Quiz today only cover 3.3.

Exam 2 will cover 2.5 – 3.3. (will update web page)

Monday 3/28

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3.3 41) 2.5 21)

25)

18)

18) $f(x) = x^5 - 5x^4 + 93$

1. DOMAIN
2. ASYMPTOTES
3. INCREASING/DECREASING (USE $f'$)
4. CONCAVITY (USE $f''$)

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$f'(x) = 5x^4 - 20x^3$

$5x^4 - 20x^3 = 0$

$5x^3(x-4) = 0$

$x=0 \quad x=4$

incr decr incr

$+ + + \ 0 \ - - - - - - \ 0 \ + + +$

$f'$: $-1 \quad 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5$

$f'(-1) = (-5)(-5) > 0$

$f'(1) = (5)(-3) < 0$

$f'(5) = (5 \cdot 5^3)(1) > 0$

Critical points: $(0, 93) \quad (4, -163)$

$f(4) = 1024 - 1280 + 93 = -163$

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

1. f not defined at $x=0$.
2. vertical asymptote at $x=0$. $\lim_{x\to\infty}\left(x-\frac{1}{x}\right)=\infty$ no horiz. asymp.
3. $f'(x) = 1 + \frac{1}{x^2}$ $\quad \frac{d}{dx}\left(x-\frac{1}{x}\right) = \frac{d}{dx}\left(x - x^{-1}\right) = 1-(-x^{-2}) = 1+x^{-2}$

$x=0$ : f' undefined

$1+\frac{1}{x^2}=0 \longrightarrow \frac{1}{x^2}=-1 \rightarrow x^2=-1$

no solution.

incr $\qquad$ incr.

$f'$: + + + + • + + + +

$-1 \quad 0 \quad 1$

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

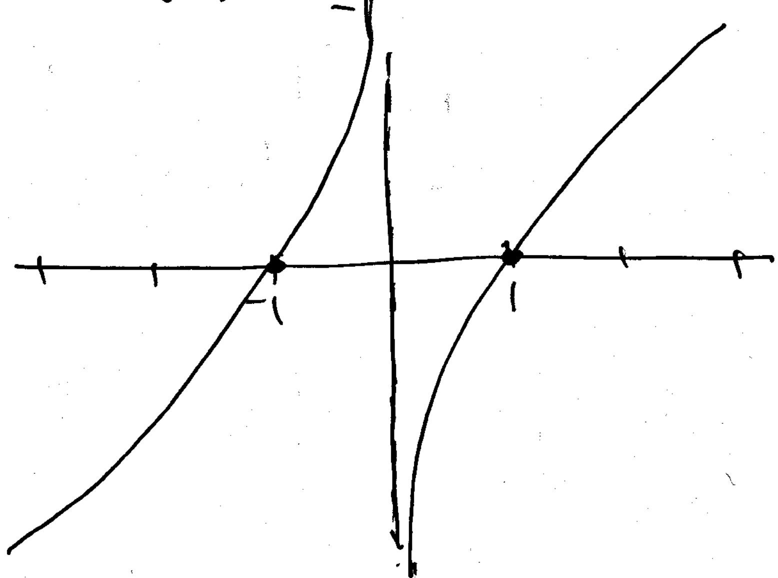
$x=0$ : f'' undef.

conc up $\qquad$ conc down

$f''$: + + + + • − − − − − −

$-1 \quad 0 \quad 1$

$f''(-1) = \frac{-2}{-1} > 0 \qquad f''(1) = \frac{-2}{1} < 0$




x-intercepts

$\frac{x^2-1}{x}=0$

$x^2-1=0$

$x=1, x=-1$

3.3 41)

(a) $f'(x) = \dfrac{x+3}{(x-2)^2}$ $\qquad \dfrac{x+3}{(x-2)^2} = 0 \quad x = -3$

$f'$ undef. $\quad x = 2$

$- - - - 0 + + + + + \bullet + + +$

$f'$: $-4 \quad -3 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad 3$

$f'(-4) = \dfrac{-1}{(-6)^2} < 0 \qquad f'(0) = \dfrac{3}{(+)} > 0 \qquad f'(3) = \dfrac{6}{(+)} > 0$

$f$ decreasing on $(-\infty, -3)$

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

(b) Relative minimum at $x = -3$

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

$= \dfrac{\cancel{(x-2)}[(x-2) - (2x+6)]}{(x-2)^{\cancel{4}3}}$

$= \dfrac{-x-8}{(x-2)^3} = -\dfrac{(x+8)}{(x-2)^3}$

$\dfrac{x+8}{(x-2)^3} = 0 \qquad \underline{x = -8} \qquad f''$ undefined at $\underline{x = 2}$

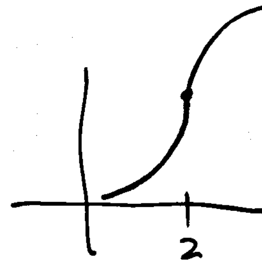
$- - - 0 + + + + + + \bullet - - -$

$f''$: conc down $\quad -8 \quad$ conc up $\quad 0 \quad 2 \quad$ conc down

$f''(-9) = -\left(\dfrac{-1}{(-11)^3}\right) < 0 \qquad f''(0) = -\dfrac{8}{(-2)^3} > 0$

$f''(3) = -\left(\dfrac{11}{(1)^3}\right) < 0$

(d) Inflection point at $x=-8$




Might have inflection point at $x=2$

Can say: concavity changes at $x=2$