

2.2 Polynomial Functions

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

b) $f(x) = x^5 - 5x^4 + 5x^3 + 5x^2 - 6x - 1$

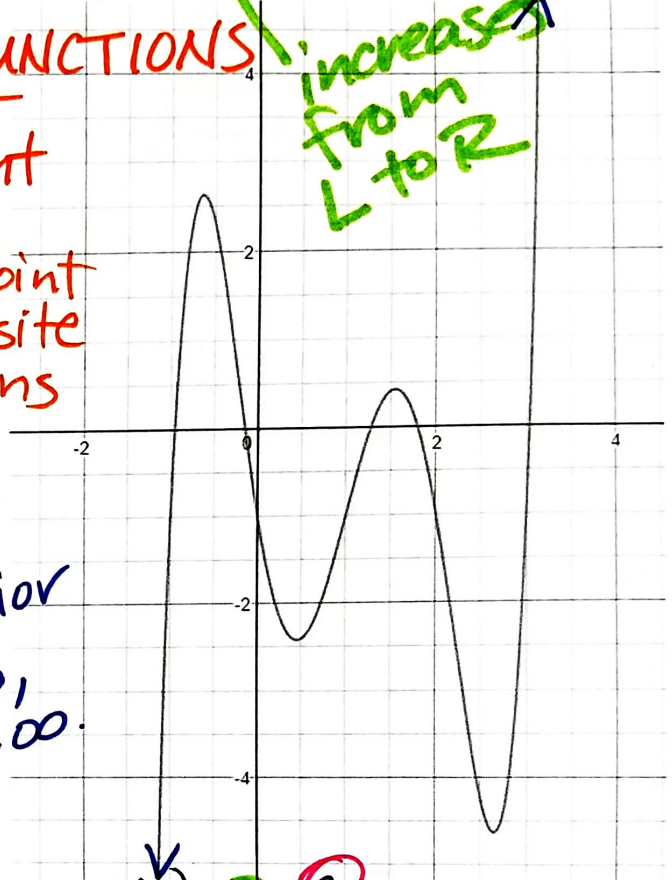
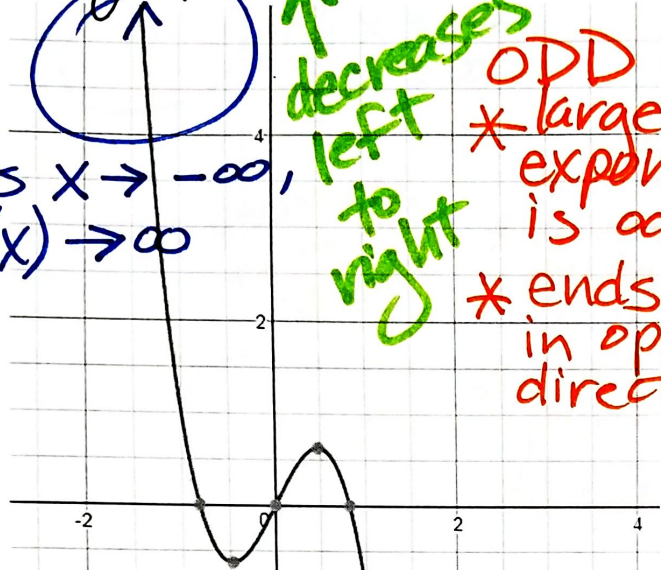
decreases
left to right

ODD FUNCTIONS

* largest exponent is odd
* ends point in opposite directions

increases
from L to R

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



End behavior
As $x \rightarrow \infty$,
 $f(x) \rightarrow -\infty$.

