Equivalent Linear Expressions

Use What You Know

In previous years you learned how to write expressions in many different ways. Take a look at this problem.

Micah and three friends bought a total of 4 bags of pretzels and 4 drinks at the snack stand. If a bag of pretzels costs x dollars, and a drink costs y dollars, what expression could you write to show how much the friends spent in all?

Use the math you already know to solve the problem.

a. Suppose each friend bought 1 bag of pretzels and 1 drink. Write an expression to show how much they spent in all.

b. Suppose instead that one friend bought all 4 bags of pretzels and another friend bought all 4 drinks. Write an expression that shows the total cost.

c. Suppose one friend decided to pay for a bag of pretzels and a drink for all 4 of them. What expression could you write to show the total cost?

d. Explain how the first two expressions are related.

e. Explain how the last two expressions are related.

Find Out More

Expressions that have the same value are **equivalent** expressions. Numerical expressions such as $8 + 2$, $15 - 5$, $40 \div 4$, and 2×5 are all equivalent. They are all equal to 10.

Take a look at the following algebraic expressions. They are all equivalent.

Expression 1: $(x + y) + (x + y) + (x + y) + (x + y)$

Expression 2: $4x + 4y$

Expression 3: $4(x + y)$

To show that Expression 1 is equal to Expression 2, you can use the commutative and associate properties of addition to group and change the order of the terms.

$(x + y) + (x + y) + (x + y) + (x + y) = (x + x + x + x) + (y + y + y + y) = 4x + 4y$

To show that Expression 2 is equal to Expression 3, you can use the distributive property to factor 4 from both terms of the expression.

$4x + 4y = 4(x + y)$

You can also evaluate these expressions to see if they are equivalent. If you know that a bag of pretzels costs \$2 and a drink costs \$3, you can substitute 2 for x and 3 for y into each of the three expressions above.

$(x + y) + (x + y) + (x + y) + (x + y) = (2 + 3) + (2 + 3) + (2 + 3) + (2 + 3) = 20$

$4x + 4y = 4(2) + 4(3) = 8 + 12 = 20$

$4(x + y) = 4(2 + 3) = 4(5) = 20$

The expressions all have a value of **20**.

Reflect

1 Write two other expressions equivalent to $4x + 4y$. Explain your thinking.

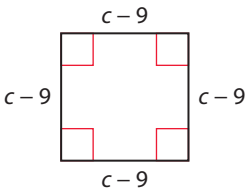
Learn About

Identifying Equivalent Expressions for the Perimeter of a Square

Read the problem below. Then explore different ways to write equivalent expressions for the perimeter of a square.

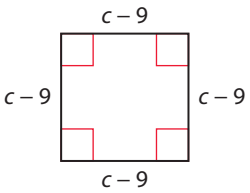
The length of a side of a square is $c - 9$. Three students wrote three different expressions for the perimeter of this square. Are the expressions equivalent? Explain why or why not.

Model It Miguel wrote the perimeter as the sum of the four equal side lengths.



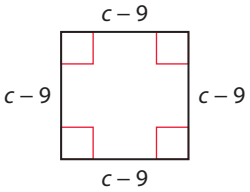
Perimeter = $(c - 9) + (c - 9) + (c - 9) + (c - 9)$

Model It Jessica rearranged the terms, putting the like terms together.



Perimeter = $c + c + c + c - 9 - 9 - 9 - 9$

Model It Petria multiplied the number of sides by the length of a side.



Perimeter = $4(c - 9)$