Questions? §3.9 #29

$$f''(x) = 20x^3 - 12x^2 + 6x$$

$$f'(x) = \frac{20}{4}x^4 - \frac{12}{3}x^3 + \frac{6}{2}x^2 + C = 5x^4 - 4x^3 + 3x^2 + C$$

$$f(x) = \frac{5}{5}x^5 - \frac{4}{4}x^4 + \frac{3}{3}x^3 + Cx + D$$

$$= x^5 - x^4 + x^3 + Cx + D$$

Find $f(x)$, if $\boxed{f'(1) = 3 \text{ and } f(1) = 7.}$

Initial conditions.

$$f'(x) = 5x^4 - 4x^3 + 3x^2 + C$$

$$f'(1) = 5 - 4 + 3 + C = 3$$

$$\Longrightarrow 4 + C = 3$$

$$\Longrightarrow \boxed{C = -1}$$

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

$$f(1) = 7 = 1 - 1 + 1 - 1 + D = 7$$

$$\boxed{D = 7}$$

$$\boxed{f(x) = x^5 - x^4 + x^3 - x + 7}$$

$$\int \sec^2 x \, dx$$

$$\int \cos x \, dx = \sin x + C$$

working derivatives backwards.

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C$$

§3.5 oblique Asymptote question:

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

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

$$\frac{17x^2}{x^2} = 17$$

$$\begin{array}{r} 3x+17 \\ x^2-5x+2 \overline{)\,3x^3+2x^2-7x+1} \\ -(3x^3-15x^2+6x) \\ \hline 17x^2-13x+1 \end{array}$$

is far enough to get O.A.

$$\boxed{y = 3x+17}$$

Find eq'n of H.A., V.A., O.A. are all legit questions over 3.5 in-class.

§3.1 EVT & Max/Min on closed Interval

EVT → Extreme Value Theorem.

Local extremes via f' ($\&$ f'' (2nd derivative test))

$+ \mid -$ f'

MAX

$- \mid +$ f'

MIN

Nice for confirmation

$\frown$ MAX $\quad$ $\smile$ MIN.

§3.2 MVT – mean value theorem.

Find $c \in (a,b) \ni f'(c) = \dfrac{f(b)-f(a)}{b-a} = m_{AVG}$

① Find $m_{AVG} = \dfrac{f(b)-f(a)}{b-a}$

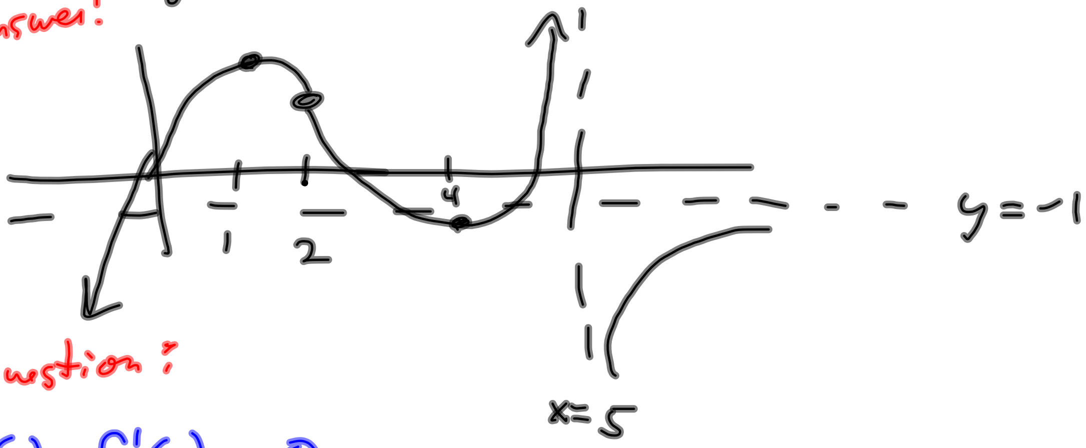
② Find $f'(x)$.

③ Solve $f'(x) = m_{AVG}$

Oct 21-12:25 PM

§3.3 Let's build a question from a graph, & the question is "Sketch the graph."