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

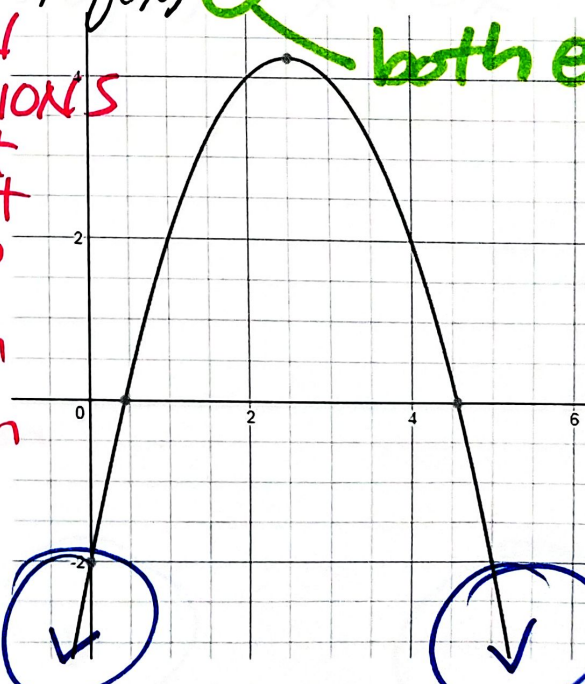
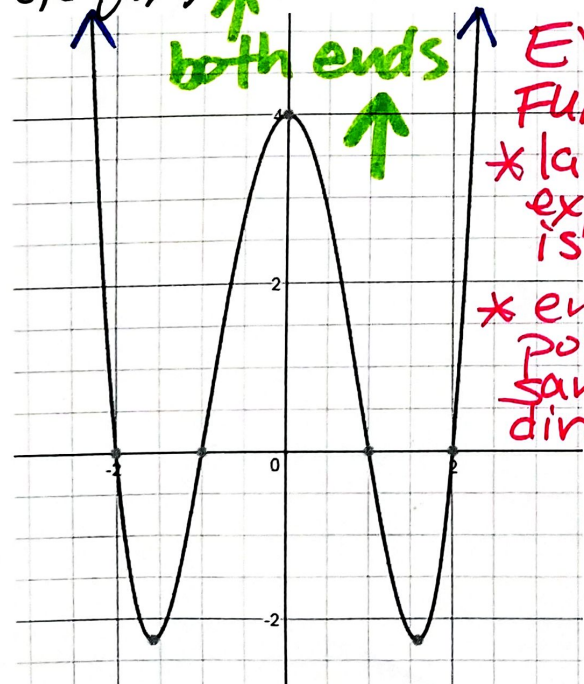
d) $f(x) = -x^2 + 5x - 2$

both ends ↑

EVEN FUNCTIONS

* largest exponent is even
* ends point in same direction

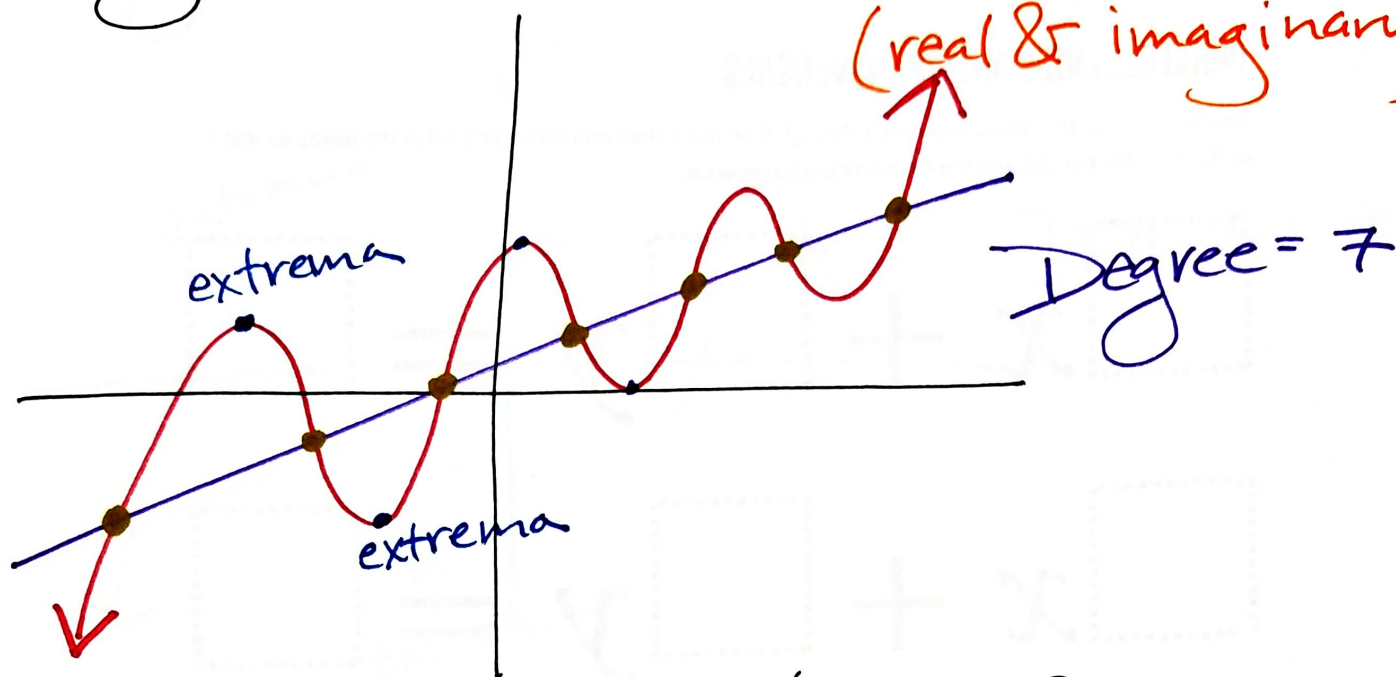
both ends ↓



As $x \rightarrow -\infty$,
 $f(x) \rightarrow -\infty$.

