Math 115E Activity 21

Chapter 7: Polynomials
Multiplicities

Multiplicities of 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 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
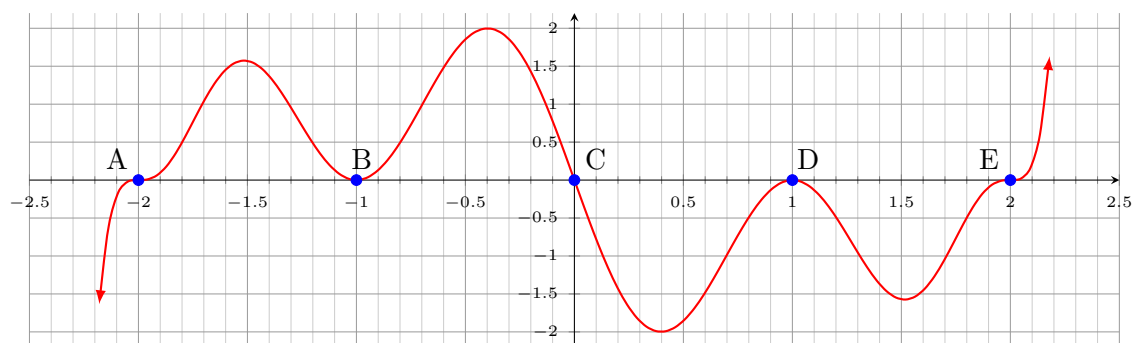
#1 $f(x) = (x - 2)^3(x - 1)$

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

Graphing Multiplicities

We have 5 intercepts for the following function as described on the above graph assume their multiplities are the smallest that they can be.

Let's find the multiplities of each intercept and their value

- Intercept A:

- Intercept B:

- Intercept C:

- Intercept D:

- Intercept E:

What do we think the smallest degree of the polynomial will be?

What is the end behavior of this function?