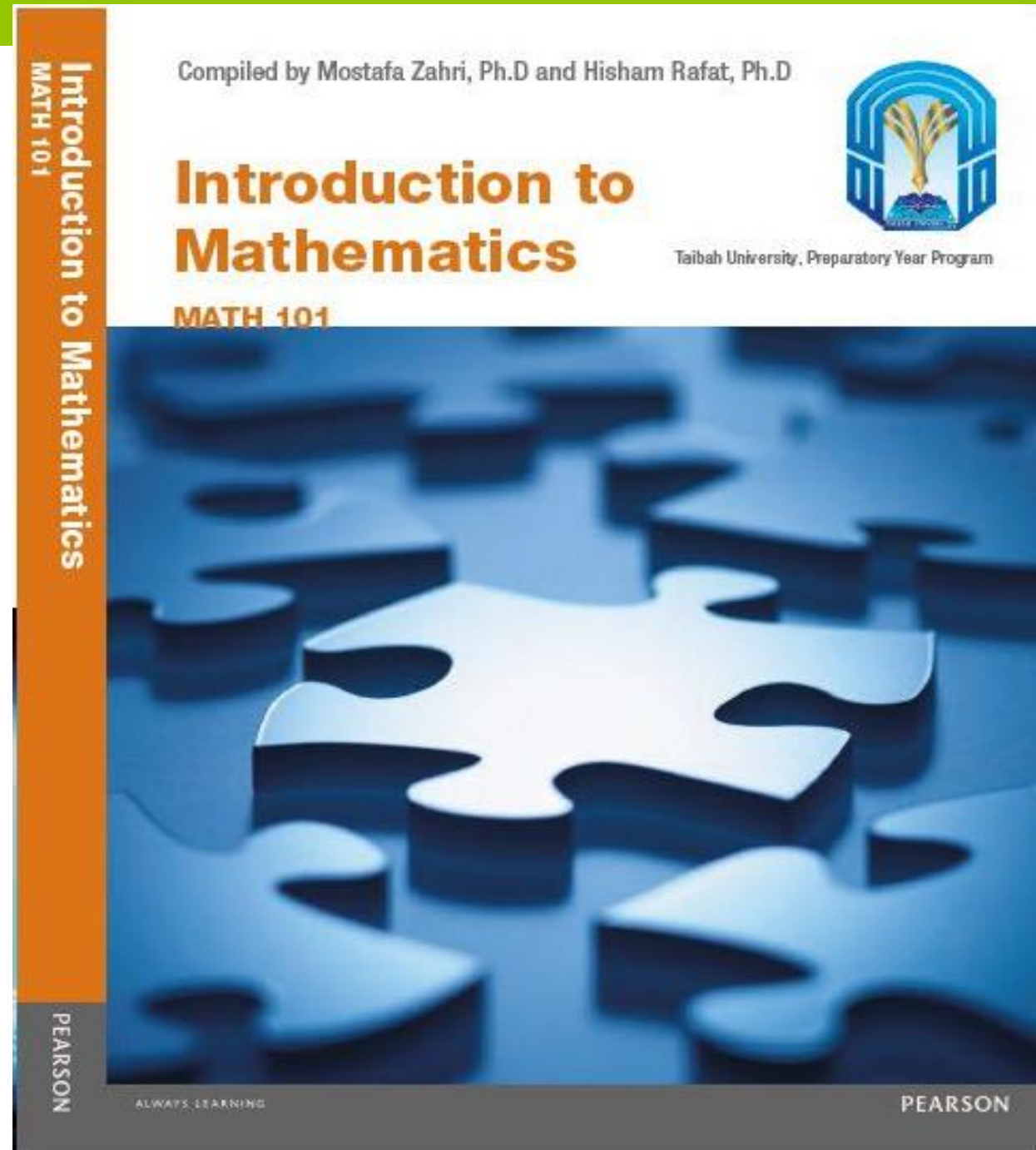


- Math-101
- # Chaaper-1.3
- Polynomials



1.3 Polynomials

- Rules for Exponents
- Polynomials
- Addition and Subtraction
- Multiplication
- Division

Rules of Exponents

Rule	Math notation	Description
Product rule	$a^m \cdot a^n = a^{m+n}$	When multiplying powers of like bases, keep the base and add the exponents.
Power rule 1	$(a^m)^n = a^{mn}$	To raise a power to a power, multiply the exponents.
Power rule 2	$(ab)^m = a^m b^m$	To raise a product to a power, raise each factor to that power.
Power rule 3	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m} \quad b \neq 0$	To raise a quotient to a power, raise the numerator and the denominator.
Zero exponent	$a^0 = 1 \quad a \neq 0$	A nonzero number to the power of zero equals 1.

Examples:

Find each product :

a) $y^4 \cdot y^7$

b) $(6z^5)(9z^3)(2z^2)$

Homework1

Simplify:

a) $(5^3)^2$

b) $(3^4 x^2)^3$

c) $(\frac{2^5}{b^4})^3$

d) $(\frac{-2m^6}{t^2 z})^5$

Homework 1: Simplify:

a) $(5^3)^2$

b) $(3^4 x^2)^3$

c) $\left(\frac{2^5}{b^4}\right)^3$

d) $\left(\frac{-2m^6}{t^2 z}\right)^5$

Example 2 : Evaluate each power

a) 4^0

b) $(-4)^0$

c) -4^0

d) $-(-4)^0$

e) $(7r)^0$

Evaluate $[(-4)^0]^5$

A. 5

B. -5

C. 1

D. -1

Simplify $\frac{(x^3y^3)^5}{x^5y^2}$.