As $x \rightarrow \infty$,
 $f(x) \rightarrow -\infty$.

Degree of a function = # of zeros/roots/solutions
(real & imaginary)



To find solutions/zeros for polynomial functions & equations:

1) Set $f(x) = 0$, then solve for x .

2) Find places where graph crosses the x -axis. (real solutions only)

ex: Find the zeros for $f(x) = 3x^4 - 9x^2 + 6$

$$\frac{0}{3} = \frac{3x^4}{3} - \frac{9x^2}{3} + \frac{6}{3}$$

$$0 = x^4 - 3x^2 + 2$$

$$0 = (x^2 - 1)(x^2 - 2)$$

$$x^2 - 1 = 0$$

$$\sqrt{x^2} = \sqrt{1}$$

$$x = \pm 1$$

$$x^2 - 2 = 0$$

$$\sqrt{x^2} = \sqrt{2}$$

$$x = \pm \sqrt{2}$$

$$\begin{array}{r} 2 \\ -1 \quad -2 \\ -3 \\ + \end{array}$$

ex: Find all real zeros of

$$f(x) = x^3 - 12x^2 + 36x$$

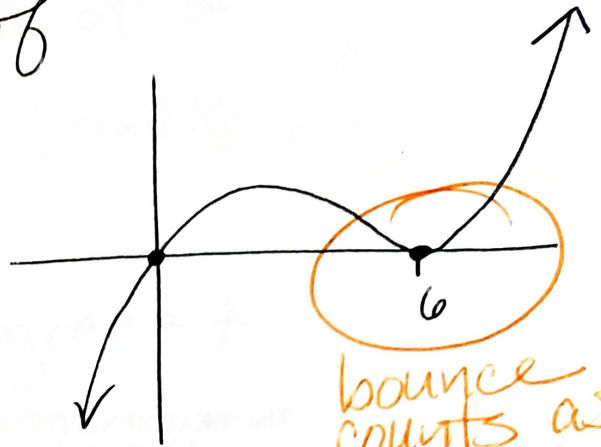
$$0 = x^3 - 12x^2 + 36x$$

$$0 = x(x^2 - 12x + 36)$$

$$0 = x(x-6)(x-6)$$

$$x=0 \quad x-6=0 \quad x-6=0$$

$$\boxed{x=0} \quad \boxed{x=6} \quad \boxed{x=6}$$



bounce counts as 2 roots

ex: $f(x) = 3x^4 - 9x^2 + 6$

$$0 = 3x^4 - 9x^2 + 6$$

$$0 = \frac{3}{3}(x^4 - 3x^2 + 2)$$

$$0 = (x^2 - 1)(x^2 - 2)$$

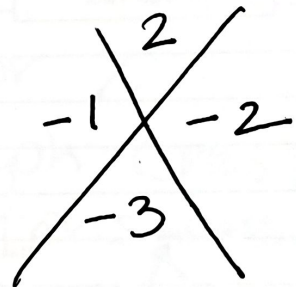
$$x^2 - 1 = 0 \quad x^2 - 2 = 0$$

$$\sqrt{x^2} = \sqrt{1}$$

$$\boxed{x = \pm 1}$$

$$\sqrt{x^2} = \sqrt{2}$$

$$\boxed{x = \pm \sqrt{2}}$$



ex: Write a possible polynomial equation w/ the following zeros: $-2, -2, \frac{3}{4}$ (function)

$$x = -2$$

$$x = -2$$

$$4(x) = \left(\frac{3}{4}\right)^4$$

$$4x = 3$$

$$(x+2) = 0$$

$$(x+2) = 0$$

$$(4x-3) = 0$$

$$(x+2)(x+2)(4x-3) = 0$$

$$(x^2 + 4x + 4)(4x-3) = 0$$

$$4x^3 + 13x^2 + 4x - 12 = 0$$

	x^2	$4x$	4
$4x$	$4x^3$	$16x^2$	$16x$
-3	$-3x^2$	$-12x$	-12

$$f(x) = 4x^3 + 13x^2 + 4x - 12$$