Review: Determine the domain:

$$f(x) = \frac{5}{x-2} \quad ; \quad g(x) = \sqrt{x+3} \quad ; \quad (f \circ g)(x) \quad ; \quad (g \circ f)(x)$$

$$(f \circ g)(x) = \frac{5}{\sqrt{x+3} - 2}$$

$x + 3 \geq 0$

$x \geq -3$

$; \sqrt{x+3} - 2 \neq 0$

$\sqrt{x+3} \neq 2$

$x + 3 \neq 4$

$x \neq 1$

$$\boxed{[-3, 1) \cup (1, \infty)}$$

$$(g \circ f)(x) = \sqrt{\frac{5}{x-2} + 3}$$

$$\frac{5}{x-2} + 3 \geq 0$$

$$\frac{5 + 3(x-2)}{x-2} \geq 0$$

$$\boxed{\left\{ x \,\middle|\, \frac{3x-1}{x-2} \geq 0 \right\}}$$

zeros of a function v. x-intercepts of a function

x is a zero of a function *f* if *f(x)=0*
That is, zeros of a function are all of the input values that have 0 as their output.

(x,0) is an x-intercept of a function *f* if the graph of *f* intersects the x-axis at the point *(x,0)* .

Since the x-coordinates of the x-intercepts are exactly those input values that map to 0, we can get our x-intercepts from our list of zeros.
Note, however, that *only real zeros contribute to x-intercepts*.

Multiplicity of a zero

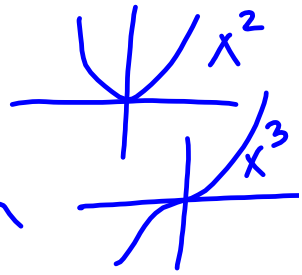
$$f(x) = (x-2)^4(x-3)(x+6)^3(x+2)^2$$

degree : $x^4 \cdot x \cdot x^3 \cdot x^2 = x^{10}$

zeros :	2	3	-6	-2
multiplicity :	4	1	3	2

even multiplicity : bounces

odd multiplicity : crosses through

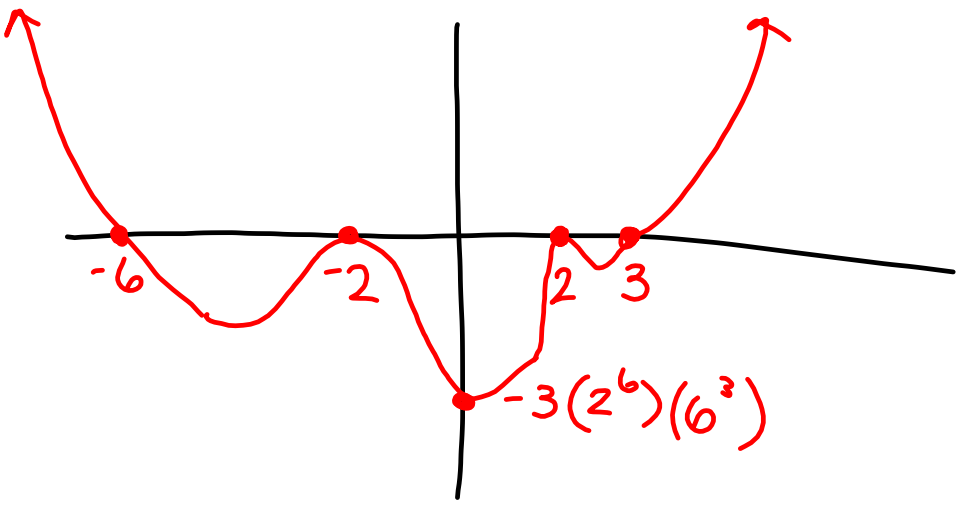


$$f(x) = (x-2)^4(x-3)(x+6)^3(x+2)^2$$

lead term : x^{10} $\Rightarrow$ end behavior

zeros :	2	3	-6	-2
multiplicity :	4	1	3	2

constant term :
$(-2)^4(-3)(6^3)(2^2) < 0$



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

lead term: $(-3x^2)(x^3)(x^2) = -3x^7$

constant term: 0
(y-int)

zeros/mult:

0	1	-2
(2)	(3)	(2)
even	odd	even

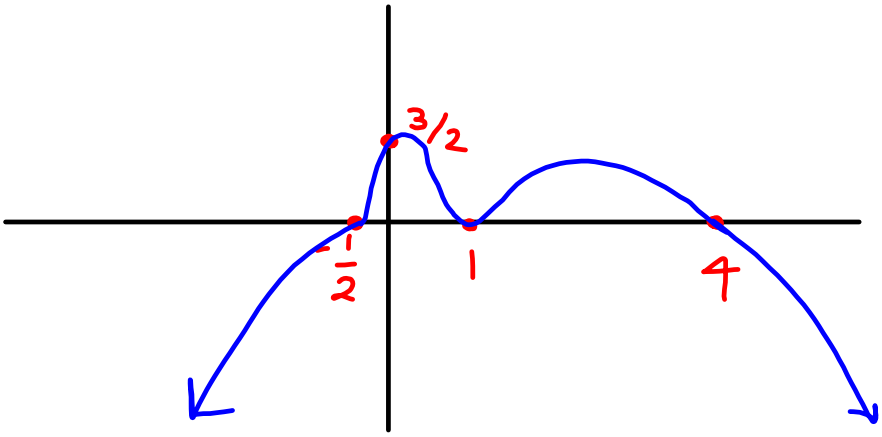
$f(x) = -3(x-4)(x+\frac{1}{2})^3(x-1)^2$

lead term: $-3(x)(x^3)(x^2) = -3x^6$

constant term: $-3(-4)(\frac{1}{2})^3(-1)^2 = 12 \cdot \frac{1}{8} \cdot 1 = \frac{3}{2}$

zeros/mult:

