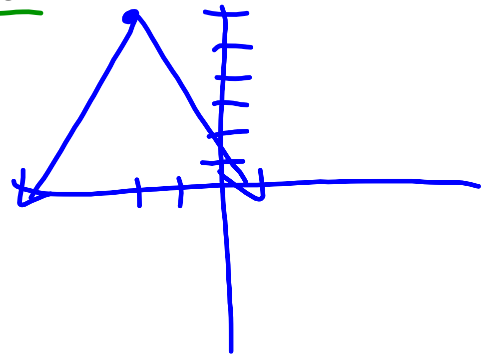
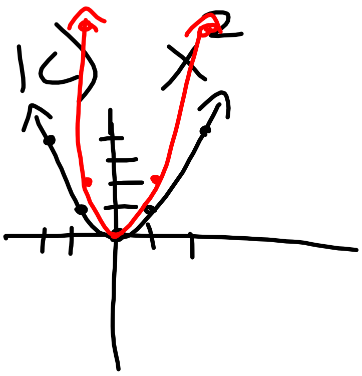
Bellwork:

List the transformations from f(x) to g(x)

$f(x)=|x|$ $\quad$ $g(x) = -|x+2|+6$

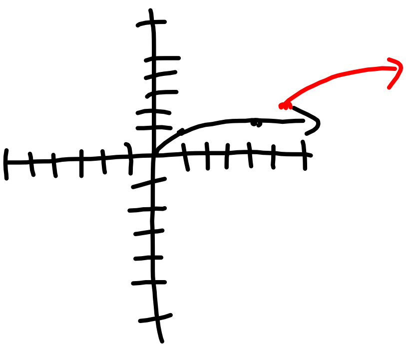
1. shift left 2
2. shift up 6
3. up-down flip





$2f(x)$

2b) $f(x)=\sqrt{x}$ $\quad$ $f(x-7)+2$



Today's Objective

I can graph polynomials using technology and by hand

Fundamental Theorem of Algebra
A polynomial function of degree $n > 0$ has n complex zeros (every real number is a complex number i.e., $3 = 3 + 0i$). Some of the zeros may be repeated.

The number of zeros is less than or equal to the degree of the polynomial

☆ zero = root = x-intercept

Example 5: Determine the number of zeros each of the following polynomials have.

a. $f(x)=3x^3+2x^2-7x+2$

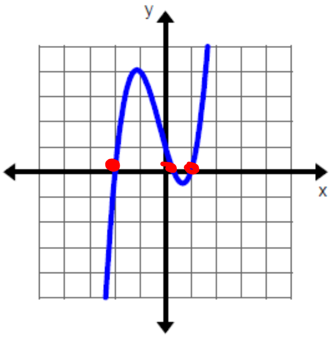
3 zeros

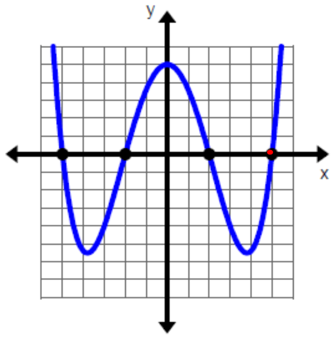
b. $g(x)=100+x^4-29x^2$

4 zeros

a. $f(x)=3x^3+2x^2-7x+2$

b. $g(x)=100+x^4-29x^2$

<table>
<tr>
<td>a. $f(x)$ is a 3rd degree polynomial function, therefore, the function will have three zeros.


You can see from the graph that the function crosses the x-axis three times.</td>
<td>b. $g(x)$ is a 4th degree polynomial function, therefore, the function will have four zeros.


