take note

Key Concept Standard Form of a Polynomial Function

The **standard form of a polynomial function** arranges the terms by degree in descending numerical order.

A polynomial function $P(x)$ in standard form is

$$P(x) = a_n x^n + a_{n-1}x^{n-1} + \cdots + a_1 x + a_0,$$

where n is a nonnegative integer and $a_n, \ldots, a_0$ are real numbers.

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

Cubic term | Quadratic term | Linear term | Constant term

You can classify a polynomial by its degree or by its number of terms. Polynomials of degrees zero through five have specific names, as shown in this table.

Degree	Name Using Degree	Polynomial Example	Number of Terms	Name Using Number of Terms
0	constant	5	1	monomial
1	linear	$x + 4$	2	binomial
2	quadratic	$4x^2$	1	monomial
3	cubic	$4x^3 - 2x^2 + x$	3	trinomial
4	quartic	$2x^4 + 5x^2$	2	binomial
5	quintic	$-x^5 + 4x^2 + 2x + 1$	4	polynomial of 4 terms

Write each polynomial in standard form. What is the classification of each polynomial by degree? by number of terms?

A $3x + 9x^2 + 5$

$9x^2 + 3x + 5$

quadratic (by degree) trinomial (by # of terms)

B $4x - 6x^2 + x^4 + 10x^2 - 12$

$x^4 + 4x^2 + 4x - 12$

quartic (by degree) polynomial of 4 terms (by # of terms)

Write each polynomial in standard form. What is the classification of each by degree? by number of terms?

a. $3x^3 - x + 5x^4$

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

quartic (by degree)

trinomial (# of terms)

b. $3 - 4x^5 + 2x^2 + 10$

$-4x^5 + 2x^2 + 13$

quintic (by degree)

trinomial (by # of terms)

Vocabulary

Monomial: 1 term **Binomial**: 2 terms **Trinomial**: 3 terms

Polynomial: A monomial or a sum of terms that are monomials.

Degree of a monomial: is the sum of the exponents of its variables.

Degree of a polynomial: is the same as that of its term with the greatest degree

Find the degree of each polynomial:

1. $3xy + 2y^3$

degree 2 degree 3

Greatest degree: **3**

2. $5x^4 - x + 9$

degree =4 degree =1 degree=0

Greatest degree: **4**

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Key Concept Standard Form of a Polynomial Function

The **standard form of a polynomial function** arranges the terms by degree in descending numerical order.

Write each in standard form, then classify by degree and number of terms.

1. $(2x^2+9x-7)-(4x^3+9x-2)$

$2x^2+9x-7-4x^3-9x+2$

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

cubic

trinomial

2. $(3x^2+1)(3x^2-1)$

$9x^4-1$

quartic

binomial

Write each polynomial in factored form.

3. x^3-x^2-12x

$x(x^2-x-12)$

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

4. x^3-2x^2-15x

$x(x^2-2x-15)$

$x(x-5)(x+3)$

Find the zeroes of each function.

5. $y=(x+2)(x-1)(x-3)$

Set $y=0$ & solve for x

$0=(x+2)(x-1)(x-3)$

$x+2=0$ or $x-1=0$ or $x-3=0$

$x=-2$ or $x=1$ or $x=3$

6. $y=x(x-3)(x+5)$

$0=x(x-3)(x+5)$

$x=0$ or $x-3=0$ or $x+5=0$

$x=0$ or $x=3$ or $x=-5$

a is a zero of multiplicity *n* means that x-a appears *n* times as a factor

Find the zeroes of each function. State the multiplicity of multiple zeroes.

7. $y=(x-3)^3(2x+5)$

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

$x-3=0$ or $2x+5=0$

$x=-5/2$

$x=3$ multiplicity of 3

$x=-5/2$ multiplicity of 1

8. $y=x^3-4x^2+4x$

$0=x^3-4x^2+4x$

$0=x(x^2-4x+4)$

$0=x(x-2)(x-2)$

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

$x=0$ multiplicity of 1 or $x-2=0$, $x=2$ multiplicity of 2