GRADE 9 MATH - POLYNOMIALS

KEY TERMS:

- algebra
- monomial
- degree of a term
- opposite polynomial
- term
- binomial
- degree of a polynomial
- distributive property
- polynomial
- trinomial
- like terms

Students will be able to create a concrete model for a given polynomial expression, write the expression for a given model of a polynomial.

Students will identify the variables, degree, number of terms and coefficients and constants.

Students will model, record and explain the operations of addition, subtraction , multiplication and division of polynomial expressions.

Key Ideas

- Algebra is a branch of mathematics that uses symbols to represent unknown numbers or quantities. The symbols are often letters and are called variables.
- Polynomials are made up of terms. Terms are connected by addition or subtraction.

  $3x^2 + 2x - 7$ has three terms.
- Polynomials can have one or more terms. Some polynomials have specific names.

Name	Number of Terms	Example
monomial	1	$6x^2$
binomial	2	$3a^2 - 5$
trinomial	3	$-w^2 + 5w + 1$
polynomial	more than 3	$2s^2 - t^2 + st + 7t - 4$

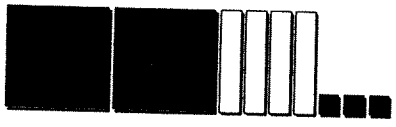
- Each algebraic term has a degree. You can find the degree of a term by adding the exponents of the variable(s) in the term.

  $3x$ has degree 1. $-5x^2y$ has degree 3.
- A polynomial has the same degree as its highest-degree term.

  $x^2 + 5x - 7$ has degree 2.

  12 has degree 0.
- You can use models, such as algebra tiles and diagrams, to represent some polynomials.

  $2x^2 - 4x + 3$



Key Ideas

- An algebraic expression is made up of terms. Each term can have any number of variables. Each variable has an exponent. A constant term, such as 9, has no variable.

Term	Coefficient	Variable(s)	Variable's Exponent
$6p^2$	6	p	2
$-x^2y$	-1	x, y	2 for x, 1 for y

- Like terms differ only by their numerical coefficients.

Like terms can be combined.

Like terms:
- $-7x$ and $3x$
- w^2, $3w^2$, and $0.5w^2$
- 6 and 15

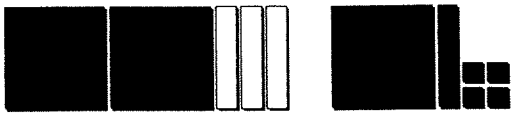
Unlike terms cannot be combined.

Unlike terms:
- $6x$ and $3x^2$
- m^2n and $4mn^2$
- 7 and $7d$

Key Ideas

- You can add or subtract polynomials. You can use models to help simplify the expression.

$(2x^2 - 3x) + (x^2 + x + 4)$



Group like terms. Remove any zero pairs.

$(2x^2 - 3x) + (x^2 + x + 4) = 3x^2 - 2x + 4$

- The opposite of a polynomial is found by taking the opposite of each of its terms.

The opposite of $-3x^2 + x + 1$ is $3x^2 - x - 1$.

- To subtract polynomials, you can add the opposite.

$(6x^2 - 3x + 4) - (x^2 - 3x + 2)$
$= (6x^2 - 3x + 4) + (-x^2 + 3x - 2)$
$= 6x^2 - x^2 - 3x + 3x + 4 - 2$
$= 5x^2 + 0x + 2$
$= 5x^2 + 2$

$-3x + 3x = 0x$ or 0, so it does not need to be included in the answer.

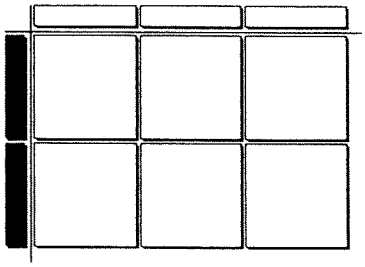
Key Ideas

- You can represent the multiplication and division of monomials using a model.

