P4

Math 9

4.1 Introduction to Polynomials

(many terms)

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Learning Goals: *I will learn to*

- show mathematical understanding through concrete, pictorial, and symbolic representations
- model algebraic expressions using algebra tiles
- use mathematical terminology to describe polynomials

An algebraic expression is a mathematical phrase that combines numbers and variables connected by mathematical operations.

Example: $-7x^2 + 2xy - 4x + y^2 - 5$ (5 terms, 2 variables (x and y))

term
- A number or variable, or the product (×) of numbers and variables.
  Example: The expression $5x + 3$ has two terms: $5x$ and 3.

variable
- A symbol that represents an unknown number or quantity.

coefficient
- A number that multiplies an expression.
  Example: in $-5(4)^2$, the coefficient is -5.

constant
- A term with no variable.

A **polynomial** is an expression with one or more terms, separated by addition or subtraction. **The exponent of any variable must be a positive integer.**

Examples: $5x^2$ $6x^2+7$ $-8x+3y-5$

~~$7a^{-1}$~~ ($\frac{1}{a}$) ~~$3pq^{\frac{1}{2}}$~~ ~~$3y^x + 4x$~~

- A one term polynomial is a monomial (eg. $5x^2$)
- A two term polynomial is a binomial (eg. $6x^2+7$)
- A three term polynomial is a trinomial (eg. $-8x+3y-5$)

If there are more than 3 terms, the expression is just called a polynomial.

The degree of a term is the sum of the exponents on the variables in that term.

Examples: $3x^2$ (degree = 2) $7x^1y^4$ (degree = 5) $-7a^2b^1c^5$ (degree = 8) $12x^1$ (degree = 1)

12 (degree = 0)

The degree of a polynomial is the degree of the highest-degree term in the polynomial.

Examples:

$5y^2 + 5y^1$ → degree of polynomial = 2

degree = 2, degree = 1

$6x^2 + 5x^2y^2 + 4x^1y^2$ → degree of polynomial = 4

2, 4, 3

Develop Understanding

Example: Identify Coefficients and Variables

Identify the coefficient and variable in each expression.

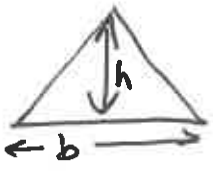
a) Angie earns \$14 per hour at her job If she works t hours, she earns $14t$ dollars.

$14t$ coeff = 14, variable = t

b) The area of a circle is πr^2, where r is the radius.

πr^2 coeff = π, variable = r

c) The area of a triangle with base b and height h is $\frac{1}{2}bh$.



$\frac{1}{2}bh$ coeff = $\frac{1}{2}$, variables = b AND h

d) Dexter's height is 1.6 m. ← metres

1.6 coeff = 1.6, no variable (constant)

Example: Classify Polynomials

mono... bi... tri...

Classify each polynomial by the number of terms, polynomial type, and degree.

a) $5w^2$

- one term
- monomial
- degree = 2

b) $6y - 2$ (1, 0)

- two terms
- binomial
- degree = 1

c) $3x^2 - 9xy + y^2$ (2, 2, 2)

- three terms
- trinomial
- degree = 2

d) $m + mn - 3n + 5$ (1, 2, 1, 0)

- four terms
- polynomial
- degree = 2

e) 124

- one term
- monomial
- degree = 0

f) $-9p^2q^3 + 7pq + 21pq^2r + 9$ (5, 2, 4, 0)

- four terms
- polynomial
- degree = 5

Example: Evaluate an Algebraic Expression

On a game show, a contestant receives 500 points for each correct answer and loses 300 points for each incorrect answer. The total number of points can be calculated using the expression $500c - 300i$ where c is the correct number of answers and i is the number of incorrect answers. Calculate the number of points for each contestant.

a) Jim has 12 correct and 7 incorrect answers.

b) Anna has 5 correct and 10 incorrect answers.

c) Chi Yang has 6 correct and 6 incorrect answers.

$500c - 300i$

a) JIM
$c = 12$
$i = 7$

$500(12) - 300(7)$
$= 6000 - 2100$
$= \boxed{3900}$ *WINNER!

