

# Warm-Up

**If you solved** the following from homework:

Page 1: Section 1 (write degree)

Page 1: Section 2 (fill in the blank info)

Page 2: Spiral Review

**Then:**

1. Find a classmate that also completed the work above
2. Discuss your solutions

**If you DID NOT solve** the following from homework:

Page 1: Section 1 (write degree)

Page 1: Section 2 (fill in the blank info)

Page 2: Spiral Review

**Then work alone or with a classmate in the same situation to solve the exercises listed above.**

# Polynomial Functions

## Roots

# Today's Plan

1. Short lesson
2. Practice exercises
3. Exit ticket

# Polynomial Function

A *polynomial function* is a function  $f(x)$  of the form:

$$a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0$$

Where  $n$  is a non-negative integer.

## Vocabulary

Term

Coefficient

Constant Term

# Degree

The *degree of a term* is the sum of the exponents of all variables.

The *degree of a polynomial* is the maximum degree of its terms.

$$x^2y + x^2z + xy^2$$

The degree of the polynomial is 3.

What is the leading term?

It depends!

# Roots/Zeros

A **root** of a polynomial  $p(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0$  is a real or complex number  $a$  such that  $p(a) = 0$ .

1 is a root of the polynomial

$$p(x) = x^2 - 1$$

Justification:

$$p(1) = 1^2 - 1 = 0$$

$i$  is a root of the polynomial

$$p(x) = x^2 + 1$$

Justification:

$$p(i) = i^2 + 1 = -1 + 1 = 0$$

# Fundamental Theorem of Algebra

A polynomial of degree  $n$  has exactly  $n$  complex roots.

Polynomial	Degree	Roots
$p_1(x) = 5$	0	None
$p_2(x) = x - 5$	1	5
$p_3(x) = (x - 5)(x + 5)$	2	-5, 5
$p_4(x) = (x^2 + 1)(x + 5)$	3	$-i, i, -5$
$p_5(x) = (x - 1)^2(x + 2)$	2	-1, 1

# Root Multiplicity

A root  $a$  of a polynomial  $p(x)$  has **multiplicity**  $k$  if the factor  $(x - a)$  appears  $k$  times in the factorization of  $p(x)$ .

Polynomial	Root	Multiplicity
$p_5(x) = (x - 1)^2(x + 2)$ $= (x - 1)(x - 1)(x + 2)$	1	2
	-2	1
$p_6(x) = x^4(x^2 + 1)^2$ $= xxxx(x - i)(x - i)(x + i)(x + i)$	0	4
	$i$	2
	$-i$	2



# Factoring

Find the roots of the polynomial function  $p(x) = x^3 - x^2 - 6x$ .

# Reversibility Question

Find a polynomial with roots 5, 6,  $-3$ .

# Reversibility Question

Find a polynomial with roots  $0$  (*multiplicity 2*),  $-2$ ,  $3$ .

# Charge

## In-class:

Finish the homework handed out last week (2.2 Polynomial Functions Assignment).

Complete the Exit Ticket.

## At-home:

Complete the homework assigned today on Desmos.

Delta Math assignment due on Friday, Oct 8.

Go to [student.desmos.com](https://student.desmos.com)  
and type in:

**Y5M 4M4**