

Date:

8/31/23

Section:

1.5

Objective:

I can graph a polynomial.

**Degree of polynomial and end behaviors**

Without graphing, determine the end behavior of each polynomial. Write answers in limit notation.

Determine the number of zeros.

1.  $f(x) = 2x^5 + 7x^3 - 4x$

2.  $f(x) = -3x^6 - 8x^5 + 2x$

3.  $f(x) = -10x^3 - 3x^2 - 5$

5 zeros

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

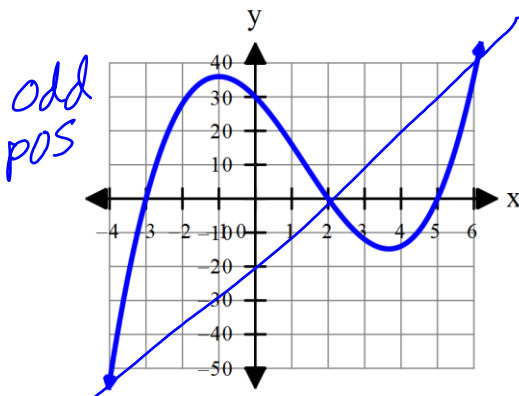
$$\lim_{x \rightarrow -\infty} f(x) = -\infty$$

**Find the zeros:**Definitions of **Zeros**: 1. Solutions (answers) when solving a polynomial for  $x$ .2. The  $x$ -intercepts (where the graph crosses the  $x$ -axis).Determine the **number of zeros** for each of the polynomials and **state the degree**.

a.)  $f(x) = x^3 - 4x^2 - 11x + 30$

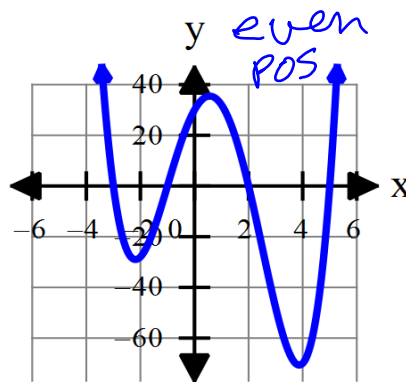
b.)  $f(x) = x^4 - 3x^3 - 15x^2 + 19x + 30$

c.)  $f(x) = x^2 - 9 = (x-3)(x+3)$



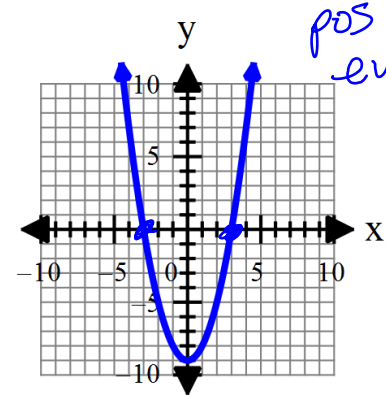
Zeros: 3

Degree: 3



Zeros: 4

Degree: 4



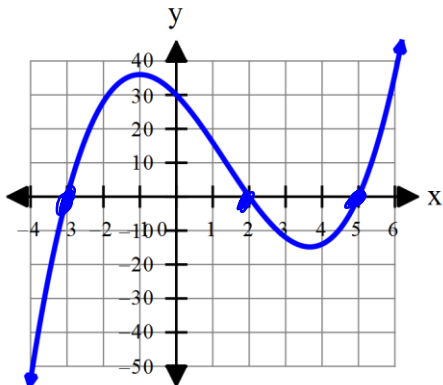
Zeros: 2

Degree: 2

What do you notice about the number of zeros and the degree of the polynomial?

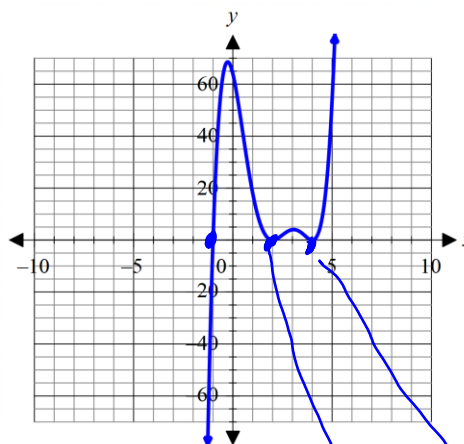
they are same

**Find the multiplicity of the zeros:**



$x = -3, 2, 5$

a.)  $f(x) = (x+3)^1(x-2)^1(x-5)^1$



$x = -1, 2, 4, 2, 4$

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

**What do you notice about the zeros and the exponent that gives you that zero?**

*if multiplicity odd crosses x-axis, if multiplicity is even it touches/bounce x-axis*

For each polynomial below:

- Identify the zeros and their multiplicity
- Determine whether the graph touches or crosses the x-axis at each zero.