4	$-\frac{1}{2}$	1
(1)	(3)	(2)



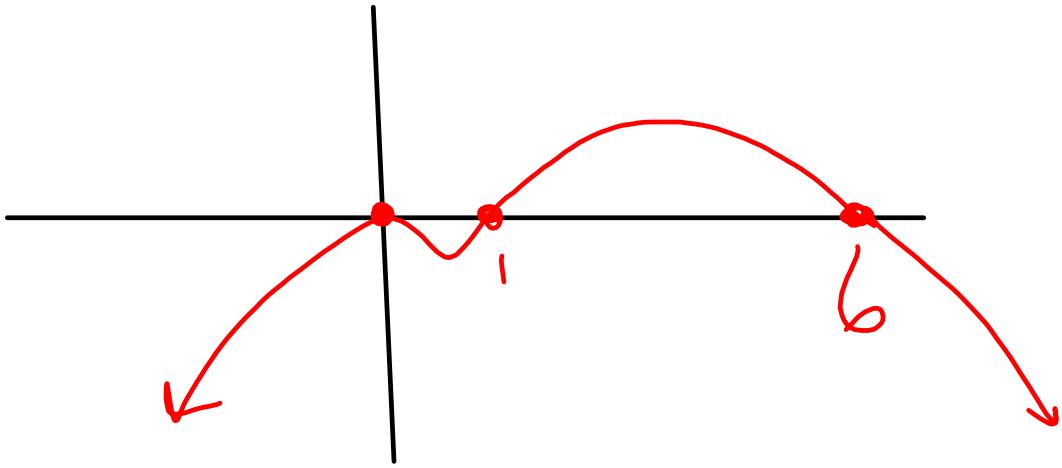
$y = -x^4 + 7x^3 - 6x^2 = -x^2(x^2 - 7x + 6)$

$= -x^2(x-6)(x-1)$

lead term: $-x^4$

const. term: 0

zeros/mult: 0 (2), 6 (1), 1 (1)



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

3.3 Zeros of Polynomials & Polynomial Division

$f(x) = (x-a)(x-b)(x-c)$

$\Rightarrow$ zeros are $a, b, \& c$.

$12 \div 3 = 4 \Rightarrow 12 = 3 \cdot 4$

Long Division

3.3 #6

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

$d(x) = x - 3$

$\frac{P(x)}{d(x)} = P(x) \div d(x)$

$$
\begin{array}{r}
2x^2 + 3x + 10 \\
x-3 \overline{\big) 2x^3 - 3x^2 + x - 1} \\
-(2x^3 - 6x^2) \\
\hline
3x^2 + x - 1 \\
-(3x^2 - 9x) \\
\hline
10x - 1 \\
-(10x - 30) \\
\hline
29
\end{array}
$$

quotient

remainder

$2x^3 - 3x^2 + x - 1 = (x-3)(2x^2 + 3x + 10) + 29$

$5 = 2 \cdot 2 + 1$

$\frac{2x^3 - 3x^2 + x - 1}{x-3} = 2x^2 + 3x + 10 + \frac{29}{x-3}$

$\frac{5}{2} = 2 + \frac{1}{2}$

8. $P(x) = x^3 - 9x^2 + 15x + 25$

$d(x) = x - 5$

$$
\begin{array}{r|l}
 & x^2 - 4x - 5 \\
\hline
x-5 & x^3 - 9x^2 + 15x + 25 \\
 & -(x^3 - 5x^2) \\
\hline
 & -4x^2 + 15x + 25 \\
 & -(-4x^2 + 20x) \\
\hline
 & -5x + 25 \\
 & -(-5x + 25) \\
\hline
 & 0
\end{array}
$$

$P(x) = (x-5)(x^2 - 4x - 5) = (x-5)(x-5)(x+1)$

<u>HW #5</u> (due **Fri, 09/05**)

- <u>2.4</u>: #3-13 odd — Find vertex, etc. and graph
  #29-37 odd — Find vertex, etc.
  #41-49 odd — Applications of quadratics
- <u>3.1</u>: #8-14 all — Describing simple characteristics of polynomials
  #23-31 all — Determining zeros & multiplicities from factored polynomials
- <u>3.2</u>: #16,17,21,22,24,25,27,28 — Graph polynomials that are already factored
- <u>3.1</u>: #32-38all — Finding zeros & multiplicities of expanded polynomials
- <u>3.2</u>: #18-20all,23,26,29-32all — Graphing expanded polynomials
- <u>3.3</u>: #7,9,13,19,21,23, 35 — Long & synthetic polynomial division

<u>HW #6</u> (due Fri, 09/12)

- <u>3.4</u>: #7-16all — Given the zeros of a polynomial, find the polynomial
  #25-32all; 43-47odd — Given some zeros of a polynomial, find the other zeros
  #51-54all — List all possible rational zeros
  #55-69odd — Find all the zeros and write f(x) in factored form
  #79,89,93 — Descartes' rule of signs
  #95-98all — Graph the polynomial
- 3.5