**10/10**

# Lesson 3-1a: Polynomial Functions and their Graphs

**Objective**

Students will…

- Be able to define and identify the characteristics of polynomials.
- Be able to find the x (zeros) and the y intercepts of polynomials by factoring, grouping, and using the quadratic formula.

**Polynomial Functions**

A polynomial function consists of polynomials, which take the form

$P(x) = a_n x^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + \cdots + a_1 x^1 + a_0 x^0$, where *n* is a nonnegative integer and $a_n \neq 0$.

The numbers $a_1,\ a_2, \dots,\ a_n$ are called the ______________________.

The number $a_0$ is the ____________________coefficient or constant________________.

The number $a_n$, the coefficient of the highest power, is the ____________________coefficient, and the term $a_n x^n$ is the leading term.

Example

Underline each coefficient, circle the constant term (coefficient), and box the leading term of the following polynomial function.

$$P(x) = 3x^5 + 6x^4 - 2x^3 + x^2 + 7x - 6$$

The function *P(x)* above is a polynomial of degree _____.

Here are other examples of different polynomials. Identify the degree of each polynomial.

Degree

$P(x) = 3$ $Q(x) = 4x - 7$ $R(x) = x^2 + x$ $S(x) = 2x^3 - 6x^2 - 10$

Polynomials with just a single term like *P(x)* is called a __________________.

**Finding X, Y Intercepts**

Finding the x and the y intercepts is an important step in analyzing polynomials. We will also use them for graphing in our next lesson.

To find y-intercept, we set

To find x-intercept, we set

Ex. Find the x and the y intercepts of $f(x) = 2x^2 - 1$

**X-intercepts**

As we studied back in Algebra, there's a lot more to x-intercepts. We've learned that the x-intercepts are also known as roots or zeros of the function. All in all, the following are ______________________.

1.
2.
3.
4.

With that said, when you are instructed to find real zeros of a function, you are to find the x-intercepts.

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Example

Find the zeros of the following polynomials.

1. $P(x) = (x-2)(x+3)$

2. $Q(x) = (x+2)(x-1)(x-3)$

3. $R(x) = x^3 - 2x^2 - 3x$

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

5. $Q(x) = x^3 + 3x^2 - 4x - 12$

6. $R(x) = \frac{1}{8}(2x^4 + 3x^3 - 16x - 24)^2$

7. $S(x) = x^4 - 3x^2 - 4$

8. $Q(x) = 7b^2 - 7b + 10$

9. $R(x) = 2x^2 - 4x - 11$

**Homework 10/10**
**Zeros of Polynomial WKSHT**