Warm-up

Given: $f(x) = x^3 + 5x^2 - 4x - 20$

$= (x^2-4)(x+5) = (x-2)(x+2)(x+5)$

Determine the following characteristics. Then sketch the graph.

a) degree 3

b) sign of leading coefficient pos

c) end behavior

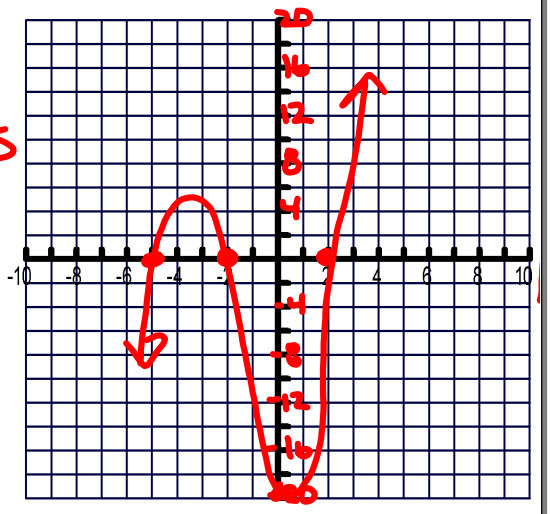
As $x \to -\infty, f(x) \to -\infty$

As $x \to \infty, f(x) \to \infty$

d) zeros and multiplicity

$x=2$ M.1 $x=-2$ M.1 $x=5$ M.1

e) y-intercept (0, -20)



Writing Equations for Polynomial Functions from a Graph

MGSE9-12.A.APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

MGSE9-12.F.IF.4 Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

MGSE9-12.F.IF.7 Graph functions expressed algebraically and show key features of the graph both by hand and by using technology.

MGSE9-12.F.IF.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

What am I learning today?

How to write the equation of a polynomial in standard form from its graph

How will I show that I learned it?

Use the intercepts of a polynomial graph to determine its equation in factored and standard form

Determine the characteristics for each graph. Then write an equation for the polynomial function that is represented by the graph.

a) Is the function even or odd? look @ end behavior

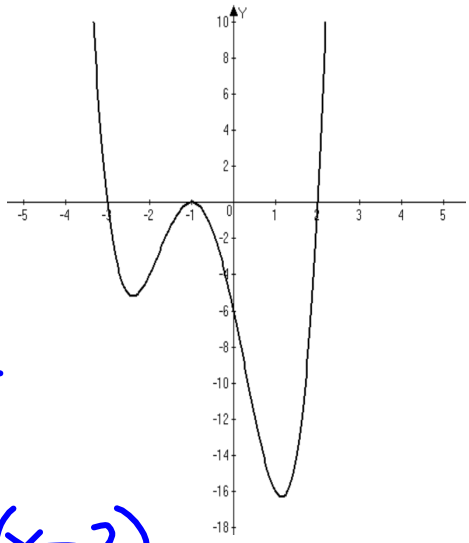
b) number of turns = n minimum degree = n+1

c) Is the leading coefficient positive or negative? look @ end behavior

d) What are the zeros? Do any have multiplicity of more than one? (Assume mult. of 1, 2, or 3)

e) What is the y-intercept? Does the LC need a multiplier? Only works if y-int is NOT (0,0)

Example 1:



a) even or odd? even

b) #turns 3 min degree 4

c) LC pos.

d) zeros and multiplicity

$x=-3$ $x=-1$ $x=2$
M.1 M.2 M.1

e) y-int $(0,-6)$

Equation: $y=a(x+3)(x+1)^2(x-2)$

$-6=a(3)(1)^2(-2)$

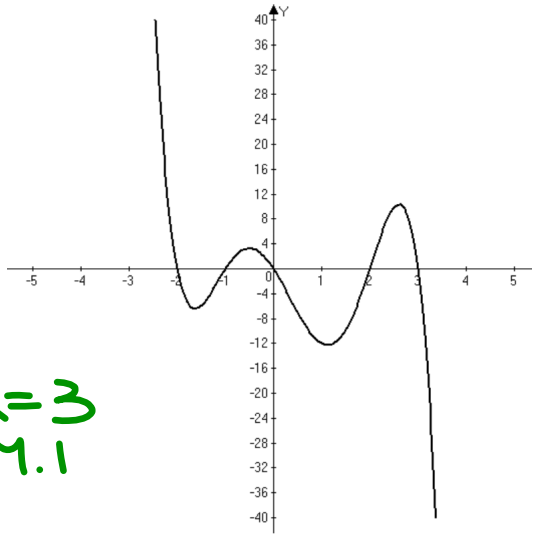
$-6=-6a \therefore a=1$

$y=(x+3)(x+1)^2(x-2)$ ← factored form

Standard Form: $=(x^2+x-6)(x^2+2x+1)$

$=x^4+3x^3-3x^2-11x-6$

Example 2:



a) even or odd? odd

b) #turns 4 min degree 5

c) LC neg

d) zeros and multiplicity

$x=-2$ $x=-1$ $x=0$ $x=2$ $x=3$
M.1 M.1 M.1 M.1 M.1

e) y-int $(0,0)$

Equation: $y=-x(x+2)(x+1)(x-2)(x-3)$

↑ factored form

Example 3:

a) even or odd? even

b) #turns 1 min degree 2

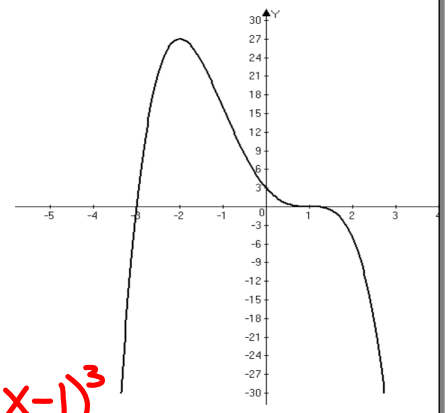
c) LC neg

d) zeros and multiplicity

x=-3 x=1

M.1 M.3

e) y-int (0,3)



