Name: KEY
Date: _____

Math 9
Lesson P1: Modelling Polynomials & Combining Like Terms

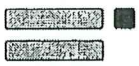
Modelling Expressions

We can use algebra tiles to model an expression.
One ▪ represents +1. One ▪ represents −1.

One ▬ represents any variable, such as x or n.

One ▬ represents $-x$ or $-n$.

There are 2 ▬. They represent $2x$.



There is 1 ▪. It represents −1.

So, the tiles represent the expression $2x - 1$.

We can use any letter as the variable.

There are 3 ▬. They represent $-3a$.

There are 2 ▪. They represent +2.

So, the tiles represent the expression $-3a + 2$.

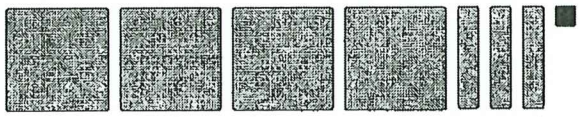
Some expressions contain x^2 terms.

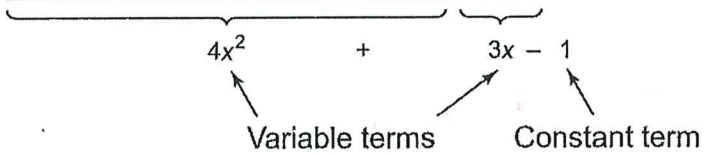
We use ▩ to represent x^2.

When the variable is n, the tile is called the n^2-tile.

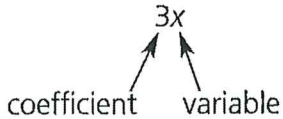
We use ■ to represent $-x^2$.

For the expression $4x^2 + 3x - 1$:





In the term $3x$, the **variable** is x and the **coefficient of the variable** is 3.



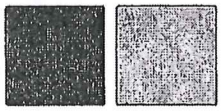
An algebraic expression like this one is also called a **polynomial**.

Example #1: Use algebra tiles to model each polynomial

a) $-4t^2$

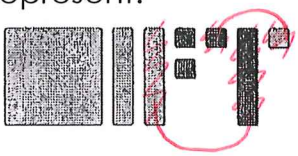
b) $2n - 5$

These are all zero pairs:

 and  and 

We can use zero pairs to simplify algebraic expressions.

Example #2: Simplify this tile model. Write the polynomial that the remaining tiles represent.



$x^2 + 2x - 3 - x + 1$

$= x^2 + x - 2$

Terms that can be represented by matching tiles are called **like terms**.

Like terms:	x^2 and $-2x^2$	$4s$ and $-s$	6 and -2	$5w$ and w
Unlike terms:	$3s$ and s^2	$2x$ and -5	$3d^2$ and 7	

We can **simplify a polynomial** by adding the coefficients of like terms.
To simplify $-5x + 2x$, add the integers: $-5 + 2 = -3$
So, $-5x + 2x = -3x$

Example #3: Simplify:

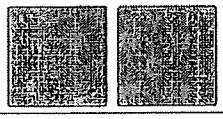
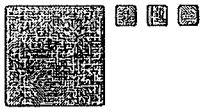
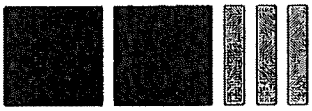
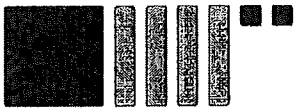
a) $3a + 6 + a - 4$

$= 4a + 2$

b) $-x^2 + 4x - 5 + 3x^2 - 4x + 1$

$= 2x^2 - 4$ OR $2x^2 + 0x - 4$

There are different **types** of polynomials, depending on the number of terms.
The **degree of a polynomial** tells you the greatest exponent of any term.

Type	Number of Terms	Example	Model	Degree
Monomial	1	$2s^2$		2
		$-2n$		1
		4		2
Binomial	2	$x^2 + 3$		2
		$2a - 1$		1
		$-2b^2 + 3b$		2
Trinomial	3	$-c^2 + 4c - 2$		2

A monomial has 1 type of tile.

A constant term has degree 0.

A binomial has 2 different types of tiles.

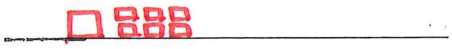
A trinomial has 3 different types of tiles.

An algebraic expression that contains a term with a variable in the denominator, such as $\frac{5}{n}$, or the square root of a variable, such as $\sqrt{n}$, is not a polynomial.

Practice

1. Sketch algebra tiles to model each polynomial.

a) $a^2 + 6$



b) $y^2 - y + 3$

c) $-2m^2 + 3m - 4$

d) $2x^2 + 5x + 4$

2. Is the polynomial a monomial, binomial, or trinomial?

a) $-7t$ The polynomial has 1 term, so it is a monomial.

b) $8d^2 + 7$ The polynomial has 2 terms, so it is a binomial.

c) $s^2 + 5s - 6$ The polynomial has 3 terms, so it is a trinomial.

d) $4t - 12$ The polynomial has 2 terms, so it is a binomial.

e) -15 The polynomial has 1 term, so it is a monomial.

