UNIT 5 Polynomials

What You'll Learn

- Recognize, write, describe, and classify polynomials.

- Represent polynomials using tiles, pictures, and algebraic expressions.

- Add and subtract polynomials.

- Multiply and divide a polynomial by a monomial.

Why It's Important

Polynomials are used by

- homeowners to calculate mortgage and car payments

- computer technicians to encode information, such as PIN numbers for ATM machines and debit cards

Key Words

term	monomial
variable term	binomial
constant term	trinomial
variable	simplify a polynomial
coefficient of the variable	like terms
polynomial	unlike terms
degree of a polynomial	distributive property

5.1 Skill Builder

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 $2x - 1$.

There are 3 ▬ .

They represent $-3a$.

There are 2 ▢ .

They represent $+2$.

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

We can use any letter as the variable.

Check

1. Which expression does each set of tiles represent?

a) _____

b) _____

c) _____

d) _____
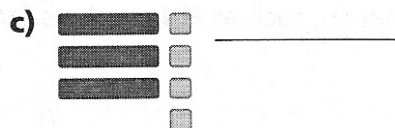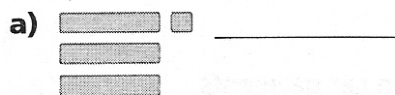
2. Sketch algebra tiles to model each expression.

a) $s + 4$

b) $5b - 3$

c) $-4n + 5$

d) $-6w - 1$

5.1 Modelling Polynomials
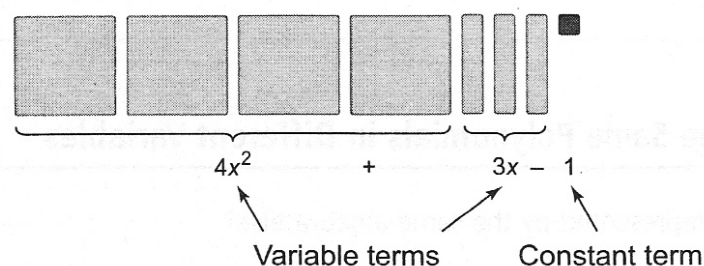
FOCUS Model, write, and classify polynomials.

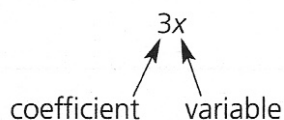Some expressions contain x^2 terms.

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 $4x^2 + 3x - 1$:

$$\underbrace{4x^2}_{} \qquad + \qquad \underbrace{3x}_{} \; - \; \underbrace{1}_{}$$

                        Variable terms   Constant term

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

$$\overset{3x}{\underset{\text{coefficient}\quad\text{variable}}{\uparrow\;\uparrow}}$$

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

Example 1 | Modelling Polynomials with Algebra Tiles

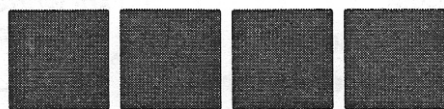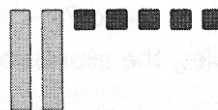Use algebra tiles to model each polynomial.

a) $-4t^2$ **b)** $2n - 5$

Solution

a) To represent $-4t^2$, use 4 [ ].

b) To represent $2n$, use 2 [ ].
To represent -5, use 5 ■.

Check

1. Sketch algebra tiles to model each polynomial.

    a) -3 **b)** $2x + 3$

    c) $2e^2 - e + 2$ **d)** $-3d^2 + 2d - 5$

Example 2   Recognizing the Same Polynomials in Different Variables

Which of these polynomials can be represented by the same algebra tiles?

    a) $2x^2 + 7x - 4$ **b)** $-4 + 2b^2 - 7b$ **c)** $7s - 4 + 2s^2$

Solution

Select the tiles that match each term.

    a) $2x^2 + 7x - 4$
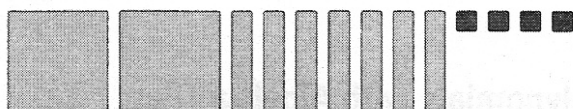
    b) $-4 + 2b^2 - 7b$

    c) $7s - 4 + 2s^2$

The variable used to name a tile does not matter.

In parts a and c, the same algebra tiles are used.

Since $2x^2 + 7x - 4$ and $7s - 4 + 2s^2$ can be represented
by the same tiles, the expressions represent the same polynomial.

The order in which the terms are written does not matter.

Check

1. Which of these polynomials can be represented by the same algebra tiles?
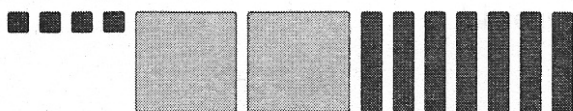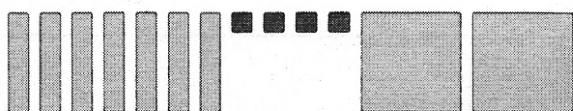
   a) $3s^2 - 2s + 5$

   b) $5 - 3a^2 - 2a$

   c) $-2c + 5 - 3c^2$

   The same tiles are used in parts _____ and _____.
   So, _____ and _____ represent the same polynomial.

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	A monomial has 1 type of tile.
		4		2	*A constant term has degree 0.*
Binomial	2	$x^2 + 3$		2	
		$2a - 1$		1	A binomial has 2 different types of tiles.
		$-2b^2 + 3b$		2	
Trinomial	3	$-c^2 + 4c - 2$		2	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 ___ term, so it is a _____.

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

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

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

e) -15 The polynomial has ___ term, so it is a _____.

3. Name the degree of each polynomial.

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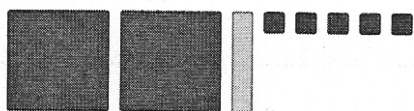So, the polynomial has degree _____.

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

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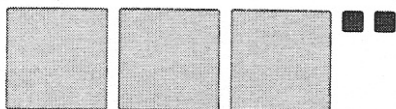It has exponent _____.
So, the polynomial has degree _____.

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

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

a) Use the variable f.

_____

b) Use the variable n.

_____

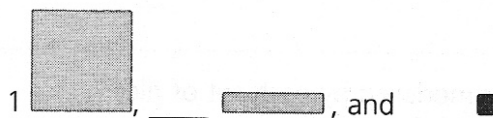**c)** Use the variable p.

_____

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

_____

_____

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

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

1 _____ , _____ _____ , and _____ ▪

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

_____

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

_____

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

_____

Parts _____ and _____ use the same algebra tiles.
So, _____ and _____ both represent
the same polynomial.