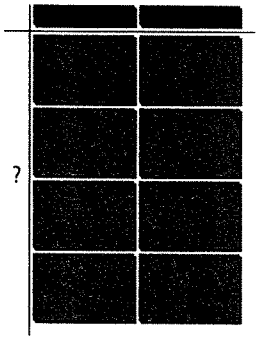
$(2x)(-3x)$

There are 6 negative x^2-tiles.

$(2x)(-3x) = -6x^2$

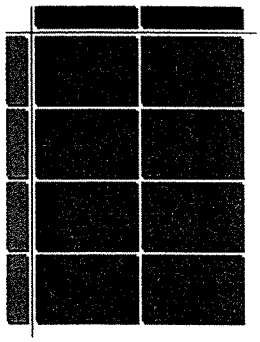


$\frac{8xy}{2x}$



The unknown side length of the rectangle is made up of 4 positive y-tiles.

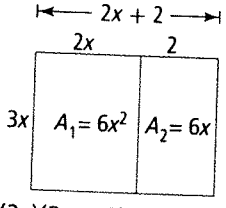
$\frac{8xy}{2x} = 4y$



- To multiply monomials algebraically, you can multiply the numerical coefficients and use the exponent rules to multiply the variables.
- To divide monomials algebraically, you can divide the numerical coefficients and use the exponent rules to divide the variables.

Key Ideas

- You can represent the multiplication of a polynomial by a monomial using models.
  - area model

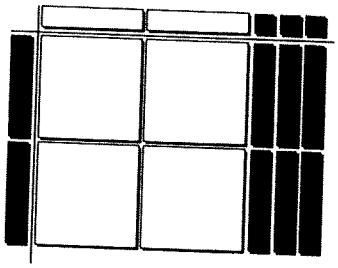


$(3x)(2x + 2)$

The product is represented by $A_1 + A_2$.

$(3x)(2x + 2) = 6x^2 + 6x$

  - algebra tiles



$(2x)(-2x + 3)$

There are 4 negative x^2-tiles and 6 positive x-tiles.

$(2x)(-2x + 3) = -4x^2 + 6x$

- To multiply a polynomial by a monomial algebraically, you can expand the expression using the distributive property. Multiply each term of the polynomial by the monomial.

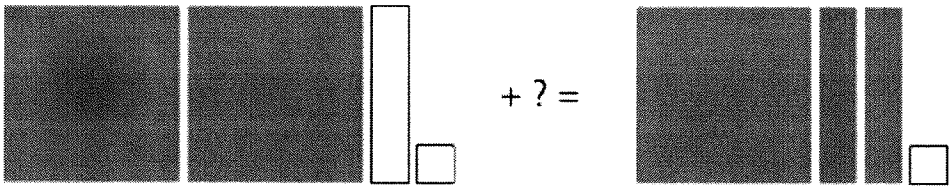
$(-1.2x)(3x - 7)$

$= (-1.2x)(3x) - (-1.2x)(7)$

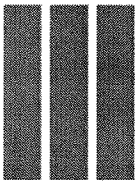
$= -3.6x^2 + 8.4x$

Grade 9 Math – Polynomials -Questions

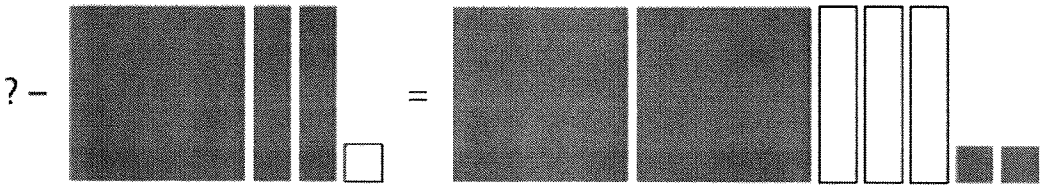
1. Replace the question mark with an algebra tile model to make a true statement.