A. x^3y^6

B. x^2y

C. $x^{10}y^{11}$

D. $x^{10}y^{13}$

Simplify $(-3^3)^3$

A. 3^6

B. -3^9

C. 3^9

D. -3^6

Polynomials

Algebraic expression.

Any collection of numbers or variables joined by the basic operations of addition, subtractions multiplication or division and so on

$$\left[-2x^2 + 3x, \frac{15y}{2y - 3}, \sqrt{m^3 - 64}, (3a + b)^4 \right]$$

Polynomials

Term:

The product of a real number and one or more variables raised to powers

Example:

1) the term $-3m^4$

The coefficient is -3, the variable is m the power (degree) is 4

2) the term $-p^2$

The coefficient is -1, the variable is p the power (degree) is 2

Polynomials

Like Terms:

Are terms with the same variables each raised to the same powers

Example:

1) the terms $-3m^4, 6m^4, 4m^4$ are like terms

2) the terms $-3y^4, 6m^4, 4r^4$ are unlike terms.

Types of Polynomials:

1. One term is called **Monomial**. $-10r^6s^8$
2. Two terms is called **Binomial**. $29x^{11} + 8x^{15}$
3. Three terms is called **Trinomial**. $9p^7 - 4p^3 + 8p^2$
4. More than three terms is called **None of These**
 $5a^3b^7 - 3a^5b^5 + 4a^2b^9 - a^{10}$

Which expression is *not* a polynomial?

A. $x^3 - 2x^2 + 3x - 2$

B. $-3x + 5x^{14} - 3$

C. $x^{-2} + 2$

D. 5

What is the degree of this polynomial?

$$4x^5 - 5x^4 - 3x^2 + 2$$

A. 2

B. 3

C. 4

D. 5

The expression $x^3 - \sqrt{2}$ is a polynomial.

A. True

B. False

Addition and Subtraction

- **Example 3: Adding and subtracting polynomials:**

Add or subtract , as indicated.

- a) $(2y^4 - 3y^2 + y) + (4y^4 + 7y^2 + 6y)$

- b) $(-3m^3 - 8m^2 + 4) - (m^3 + 7m^2 - 3)$

$$\text{c) } (8m^4p^5 - 9m^3p^5) + (11m^4p^5 + 15m^3p^5)$$

$$\text{d) } 4(x^2 - 3x + 7) - 5(2x^2 - 8x - 4)$$

• Multiplication of Polynomials

• Multiplication of Polynomials

- There are several methods for multiplying polynomials.
- The choice of method depends on the type of polynomials being multiplied together.
- One of the easiest methods of multiplying polynomials is to use the concept of distribution property.
- $-3x(4x^2 - x + 10) = -12x^3 + 3x^2 - 30x$

• Multiplication of Polynomials

For example: :(Product horizontal)

$$\begin{aligned} & (3x - 4)(2x^2 - 3x + 5) = \\ & = (3x - 4)(2x^2) - (3x - 4)(3x) + (3x - 4)(5) \\ & = 3x(2x^2) - 4(2x^2) - 3x(3x) - (-4)(3x) + 3x(5) - 4(5) \\ & = 6x^3 - 8x^2 - 9x^2 + 12x + 15x - 20 \\ & = 6x^3 - 17x^2 + 27x - 20 \end{aligned}$$

• Multiplication of Polynomials

For example: (Product vertically)

$$\begin{array}{r} (2x^2 - 3x + 5) \\ (3x - 4) \\ \hline -8x^2 + 12x - 20 \quad \leftarrow (-4)(2x^2 - 3x + 5) \\ 6x^3 - 9x^2 + 15x \quad \leftarrow (3x)(2x^2 - 3x + 5) \\ \hline 6x^3 - 17x^2 + 27x - 20 \end{array}$$

• Multiplication of Polynomials

Homework 3:

Multiplication of Polynomials

Multiply $(3p^2 - 4p + 1)(p^3 + 2p - 8)$

• Multiplication of Polynomials

FOIL method: (First, Outside, Inside, Last)

Example 4:

Find each product:

a) $(6m + 1)(4m - 3)$

b) $(2x + 7)(2x - 7)$

c) $r^2(3r + 2)(3r - 2)$.

• Special product

Product of the sum and difference of two terms:

$$(x + y)(x - y) = x^2 - y^2$$

Square of a binomial :

$$(x + y)^2 = x^2 + 2xy + y^2$$

$$(x - y)^2 = x^2 - 2xy + y^2$$

•Special product

Homework 4: Using the special product

Find each product:

a) $(3p + 11)(3p - 11)$

b) $(5m^3 - 3)(5m^3 + 3)$

c) $(9k - 11r^3)(9k + 11r^3)$

d) $(2m + 5)^2$

e) $(3x - 7y^4)^2$

•Special product

Example 5: Multiplying more complicated Binomials

Find each product.

a) $[(3p - 2) + 5q][(3p - 2) - 5q]$

b) $(x + y)^3$

c) $(2a + b)^4$

• Division

Homework 5: Dividing Polynomials

Divide $4m^3 - 8m^2 + 5m + 6$ by $2m - 1$.

• Division

Example 6: Dividing Polynomials with Missing Terms

Divide $3x^3 - 2x^2 - 150$ *by* $x^2 - 4$.