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Empire State Mathematics Grade 8 Supplemental Lessons

Supplemental Lessons for Unit 4 Equations and Inequalities

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LESSON 1

Algebraic Expressions

Indicators 7.A.3; 8.A.2

algebraic expression variable verbal expression polynomial term coefficient

An **algebraic expression** represents a number. It may contain numerals, variables, and/or operations.

$5y$ $x^2 - 4$ $\frac{2a + 1}{b}$ $4p^2 + \frac{1}{9}$

A **variable** is a symbol that stands for a number. It is often a letter of the alphabet.

a b n x y

An algebraic expression can represent a **verbal expression,** a quantity that is described in words. You can translate words into symbols, or symbols into words, according to their meanings.

A tree was 8 feet tall. It is growing 3 feet taller each year. Write an expression for the height of the tree after n years.

1. Write a term to describe the increase in the tree's height: $3n$.
2. Add the tree's initial height: $3n + 8$. The tree will be $3n + 8$ feet tall after n years.

Translating between words and symbols:

$n + 7$	7 more than n
$n - 7$	7 less than n
$7n$	7 times n
$\frac{n}{7}$	n divided by 7

A **polynomial** is an algebraic expression that contains one or more terms. However, none of the terms is a fraction with variables in the denominator, and none of the exponents is negative.

Is the expression below a polynomial?

$$6x^2 + \frac{3x}{4} - 5x^{-2}$$

1. Check to see if any term is a fraction with variables in the denominator: No.
2. Check to see if any term has a negative exponent: Yes. Since the third term has a negative exponent, the expression is ***not*** a polynomial.

A **term** in a polynomial is a number, a variable, or a product of numbers and variables.

-2 x $5y$ $-3z^2$ $8xy$

$5y$ means $5 \cdot y$ or $5 \times y$.

The number in a term is called the **coefficient.**

$6x$ $3x^2$ $-8xy$

GUIDED PRACTICE

Try this sample multiple-choice problem.

S When James bought a chess set, an 8% sales tax was added to the price. He paid with a $20 bill. If p = the price in dollars, which expression gives the amount of change in dollars James received?

A $20 + 0.08p$

B $20 - 0.08p$

C $20 + p + 0.08p$

D $20 - p - 0.08p$

This problem asks you to choose the algebraic expression that represents a quantity described in words. The price of the chess set is p dollars, so the amount of sales tax is 8% of p, which can be written as $0.08p$. The change James received was the result of subtracting the price, p, and the sales tax, $0.08p$, from $20. So the expression that describes the change is $20 - p - 0.08p$. The correct answer is D.

INDEPENDENT PRACTICE

Read each problem. Circle the letter of the best answer.

1 Which of these is a polynomial?

A $y^3 - 6$

B $\frac{2}{y} - 6$

C $y^{-2} + 6$

D $\frac{1}{y^3 + 6}$

2 Which verbal expression is equivalent to the algebraic expression $4x - 5$?

A four times x less than five

B five less than four times x

C negative five times four times x

D five more than negative four times x

3 Which is **not** a polynomial?

A $8z$

B $7z - 2$

C $\frac{3}{5}z^2 - 8z + 4$

D $\frac{4}{z^2} + 3z - 1$

4 The height of a triangle is 4 inches more than twice its base. If b = the base in inches of the triangle, which expression gives its height in inches?

A $\frac{b}{2} + 4$

B $\frac{b + 4}{2}$

C $2b + 4$

D $2(b + 4)$

5 Three friends had dinner at a restaurant. They left a 15% tip and split the cost equally. If the cost of the dinner (before tip) was n dollars, which expression gives the amount in dollars each of the friends paid?

A $\frac{0.15n}{3}$

B $\frac{3}{0.15n}$

C $\frac{n + 0.15n}{3}$

D $\frac{3}{n + 0.15n}$

GUIDED PRACTICE

Try this sample constructed response problem.

S Look at this algebraic expression.

$$\frac{1}{2}x^3 - \frac{1}{3}x^2 - \frac{1}{4}x$$

Is this expression a polynomial?

Answer: yes

Explain how you know your answer is correct.

This problem asks you to decide whether a given algebraic expression is a polynomial. Look to see if any term is a fraction with a variable in the denominator. Each term has a fraction, but none has a variable in the denominator. Look to see if any term has a negative exponent. No. Since no term has a variable in the denominator or a negative exponent, this expression ***is*** a polynomial.

INDEPENDENT PRACTICE

Read the problem. Write your answers.

6 Look at this algebraic expression.

$$\frac{5}{y} - 8$$

Part A: Is this expression a polynomial? Explain why or why not.

_____

_____

Part B: Write a verbal expression that is equivalent to the algebraic expression $\frac{5}{y} - 8$.

Answer: _____

Read the problem. Write your answers.

7 Nick, Carlos, and Mychal counted their baseball cards. Carlos has 10 more baseball cards than Nick. Mychal has twice as many as Nick.

Part A: If Nick has *n* baseball cards, write expressions for the number of baseball cards that Carlos and Mychal have.

Carlos: _____

Mychal: _____

Write an expression for the total number of baseball cards the three friends have.

Answer: _____

Part B: If Nick has 30 baseball cards, how many baseball cards do the three friends have in all?

To find the total number of baseball cards, replace each *n* in your expression with the number 30. Then simplify.

Answer: _____