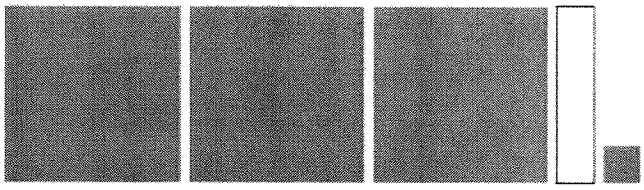
ANS:



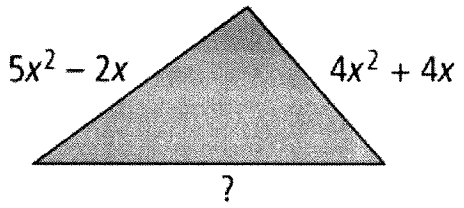
2. Replace the question mark with an algebra tile model to make a true statement.



ANS:



3. The perimeter of the triangle below can be represented by the polynomial $14x^2 + 8x$. What is the missing side length?



ANS:

Part Perimeter = $5x^2 - 2x + 4x^2 + 4x$

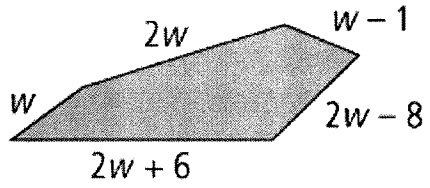
$= 9x^2 + 2x$

Difference from perimeter = $(14x^2 + 8x) - (9x^2 + 2x)$

$= 5x^2 + 6x$

The missing side length is $5x^2 + 6x$.

4. Write a simplified expression to describe the perimeter of the figure shown below.



ANS:

$w + 2w + w - 1 + 2w - 8 + 2w + 6 = w + 2w + w + 2w + 2w - 1 - 8 + 6$

$= 8w - 3$

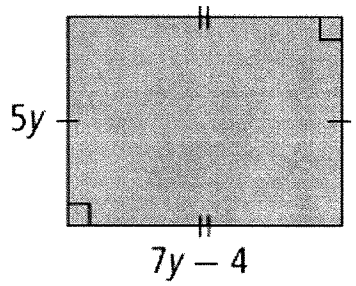
The perimeter is $8w - 3$.

5. A farm hand can move n bales of hay per hour when he is fresh. When he gets tired, however, he moves 5 fewer bales of hay per hour. One day, he works 3 h at top speed, then another 4 h at the slower speed. Write an expression to show how many bales of hay he moved. Simplify your answer.

ANS:
Number of bales moved per hour when fresh $= n$.
Number of bales moved per hour when tired $= n - 5$.
$3n + 4(n - 5) = 3n + 4n - 20$

$= 7n - 20$
He moved $7n - 20$ bales.

6. Write a simplified expression for the area of this figure. What is the area of the figure?



ANS:
$(5y)(7y - 4)$

$= 35y^2 - 20y$
The perimeter is $35y^2 - 20y$.

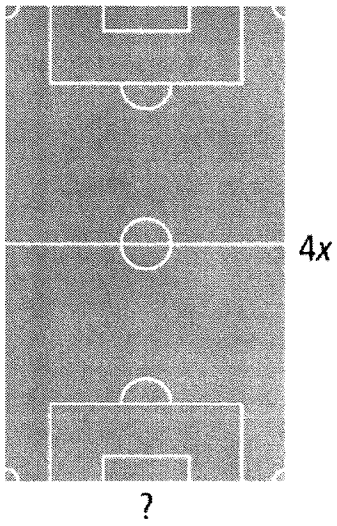
7. Apply the distributive property to simplify $2x(x - 4) - 3x(x - 4)$.

ANS:
$-x^2 + 4x$

8. The quotient of $\dfrac{4.8t^2 - 7.2t + 24}{2.4}$ is _____.

ANS: $2t^2 - 3t + 10$

9. The area of a soccer field can be expressed by the algebraic equation $A = 12x^2$.



a) If the length of the soccer field is $4x$ metres, what is the width?
b) If $x = 30$, what are the dimensions and area of the soccer field?

ANS:

a)

$$w = \frac{12x^2}{4x}$$

$$= 3x$$

The width of the field is $3x$ metres.

b) $SA = 12x^2$

$SA = 12(30)^2$

$SA = 12(900)$

$SA = 10\,800$

The soccer field has an area of 10 800 m^2.

Length $= 4(30)$
$= 120$ m

Width $= 3(30)$
$= 90$ m

The length of the soccer field is 120 m and the width is 90 m.