3.1: #8-14 all	Describing simple characteristics of polynomials
#23-31 all	Determining zeros & multiplicities from factored polynomials
3.2: #16,17,21,22,24,25,27,28	Graph polynomials that are already factored
3.1: #32-38	Finding zeros & multiplicities of expanded polynomials
3.2: #18-20,23,26,29-32	Graphing expanded polynomials
3.3: #7,9,13,19,21,23, 35	Long & synthetic polynomial division
3.4: #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: #7-25odd	**Determining asymptotes of rational functions**
#27-67odd	**Graphing rational functions**
3.6 #15-39odd	**Solving polynomial inequalities**
#47, 53-61odd	**Solving rational inequalities**
3.7: #23-37 odd	**Variation**

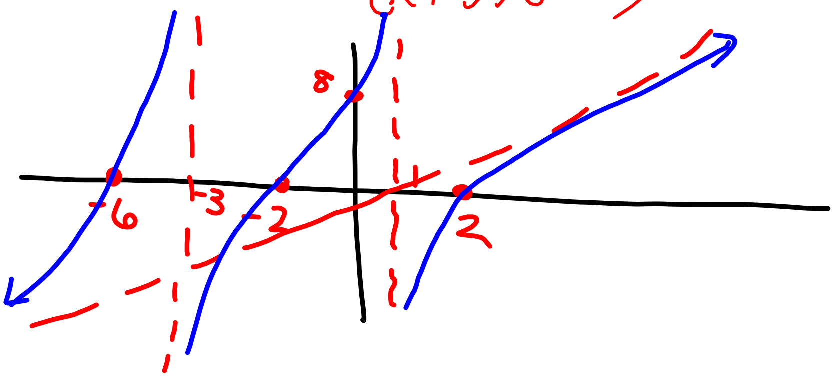
no x-intercepts ✓
y-int: (0,-8) ✓
V.A.: x=-2, x=1 ✓
H.A. y=3 ✓

$$y = \frac{3x^2 + \boxed{16}}{(x+2)(x-1)}$$

$$\frac{\boxed{}}{2(-1)} = -8$$

$$f(x)=\frac{x^3+6x^2-4x-24}{x^2+2x-3}=\frac{x^2(x+6)-4(x+6)}{(x+3)(x-1)}$$

$$=\frac{(x+6)(x-2)(x+2)}{(x+3)(x-1)}$$



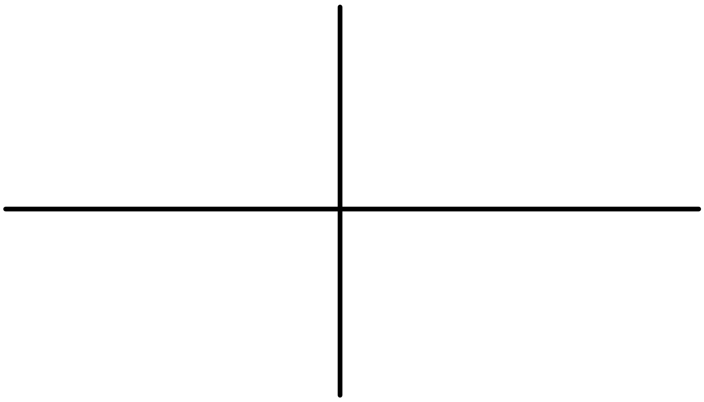
$$f(x)=\frac{(x-4)(x+3)}{x-2}$$

zero(s):

y-intercept:

vertical asymptote(s):

end behavior:



<u>Limits</u>:

as x -->	f(x) -->

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

zero(s):

y-intercept:

vertical asymptote(s):

end behavior:

Limits:

as x -->	f(x) -->

3.6 Polynomial and Rational Inequalities

union $\cup$

intersection $\cap$

Great OR $>$ $\geq$

less than AND $<$ $\leq$

Solving basic inequalities review:

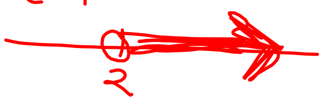
Linear:

$2x+1>5$

$2x>4$

$x>2$

$\{x \mid x>2\}$



2

$(2, \infty)$

Absolute value:

$|2x+1|>5$

$2x+1>5$ or $2x+1<-5$

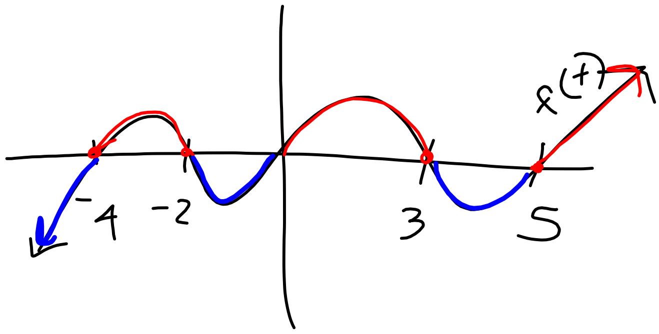
$2x>4$ $\quad$ $2x<-6$

$x>2$ $\quad$ $x<-3$

-3 $\quad$ 2

$(-\infty, -3) \cup (2, \infty)$

$\{x \mid x<-3 \text{ or } x>2\}$



$f(x) \geq 0$ Where is f(x) positive or zero?