b) ANNA
$c = 5$
$i = 10$

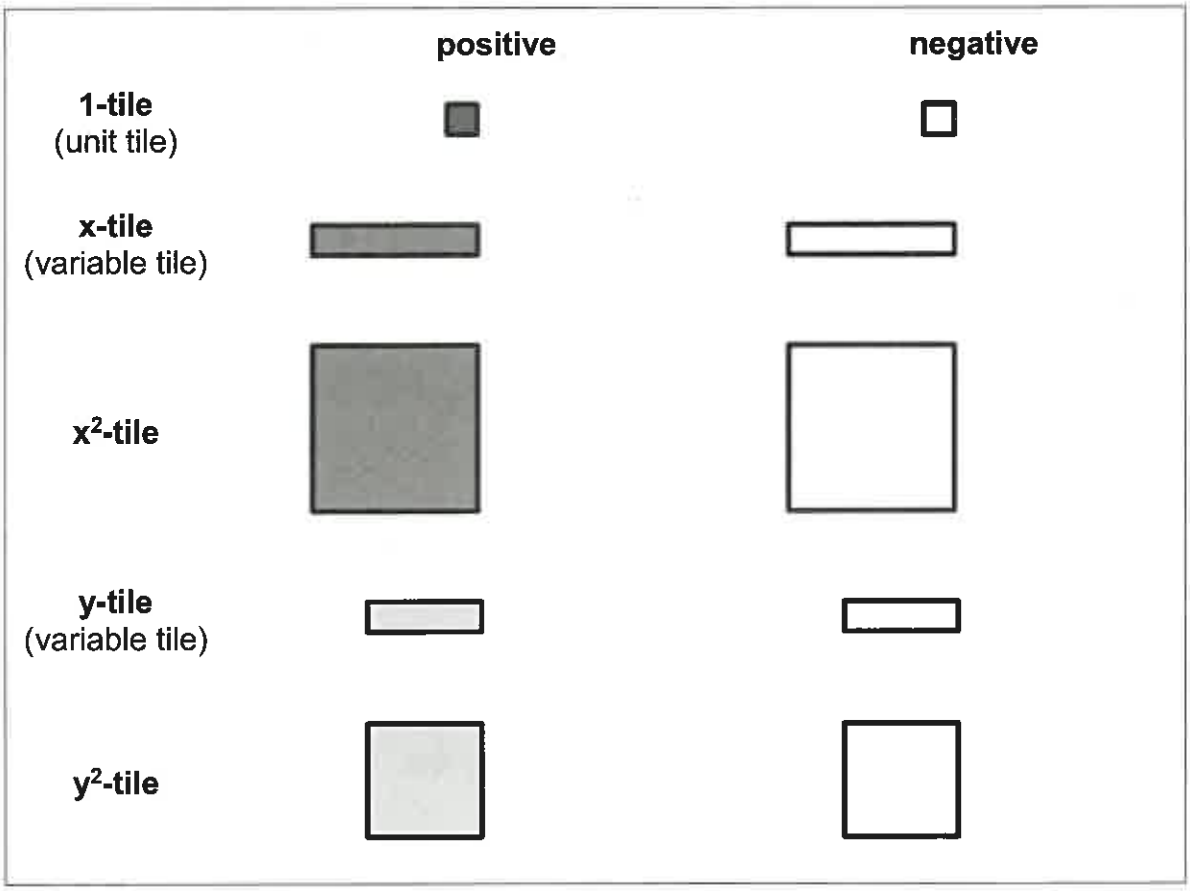
$500(5) - 300(10)$
$= 2500 - 3000$
$= \boxed{-500}$

c) CHI YANG
$c = 6$
$i = 6$

$500(6) - 300(6)$
$= 3000 - 1800$
$= \boxed{1200}$

Model with Algebra Tiles

Algebra tiles can be used to model polynomials that have a degree of 2 or less.



Examples:

Use algebra tiles to model the length represented by each algebraic expression.

a) -2

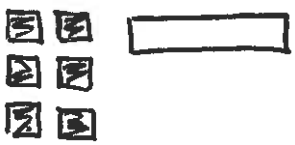
c) $x + 4$

b) $2x$

d) $-3x + 1$

e) $6 - x$

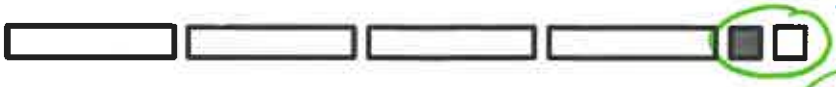
$6 + (-x)$



Write an algebraic expression modelled by each set of algebra tiles.

a) 

$3x+2$

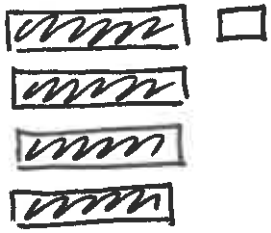
b) 

$-4x+1+(-1)$

$-4x+1-1$ zero pair

$-4x$

Use algebra tiles to explain why $4x - 1$ does not equal $3x$.



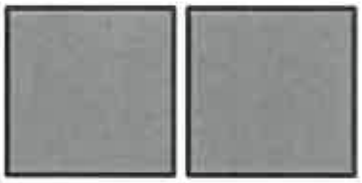
4x - 1

$\neq$

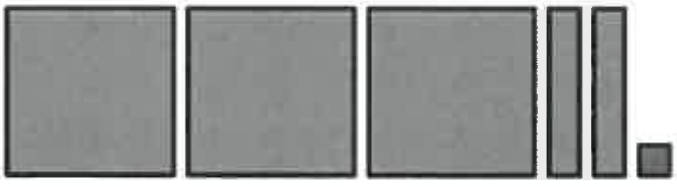
3x

x and −1 are NOT "like terms" we cannot combine them to create a zero pair.

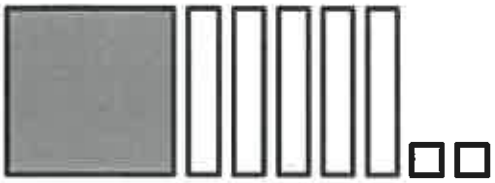
What expression for area does each set of algebra tiles model? Which one models the greatest area? Which one models the least?

a) 

$2x^2$

b) 

$3x^2+2x+1$

c) 

$1x^2+(-5x)+(-2)$

OR

x^2-5x-2

Use algebra tiles to model each algebraic expression.

a) $4x^2$

b) $x^2 + 3x$

c) $-2x^2 + 5x + 4$