Ann: Final day of test

w9F1

9.1 rational

(P)review:

1) $f(x) = x^2 - 3$ write an approximation of the perpendicular line through $f(2)$.

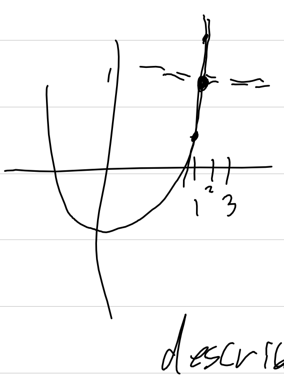
Ans: $AROC(f, 2-1, 2+1) = \frac{(3)^2-3-[(1)^2-3]}{3-1}$

$= \frac{6-(-2)}{2} = 4$

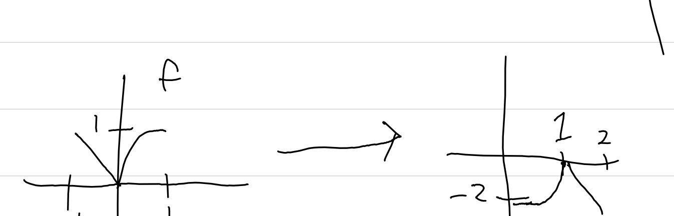
$m_\perp = \frac{-1}{4}$

$f(2) = 4-3=1$

$y-1 = -\frac{1}{4}(x-2)$



2)



describe transform

$-f(-(x-1))$

Check: $-f(-(1-1)) = f(0)$ ✓

↻ y-axis : $-f$

↻ x-axis : $f(-x)$

→ 1 : $f(x-1)$

3) $f(x) = (x-2)^2+4$; $x \in (-\infty, 2]$

$g(x) = -\sqrt{x-4} + 2$

find $f \circ g$, $g \circ f$ dom range

4) describe $f(x) = -2(x-7)^2(\frac{x}{3}-1)(2-x)$

LT:

LC:

EB:

roots w/ mult:

y-int:

sketch:

5) plot $f(x) = \frac{(2x-2)^2(x-1)(x-7)}{(x-1)(x+3)^2}$

$f(x) = \frac{4(x-1)^2(x-7)}{(x+3)^2}$; $x \neq 1$

holes: 1

roots: 1m2, 7m1

poles: -3m2

EB: $\sim \frac{4x^3}{x^2} \sim 4x$

$$x^2+6x \,\overline{\big)\,4x^3-36x^2}^{\;4x}$$

num: $4x^3 + 4x^2(-2-7) +$ lower

Content: Rational functions

Build up! Solve $0 = az - b$

$\frac{b}{a} = z$

so, $0 = (x+1)(x-3)z - (x+3)$

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

Def: A rational function is a fraction $\frac{p(x)}{q(x)}$ where both p and q $(q \neq 0)$ are polynomials. The set of all rational functions with coefficients in R and indeterminant x is $R(x)$.

Def: For $f(x) = \frac{p(x)}{q(x)}$, holes/removable singularities are where $p(x) = q(x) = 0$

roots/x-ints/... are where $p(x) = 0$ and $q(x) \neq 0$

restricted values are where $p(x) = 0$

Vert. asymptotes/poles are where $q(x) = 0$ and $p(x) \neq 0$

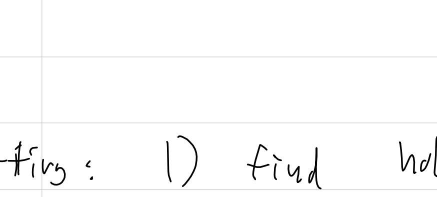
The end behavior (EB) $f(x)$ is $\lim_{|x| \to \infty} f(x)$, ie how $f(x)$ behaves as $|x|$ grows.

$EB(f) \approx \frac{LT(p)}{LT(q)} = \frac{LC(p)}{LC(q)} x^{\deg(p) - \deg(q)}$

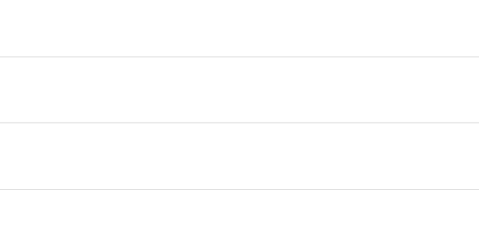
if $\deg(p) - \deg(q) = 1$, need slant.

