

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

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

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

#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 $(1, 0), (2, 0), (-3, 0), (-4, 0)$