3. Name the degree of each polynomial.

a) $5a^2 - 3a + 6$ The term with the greatest exponent is $5a^2$.
It has exponent 2.
So, the polynomial has degree 2.

b) $4b - 6$ The term with the greatest exponent is $4b$.
It has exponent 1.
So, the polynomial has degree 1.

c) $4d^2 - 3d$ The term with the greatest exponent is $4d^2$.
It has exponent 2.
So, the polynomial has degree 2.

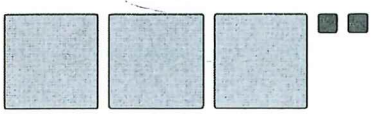
d) -4 -4 can be written as $-4x^0$.
So, the polynomial has degree 0.

4. Write the polynomial represented by each set of tiles.

a) Use the variable f.

$-2f^2+f-5$

b) Use the variable n.



$3n^2-2$

c) Use the variable p.

$-7p+3$

5. Choose a set of tiles from question 4.
Write another polynomial that can be represented by the same set of tiles.

a) → $x-5-2x^2$

6. Identify the polynomials that can be represented by the same set of algebra tiles.

a) $x^2 + 3x - 1$

1  , 3  , and 1 

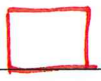
b) $4r^2 - 5r + 9$

4  , 5  , $ 9 

c) $9 + 4z^2 - 5z$

4  , 5  , $ 9 

d) $3s + 1 + s^2$

$ 1  , 3  , $ 1 

Parts b and c use the same algebra tiles.
So, $4r^2-5r+9$ and $9+4z^2-5z$ both represent the same polynomial.

Practice

1. What is the coefficient of each term?

a) $2x^2$ 2 **b)** $6w$ 6 **c)** $-3x$ -3

d) $7t$ 7 **e)** b 1 **f)** $-s$ -1

2. a) Which of these terms are like $3z^2$?

$5z$ $-z^2$ -9 $-6z$ $2z^2$ -11 $-4z^2$

$3z^2$ has variable z and exponent 2.

Find all terms with the same variable and exponent: $-z^2$, $2z^2$, $-4z^2$

b) Which of these terms are like $-5x$?

$-4x$ $-3x^2$ -2 $7x$ $5x^2$ 8 $-x$ $-5t$

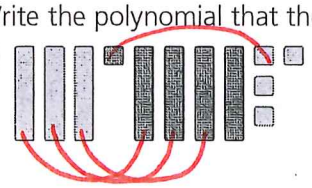
$-5x$ has variable x and exponent 1.

Find all terms with the same variable and exponent: $-4x$, $7x$, $-x$

3. Simplify each tile model.

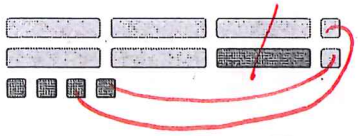
Write the polynomial that the remaining tiles represent.

a)



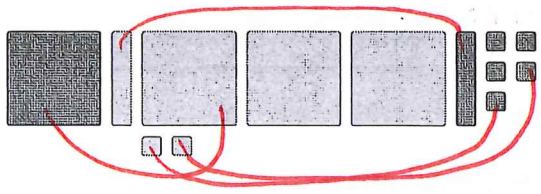
Remaining tiles:  Polynomial: $-x + 3$

b)



Remaining tiles: $4x$ [ ] $+ 2x$ [/] Polynomial: $4x + (-2) = 4x - 2$

c)



Remaining tiles: $2x$ [ ] $+ 3x$ [/] Polynomial: $2x^2 + (-3) = 2x^2 - 3$

4. Add integers to combine like terms.

a) $-3c + 5c$

$-3 + 5 =$ 2

$-3c + 5c =$ 2c

b) $4s - s$

$4 + (-1) =$ 3

$4s - s =$ 3s

c) $-2x^2 + 7x^2$

-2 + 7 = 5

$-2x^2 + 7x^2 = 5x^2$

d) $8e^2 - 8e^2$

8 − 8 = 0

$8e^2 - 8e^2 = 0$

5. Simplify each polynomial.

a) $5m + 7 - 2m + 1$

Group like terms.

$= 5m - 2m + 7 + 1$

Add the coefficients of like terms.

$= 3m + 8$

b) $7c^2 - 6c - 4c^2 + c$

Group like terms.

$= 7c^2 - 4c^2 - 6c + c$

Add the coefficients of like terms.

$= 3c^2 - 5c$

c) $11 - 9v + v^2 + 2 - v$

$= 11 + 2 - 9v - v + v^2$

$= 13 - 10v + v^2$

$= v^2 - 10v + 13$

We usually write a polynomial so the exponents of the variable decrease from left to right.

d) $-7f^2 + 12f - 2 - 3f^2 - 3f + 5$

$= -7f^2 - 3f^2 + 12f - 3f - 2 + 5$

$= -10f^2 + 9f + 3$

A polynomial in simplified form is equal to the original polynomial.

6. Identify and explain any errors you find.

a) $3x + 2 = 5x$

$3x + 2 = 3x + 2$

3x & 2 are not like terms so they can not be added

b) $5s + 3s = 8s^2$

$5s + 3s = 8s$

5 + 3 = 8, but the variable and exponent must stay the same.

c) $x^2 - x^2 = 0$

no error.