

Math 115E Activity XX

Old Activity 11-5 and 11-7

Graphing Quadratic Functions

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

$$f(x) = a_nx^n + a_{n-1}x^{n-1} + \cdots + a_2x^2 + a_1x + a_0$$

where $a_n, a_{n-1}, \dots, a_2, a_1, a_0$ are real numbers and n is a non-negative integer

For the following questions, circle which functions are polynomials based on the Definition above

$$\#1 \ f(x) = x^2 + \pi$$

$$\#5 \ f(x) = \frac{1}{x^2+x}$$

$$\#9 \ f(x) = 2^x - x^2$$

$$\#2 \ f(x) = \frac{1}{5}x - x^2$$

$$\#6 \ f(x) = -\pi x^2 - ex$$

$$\#10 \ f(x) = \sin(x) - x$$

$$\#3 \ f(x) = x^e - 2$$

$$\#7 \ f(x) = e^2x - \pi$$

$$\#11 \ f(x) = x^{-1} + x^{-2}$$

$$\#4 \ f(x) = x^{1/3} - x^2$$

$$\#8 \ f(x) = x^3 - x^2 + 1$$

$$\#12 \ f(x) = 3x^\pi - x - 1$$

For each problem you did NOT circle, briefly explain why it was not a polynomial

For the following, write down new examples of functions that are not already written above

- Two functions that are polynomials

- Two functions that are NOT polynomials

Reminder: Given a function $f(x)$,

- The x -intercepts are the coordinate points of the form $(x, 0)$ on the graph $f(x)$
- The y -intercept is the coordinate points of the form $(0, f(0))$ on the graph of $f(x)$

Definition: Given a polynomial $f(x)$, the number of times a given term $(x - c)$ appears in the factored form of $f(x)$ is called the **multiplicity**

Example: If we have the polynomial: $g(x) = (x - 1)(x - 2)^4(x + 3)^3(x + 4)^2$

- Then we can say the following solutions are $x = 1, x = 2, x = -3, x = -4$
- Now, notice that: $x = 1$ has a multiplicity of 1, and $x = 2$ has a multiplicity of 4
 $x = -3$ has a multiplicity of 3, and $x = -4$ has a multiplicity of 2
- The y-intercept is at $f(0) = (0 - 1)(0 - 2)^4(0 + 3)^3(0 + 4)^2 = (-1)(-2)^4(3)^3(4)^2 = -6912$
- The x-intercepts are at $0 = f(x)$ which are $(1, 0), (2, 0), (-3, 0), (-4, 0)$

For the following problems, find the x-intercepts and their multiplicities, and the y-intercepts

$$\#1 \quad f(x) = (x - 2)^3(x - 1)$$

$$\#2 \quad f(x) = (x + 1)^2(x - 1)$$

$$\#3 \quad f(x) = (x^2 - 4)(x + 3)^3$$

$$\#4 \quad f(x) = (x - 1)^4(x^2 + 3)(x + 2)^2$$

$$\#5 \quad f(x) = x(x^2 - 2)(x - 3)^3(x + 4)^2$$

Definition:

- The highest power of x that shows up in a polynomial is called the **degree** of the polynomial
- The number in front of the x^n with the highest power is called the **leading coefficient**

	Even Degree		Odd Degree	
Sign of Leading Coeff	POSITIVE	NEGATIVE	POSITIVE	NEGATIVE
End Behavior				