Math 115E Activity 20

Chapter 7: Polynomials

Graphing Quadratic Functions

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

$$f(x) = a_n x^n + a_{n-1}x^{n-1} + \cdots + a_2 x^2 + a_1 x + a_0$$

where $a_n, a_{n-1}, \ldots, a_2, a_1, a_0$ 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 $f(x) = x^2 + \pi$

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

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

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

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

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

#7 $f(x) = \frac{1}{2}x - x^{-1/2}$

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

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

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

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

#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

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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 multiplity of 4
  $x = -3$ has a multiplicity of 3, and $x = -4$ has a multiplity of 2
- The y-intercepts 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 $f(x) = (x-2)^3(x-1)$

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

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

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

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

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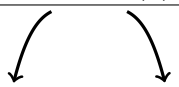
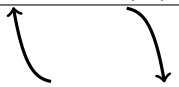
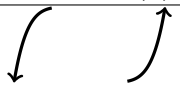
Definition:

- *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				

For each polynomial below, find the following:
(a) the degree, **(b)** the leading coeffficient, and **(c)** the rough sketch of the graph and end behavior

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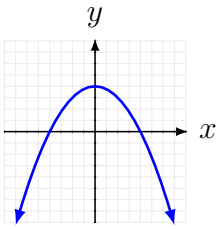
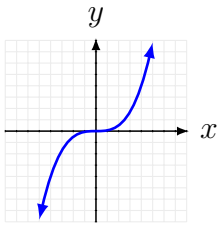
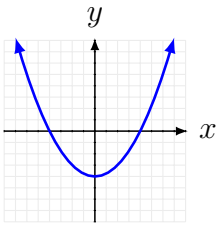
EX#1 $f(x) = -x^2+4$
Degree: 2,
Leading Coeff: -1



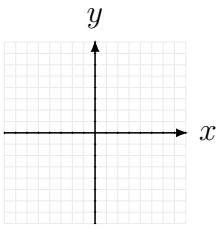
EX#2 $f(x) = 2x^3+x$
Degree: 3,
Leading Coeff: 2,



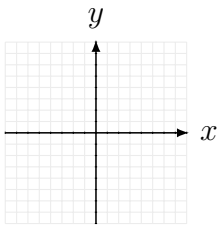
EX#3 $f(x) = 4x^6-2x-1$
Degree: 6,
Leading Coeff: 4



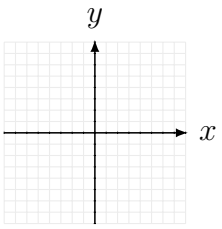
#1 $f(x) = x^3+4$



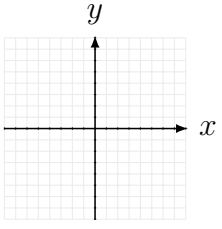
#2 $f(x) = 3x(2-x)$



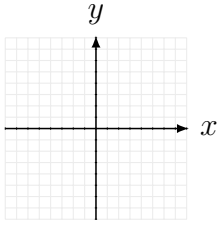
#3 $f(x) = -x^5+10x+x$



#4 $f(x) = (x-1)(x+2)$



#5 $f(x) = 2(3-x)^2$



#6 $f(x) = -x^5+10x+x$