)
- Variable Substitution Context Problems activity sheet (attached)
- Dry-erase boards and markers

Vocabulary

algebraic expression, base, coefficient, evaluate, exponent, expression, numeric expression, order of operations, rational numbers, square roots, substitute, variable (earlier grades)

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1. Display the expression $4x + y^2$. Review and discuss the algebraic terms *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 algebraic expression and evaluate the resulting numeric expression, using the order of operations.
3. Divide the class into small groups, and give each group the Number Cube Evaluating Problems activity sheet and a number cube. Direct each group to roll the cube to determine values for the variables in each expression and then evaluate the resulting numerical expression, showing all of their work.
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 dry-erase board 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 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.

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- 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 1, have team members rotate responsibilities, and continue with race 2 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 the 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 real-world situation in which you would have to evaluate algebraic expressions.
 - Explain how to evaluate algebraic expressions using substitution and the order of operations.

Extensions and Connections (for all students)

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

Strategies for Differentiation

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

Note: The following pages are intended for classroom use for students as a visual aid to learning.

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Number Cube Evaluating Problems

Name _____ Date _____

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

Solution = _____

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

Solution = _____

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

Solution = _____

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

Solution = _____

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

Mathematics Instructional Plan – Grade 8

Solution = _____

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

Solution = _____

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

Solution = _____

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

Solution = _____

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 $a = -6$, $b = \frac{1}{2}$, and $c = -2.5$

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

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

Variable Substitution Context Problems

1. The price of a visit to the dentist is calculated according to the formula $50+100n$, where n is the number of cavities the dentist finds. On your last visit to the dentist, two cavities were found. What was the cost of your visit?
2. The expression $1.08s + 1.02b$ predicts the end-of-year value of a financial portfolio, where s is the value of stocks and b is the value of bonds in the portfolio at the beginning of the year. What is the predicted end-of-year value of a portfolio that begins the year with \$200 in stocks and \$100 in bonds?
3. An ice cream stand uses the expression $2 + 0.5x$ to determine the cost (in dollars) of an ice cream cone that has x scoops of ice cream. How much does an ice cream cone with five scoops cost?
4. The expression $62.4d - 210$ gives the number of Indian rupees you receive when you exchange dollars for rupees at the local currency exchange. How many Indian rupees do you receive when you exchange \$13?
5. You sell lemonade around town and you can make \$0.30 from each bottle of lemonade. The total amount of money you earn is $0.3b$, where b represents the number of bottles of lemonade you sell. If $b = 30$ bottles of lemonade, how much you can make?

Mathematics Instructional Plan – Grade 8

6. The speed of a car is 60 kilometers per hour, so the distance it runs is $60t$ kilometers, where t represents the hours the car runs. What is the distance the car travels if $t = 5$ hours?

7. Mr. Lee wants to buy books for his students. The amount of money he will spend in dollars is $1.5b$, where b is the number of books he buys. If he buys 11 books, how much money will he spend?

8. Your sister rakes a neighbor's lawn. The total area she rakes is $6.2t$ square meters, where t is the hours she works. If she works 3.5 hours, what is the total area of the lawn she rakes?

9. You are saving for a skateboard. Your aunt gives you \$45 to start, and you save \$3 each week. The expression $45 + 3w$ gives the amount of money you save after w weeks. How much will you have after six weeks?

10. The expression $20a + 13c$ is the cost for a adults and c students to enter the Miami Science Museum. Find the total cost for four adults and 24 students.