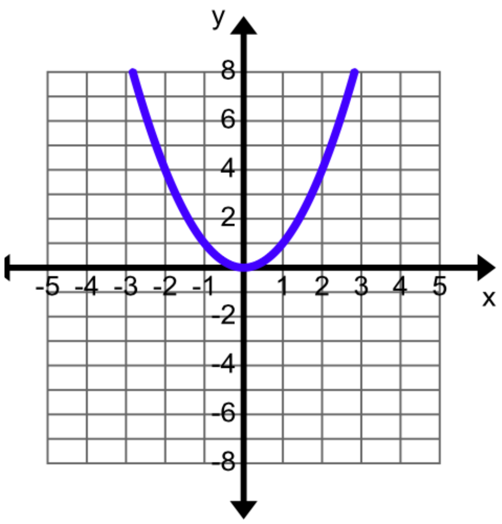
You can see from the graph that the function crosses the x-axis four times.</td>
</tr>
</table>

Finding Zeros:

"Zeros" are another name for x-intercepts. They are the x-values where y=0.

To solve for zeros, set each factor of the function equal to zero and solve for x.

$$f(x) = x^2$$



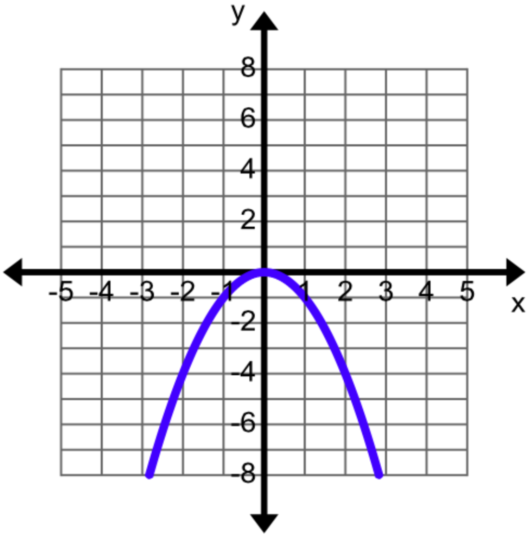
End Behavior

$$\overset{y}{f(x)} \to \infty \quad \text{as} \quad x \to \infty$$

$$\overset{y}{f(x)} \to \infty \quad \text{as} \quad x \to -\infty$$

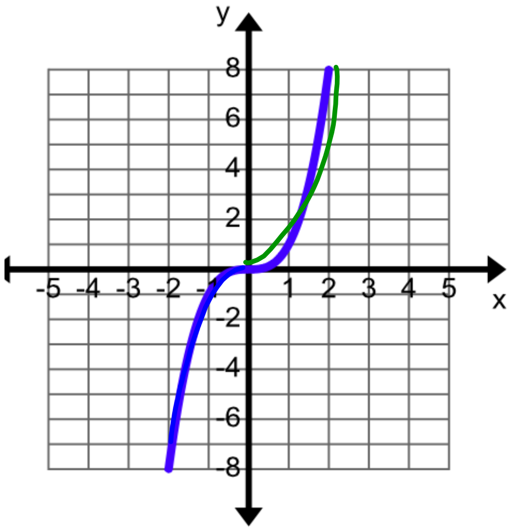