Plotting:
1) find holes
2) "simplify"
3) find roots and poles w/ multiplicities
4) find y-int (or other point if root)
5) determine end behavior
6) plot
   - 6.1) plot (3), (4), (5)
   - 6.2) use (4) or (5) to start and connect to dots

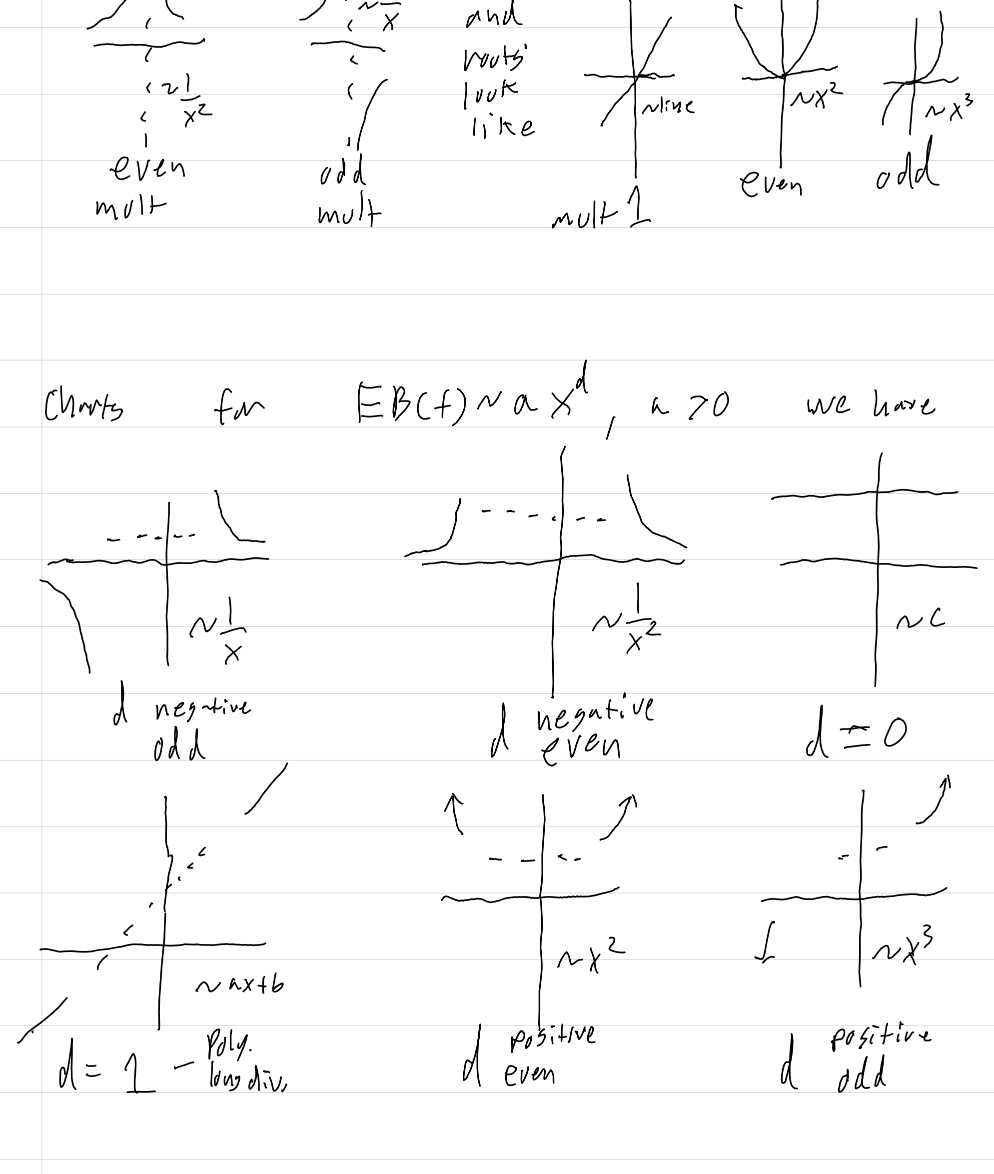
Locally: up to linear transformations, locally, poles look like



and roots look like



EB charts for $EB(f) \sim ax^d$, $a > 0$ we have



if a negative, flip corresponding chart over y-axis.

NOW: BB notes 9.1