

# 4.2

Date: 10/20/23 Section:

Objective: I can sketch the graph of a polynomial.

## Review

Name 3 ways to find zeros.

- ① factor
- ② quad formula
- ③  $\sqrt{\quad}$

## Steps for finding the multiplicities

1. The number of times a given factor appears in the factored form of the equation of a polynomial is called the multiplicity.

How do you determine the end behavior?

even/odd = degree  
neg/pos = equation

Example:  $y = 3(x+5)^3(x+2)^4(x-1)^2(x-5)$   
 $-5 =$  happens 3 times odd = cross  
 $-2 =$  happens 4 times even = touch  
 $1 =$  happens 2 times  
 $5 =$  happens 1 time

## Steps for finding if the graph touches or crosses

1. If the multiplicity is even, the graph touches and bounces off the x-axis.
2. If the multiplicity is odd, the graph crosses the x-axis.

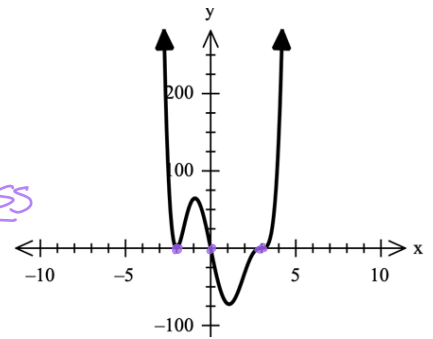
**Example:** List the zeros to the polynomial. Zeros: -2, 0, 3

What is happening at each of the zeros?

$-2 =$  touch      $3 =$  cross  
 $0 =$  cross

Can you write a possible equation for the given graph? GCF of  $x$

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



Graph each function without a calculator. Start by factoring to find the zeros. Then fill out the chart for multiplicity and determine whether each zero touches or crosses the x-axis. Find the end behavior. Finally sketch the graph (don't worry about the height of the maximums and minimums).

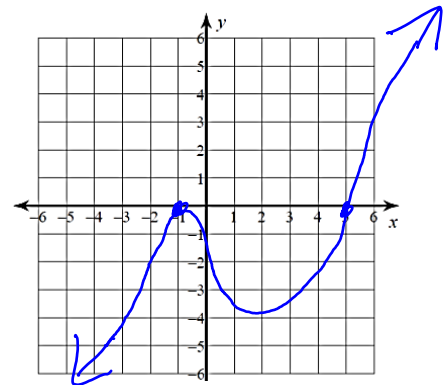
1.  $f(x) = (x+1)^4(x-5)^3$

Zero	Multiplicity	Touch/Cross
-1	4	T
5	3	C

degree: 7 odd pos

$$\lim_{x \rightarrow -\infty} f(x) = -\infty$$

$$\lim_{x \rightarrow +\infty} f(x) = \infty$$



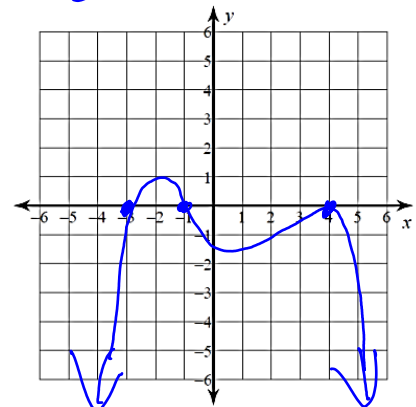
2.  $f(x) = (x-4)^2(x+1)^3(x+3)$

Zero	Multiplicity	Touch/Cross
-3	1	C
-1	3	C
4	2	T

deg: 6 even neg

$$\lim_{x \rightarrow -\infty} f(x) = -\infty$$

$$\lim_{x \rightarrow +\infty} f(x) = -\infty$$

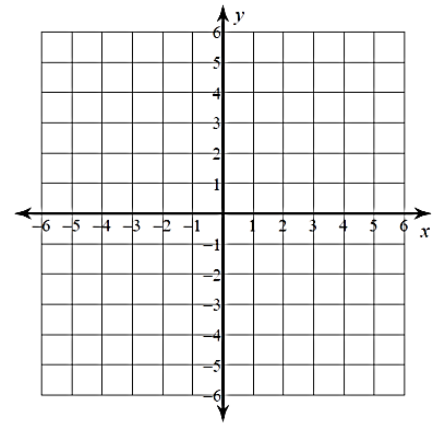


3.  $f(x) = x^2 + x - 12 = (x+4)(x-3)$

Zero	Multiplicity	Touch/Cross

$\lim_{x \rightarrow -\infty} f(x) =$

$\lim_{x \rightarrow +\infty} f(x) =$



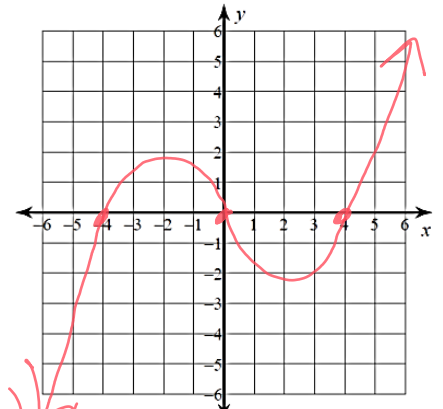
4.  $f(x) = x^3 - 16x = x(x^2 - 16) = x(x-4)(x+4)$

Zero	Multiplicity	Touch/Cross
-4	1	C
0	1	C
4	1	C

$\lim_{x \rightarrow -\infty} f(x) = -\infty$

$\lim_{x \rightarrow +\infty} f(x) = \infty$

deg: 3 odd pos



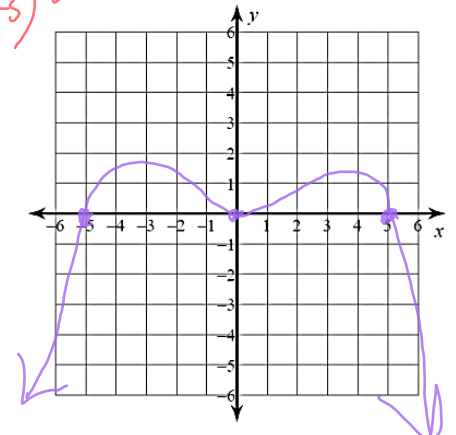
5.  $f(x) = -2x^4 + 50x^2 = -2x^2(x^2 - 25) = -2x^2(x-5)(x+5)$

Zero	Multiplicity	Touch/Cross
-5	1	C
0	2	T
5	1	C

$\lim_{x \rightarrow -\infty} f(x) = -\infty$

$\lim_{x \rightarrow +\infty} f(x) = -\infty$

degree: 4 even neg



**EXAMPLE:** Given the graph, write the equation using the lowest exponents possible.

1. Equation in factored form:

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

z	m	T/C
-4	2	T
2	1	C

$x = -4$

$(x+4)(x+4)$   
 $(x^2 + 8x + 16)(x-2)$   
 $x^3 + 8x^2 + 16x - 2x^2 - 16x - 32$

Equation in standard form:  $f(x) = x^3 + 6x^2 - 32$