$f(x) = -x^2$

$f(x) \to -\infty$
as
$x \to -\infty$



$f(x) \to -\infty$
as
$x \to \infty$

$f(x) = x^3$

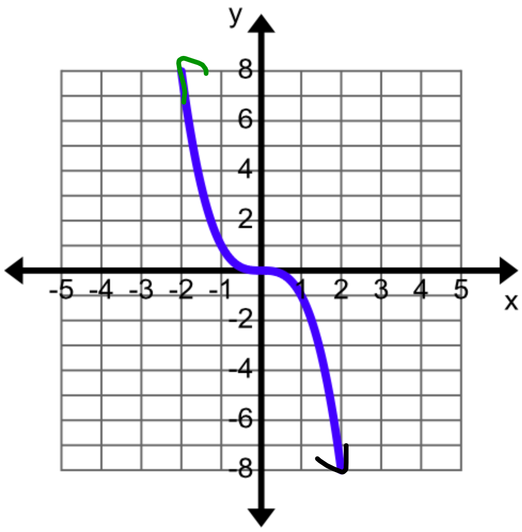


End Behavior

$f(x) \to \infty$ as $x \to \infty$

$f(x) \to -\infty$ as $x \to -\infty$

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

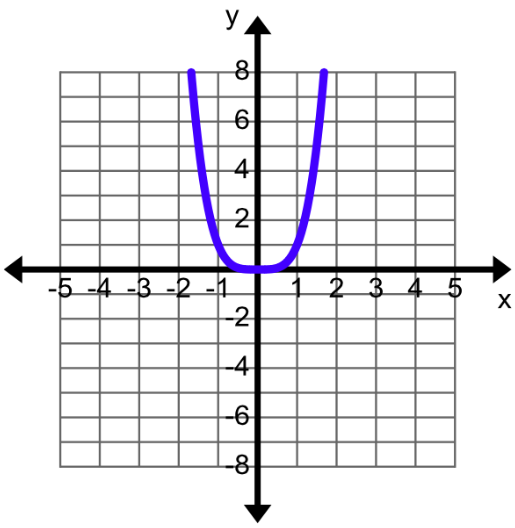


End Behavior

$f(x) \to -\infty$ as $x \to \infty$

$f(x) \to \infty$ as $x \to -\infty$

$$f(x) = x^4$$

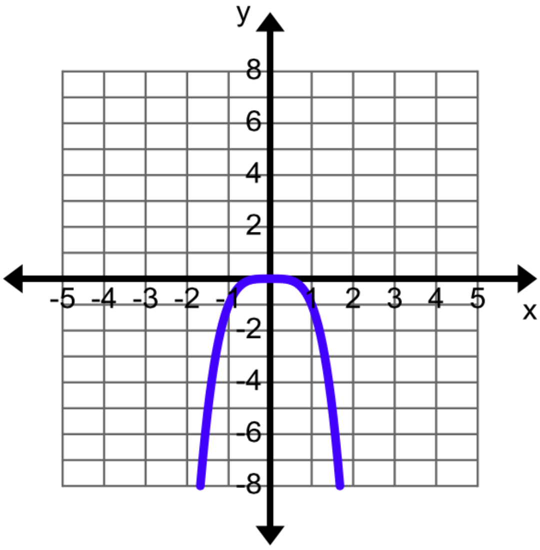


End Behavior

$f(x) \to \infty$ as $x \to \infty$