Equation: $y=-a(x+3)(x-1)^3$

$3=-a(3)(-1)^3$

$3=3a \therefore a=1$

$y=-(x+3)(x-1)^3$ ← factored form

Standard Form: $(x-1)^3=\begin{vmatrix} 1 & 3 & 3 & 1 \\ x^3 & x^2 & x & 1 \\ 1 & (-1) & (-1)^2 & (-1)^3 \end{vmatrix}$

$=x^3-3x^2+3x-1$

$y=(-x-3)(x^3-3x^2+3x-1)$

$y=-x^4+6x^2-8x+3$

Example 4:

a) even or odd? odd

b) #turns 2 min degree 3

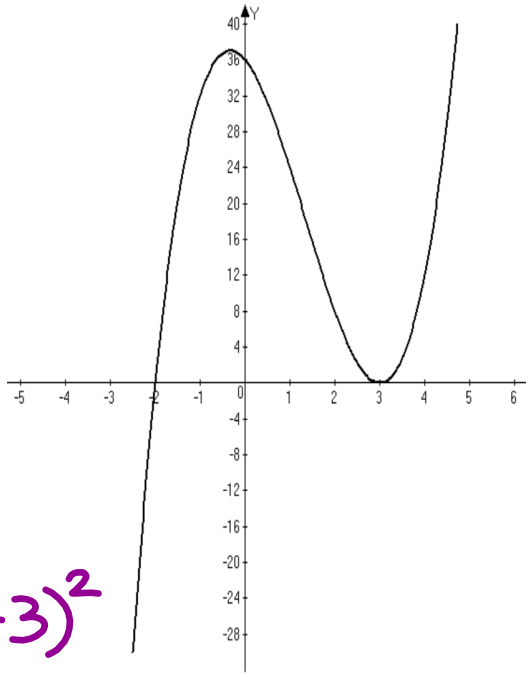
c) LC pos

d) zeros and multiplicity

x=-2 x=3

M.1 M.2

e) y-int (0, 36)



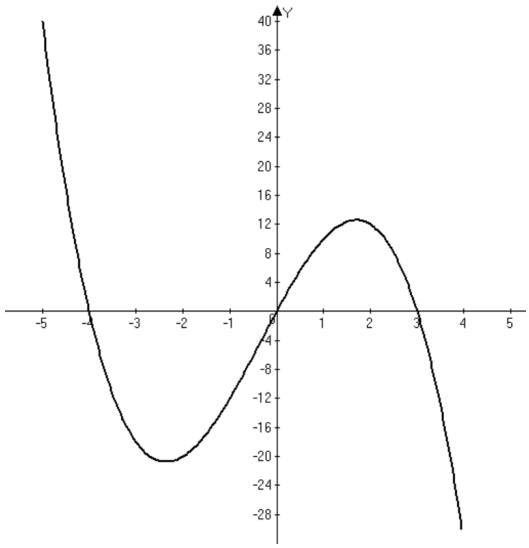
Equation: $y=a(x+2)(x-3)^2$

$36=a(2)(-3)^2$

$36=18a \therefore a=2$

$y=2(x+2)(x-3)^2$ ← factored form

Example 5:



a) even or odd? odd

b) #turns 2 min degree 3

c) LC neg

d) zeros and multiplicity

$x=-4$ M.1 $x=0$ M.1 $x=3$ M.1

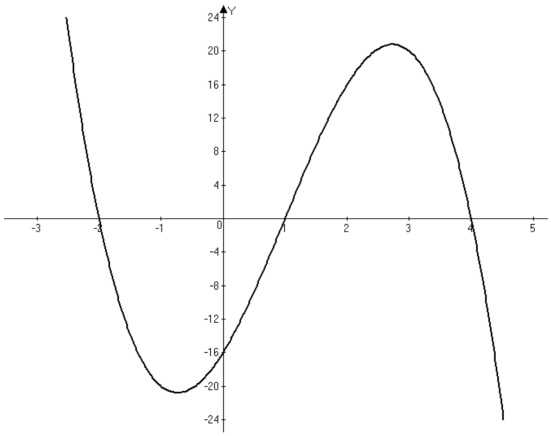
e) y-int $(0,0)$

Equation: $y=-x(x+4)(x-3)$ ← factored form

$=-x(x^2+x-12)$

Standard Form: $y=-x^3-x^2+12x$

Example 6:



a) even or odd? odd

b) #turns 2 min degree 3

c) LC neg

d) zeros and multiplicity

$x=-2$ M.1 $x=1$ M.1 $x=4$ M.1

e) y-int $(0,-16)$

Equation: $y=-a(x+2)(x-1)(x-4)$

$-16=-8a \therefore a=2$

$y=-2(x+2)(x-1)(x-4)$