$[-4,-2] \cup [0,3] \cup [5,\infty)$

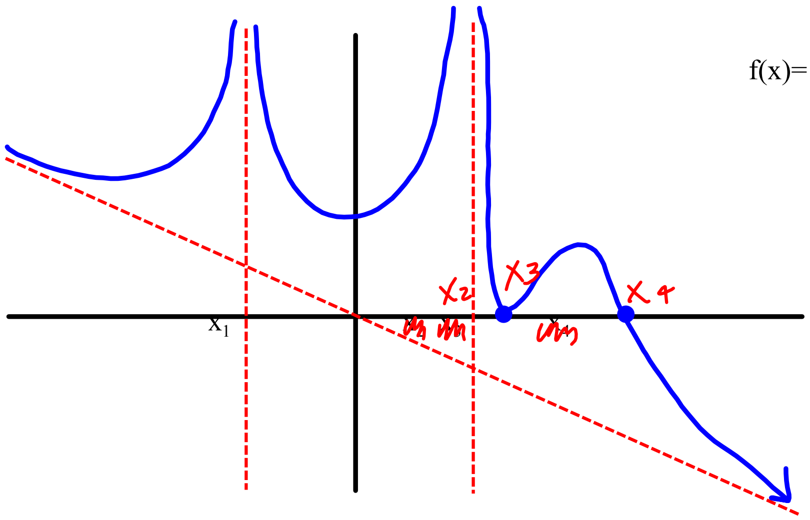
$f(x) < 0$ Where is f(x) negative?

$(-\infty,-4) \cup (-2,0) \cup (3,5)$

$$\frac{5x^3+7x^2+3x-1}{2x+4} \geq \frac{3x^2+7}{2x^3-5x}$$

This inequality is hard to solve algebraically!
It's much easier to compare it to zero
and ask "where is it positive or negative?"

The *only* x-values at which the value of f(x) *can* change from positive to negative (or negative to positive) are at x-intercepts and vertical asymptotes (but it doesn't necessarily have to change at either).

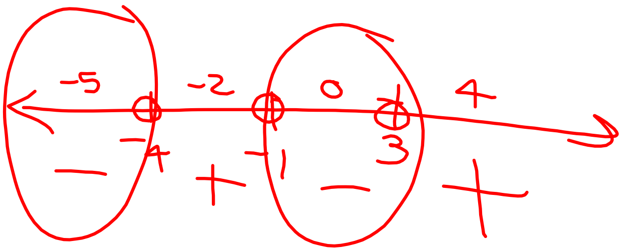


$$f(x)= \frac{-(x-x_3)^2(x-x_4)}{(x-x_1)(x-x_2)}$$

$$\frac{x^3}{x^2} = x$$

$$(x+4)(x-3)(x+1) < 0$$

zeros: $-4, 3, -1$



$$\boxed{(-\infty,-4)\cup(-1,3)}$$

$$x^2+6x \geq 7$$

1. rearrange to compare to zero

$$x^2+6x-7 \geq 0$$

2. factor to find zeros (and/or vertical asymptotes)

$$(x+7)(x-1) \geq 0$$

3. split real number line into intervals according to values found in step 2; test a value in each interval to determine if the expression being compared to zero is positive or negative in that interval

$-8 \quad 0 \quad 2$

$+ \quad -7 \quad - \quad 1 \quad +$

$$\boxed{(-\infty,-7] \cup [1,\infty)}$$

$$\frac{(x+5)(x+1)(x-2)}{(x-3)(x+4)} \geq 0$$

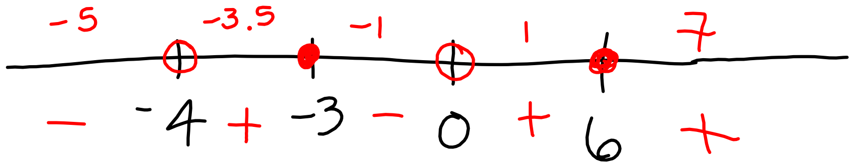
$-6 \quad -4.5 \quad -2 \quad 0 \quad 2.5 \quad 4$

$- \quad -5 \quad + \quad -4 \quad - \quad -1 \quad + \quad 2 \quad - \quad 3 \quad +$

$$\boxed{[-5,-4) \cup [-1,2] \cup (3,\infty)}$$

$$\frac{(x-6)^2(x+3)}{x(x+4)} \le 0$$

$\boxed{(-\infty,-4)\cup[-3,0)}$



3.6

56. $\dfrac{3}{x^2-4} \le \dfrac{5}{x^2+7x+10}$

$\frac{4}{4}\cdot\frac{1}{6}-\frac{1}{8}\cdot\frac{3}{3}$

$\frac{1}{2\cdot3}-\frac{1}{2\cdot4}$

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

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

$$\frac{3x+15-5x+10}{(x-2)(x+2)(x+5)}\le 0$$

$$\frac{-2x+25}{(\ \ )(\ \ )(\ \ )}\le 0$$

$$\frac{-2\left(x-\frac{25}{2}\right)}{(x-2)(x+2)(x+5)}\le 0$$

$(-\infty,-5)\cup(-2,2)\cup[12.5,\infty)$