$f(x) \to \infty$ as $x \to -\infty$

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

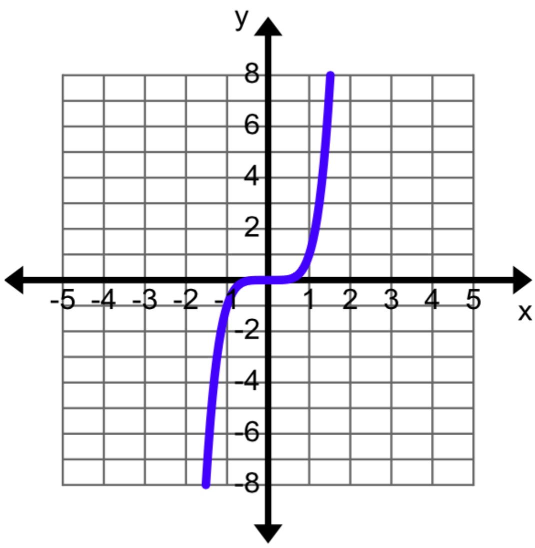


End Behavior

$f(x) \to -\infty$ as $x \to -\infty$

$f(x) \to -\infty$ as $x \to \infty$

$$f(x) = x^5$$

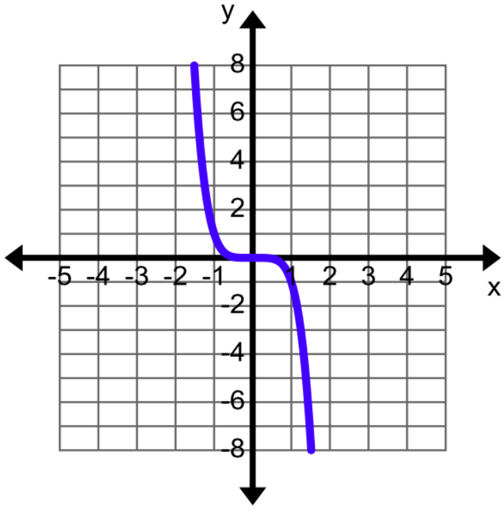


End Behavior

$f(x) \to \infty$ as $x \to \infty$

$f(x) \to -\infty$ as $x \to -\infty$

$$f(x) = -x^5$$

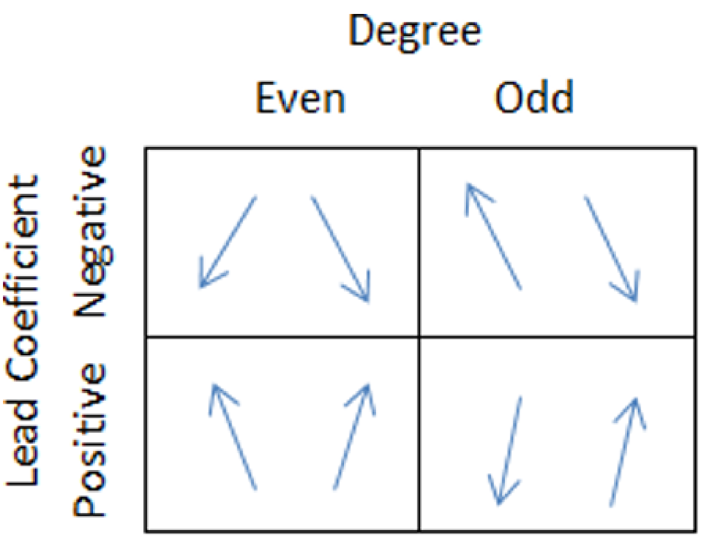


End Behavior

$f(x) \to -\infty$ as $x \to \infty$

$f(x) \to \infty$ as $x \to -\infty$

There is a pattern to end behavior:

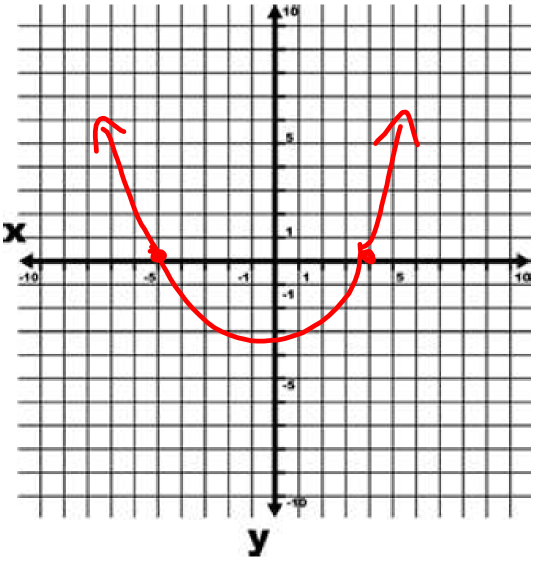


1. $f(x) = x^2 - x - 20$

$f(x) = (x - 4)(x + 5)$ $x = 4, -5$

$x - \cancel{4} = 0$
$\quad +4 \quad +4$

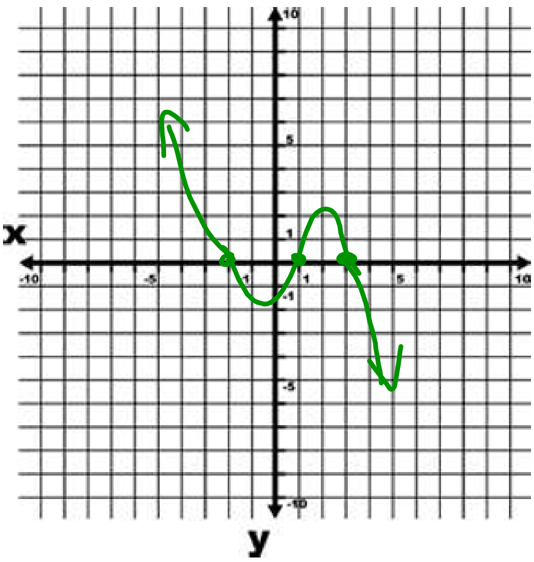
even +: $\uparrow$ $\nearrow$



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

$f(x) = -(x - 3)(x + 2)(x - 1)$ $x = 3, -2, 1$

$\uparrow$ $\downarrow$

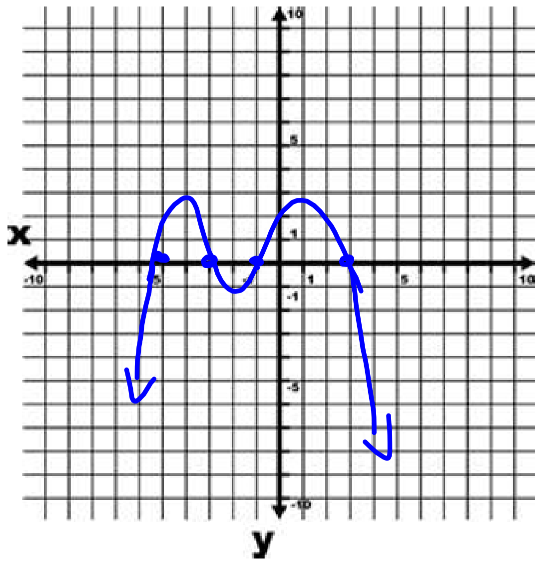


3. $f(x) = -x^4 + x^3 + 11x^2 - 9x - 18$

$f(x) = -\cancel{(x^2 - 9)}(x + 1)(x + 5)$

$(x+3)(x-3)$

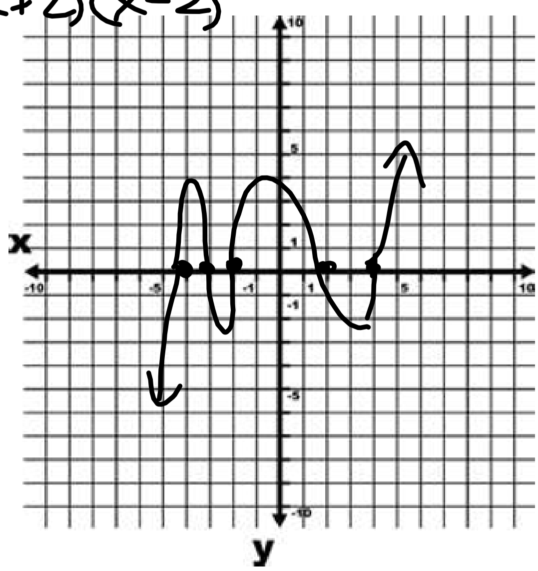
$x = 3, -3, -1, -5$



4. $f(x) = x^5 + 3x^4 - 20x^3 - 60x^2 + 64x + 192$

$f(x) = \cancel{(x^2 - 4)}(x + 3)(x - 4)(x + 4)$

$(x+2)(x-2)$



	even	odd
$-$	$x \to -\infty$, $y \to -\infty$ $x \to \infty$, $y \to -\infty$	$x \to -\infty$, $y \to \infty$ $x \to \infty$, $y \to -\infty$
$+$	$x \to -\infty$, $y \to \infty$ $x \to \infty$, $y \to \infty$	$x \to -\infty$, $y \to -\infty$ $x \to \infty$, $y \to \infty$

$(2x+3)$

$$2x+3=0 \qquad \frac{2x}{2} = \frac{-3}{2} \qquad x = -3/2,\ -1.5$$
$$-3 \quad -3$$