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

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

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

Zero	Multiplicity	Touch/Cross
1	2	T
4	3	C

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

*factored form*

Zero	Multiplicity	Touch/Cross

11.  $f(x) = x(x-4)(x+5)^3(x-1)^2$

Zero	Multiplicity	Touch/Cross
0	1	C
4	1	C
-5	3	C
1	2	T

9.  $f(x) = 3x^2 - x - 14$

*standard form (3x-7)(x+2)*

Zero	Multiplicity	Touch/Cross
-2	1	C
7/3	1	C

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

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

Graph  $f(x) = x^4 + 3x^3 - 2x + 8$

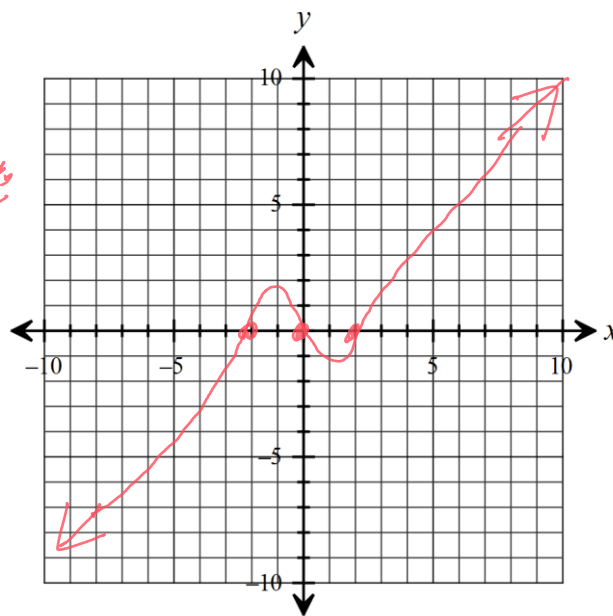
Without using technology, sketch each polynomial. (Hint: Identify the zeros, their multiplicity, determine whether they touch or cross the x-axis at each zero, and describe their end behavior)

**Example 1**

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

Zeros	Multiplicity	Touch/Cross
0	1	C
-2	1	C
2	1	C

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

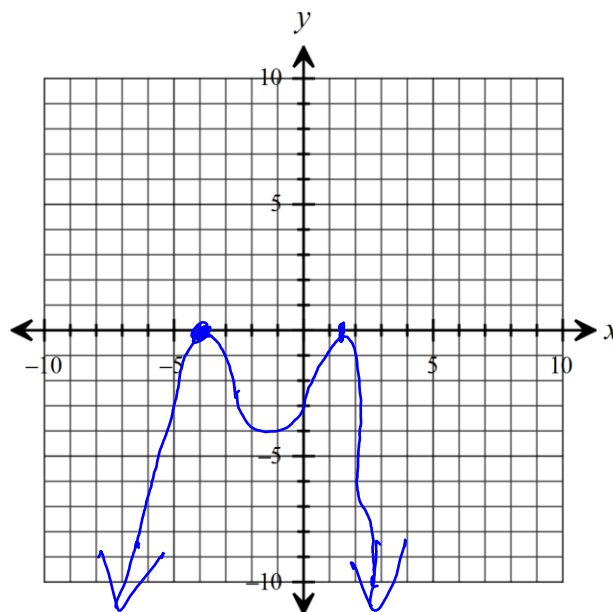


**Example 2**

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

Zeros	Multiplicity	Touch/Cross
-4	2	+
1½	2	+
	<i>degree: 4</i>	

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



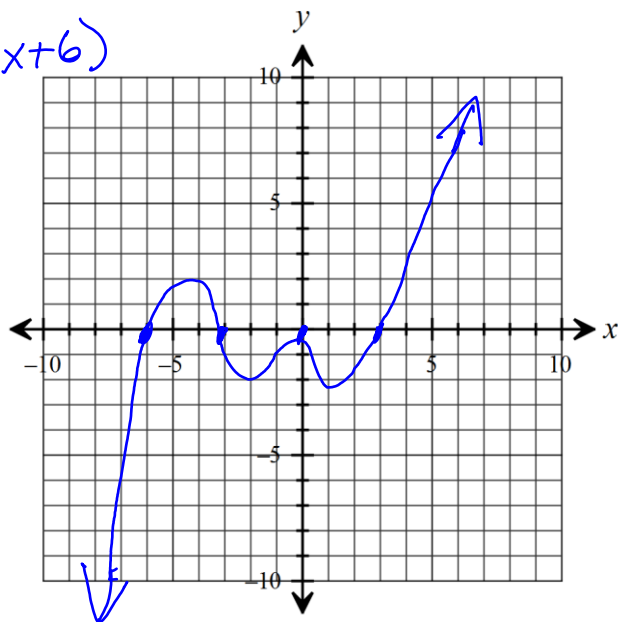
**Example 3**

$$f(x) = 4x^2(x^2 - 9)(x + 6)$$

$$4x^2(x+3)(x-3)(x+6)$$

Zeros	Multiplicity	Touch/Cross
-6	1	C
-3	1	C
0	2	T
3	1	C
	<u>degree: 5</u>	

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



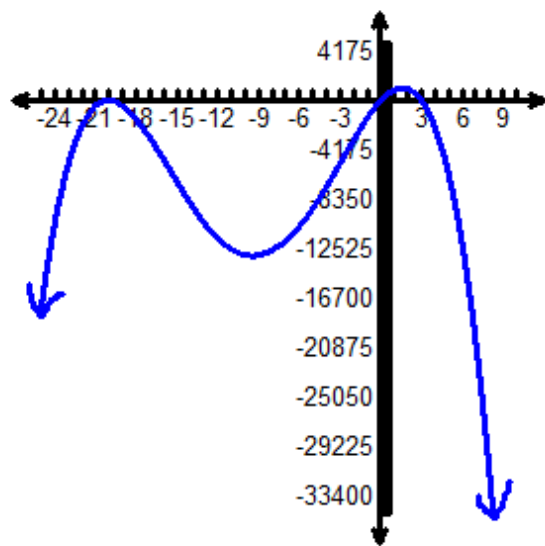
**Example 4**

Write the function for the graph in factored and standard form.

z	m	T/C
-20	2	T
0	1	C
3	1	C

even, neg

factored  $f(x) = -x(x+20)^2(x-3)$



**Example 5**

Use technology to graph the polynomial. Identify the zeros, their multiplicity (you may not be able to determine the exact number so just write odd or even), determine whether they touch or cross the x-axis at each zero and determine the end behaviors.

$$f(x) = x^3 + x^2 - 8x - 12$$

Zeros	Multiplicity	Touch/Cross
-2	2	T
3	1	C

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