The answer:



The question:

$f'(1) = f'(4) = 0$

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

$f''(2) = 0$

$f''(4) = 5$ (OR $f''(4) > 0$)

$f''(x) < 0$ for $x < 2$ OR $x > 5$

$f''(x) > 0$ for $2 < x < 5$

$\lim_{x \to 5^-} f(x) = \infty$, $\lim_{x \to 5^+} f(x) = -\infty$

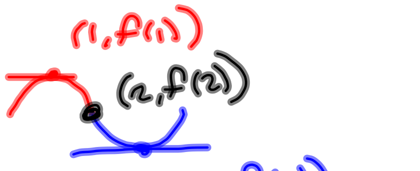
$\lim_{x \to -\infty} f(x) = -\infty$, $\lim_{x \to \infty} f(x) = -1$

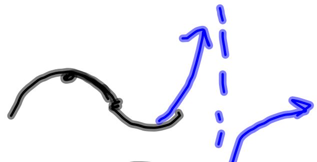
$f'(1) = f'(4) = 0$

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

$f''(2) = 0 \rightarrow$ I.P.

$\boxed{f''(4) = 5}$ (OR $f''(4) > 0$)



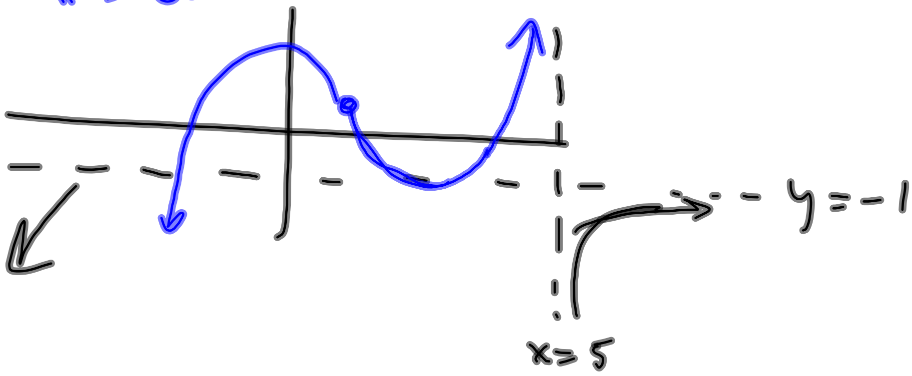


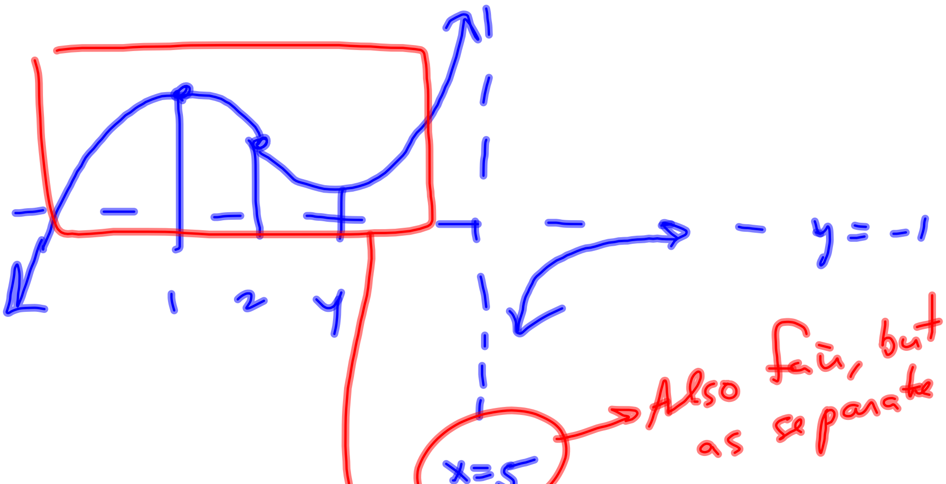
$f''(x) < 0$ for $x < 2$ OR $x > 5$

$f''(x) > 0$ for $2 < x < 5$

$\lim_{x \to 5^-} f(x) = \infty$, $\lim_{x \to 5^+} f(x) = -\infty$

$\lim_{x \to -\infty} f(x) = -\infty$, $\lim_{x \to \infty} f(x) = -1$





Also fair, but as separate question.

Fair for in-class

$x = 5$

$f''(1) = -3$ $\left(\text{OR } f''(1) < 0\right)$

$f''(2) = 0$

$f''(4) = 5$ $\left(\text{OR } f''(4) > 0\right)$

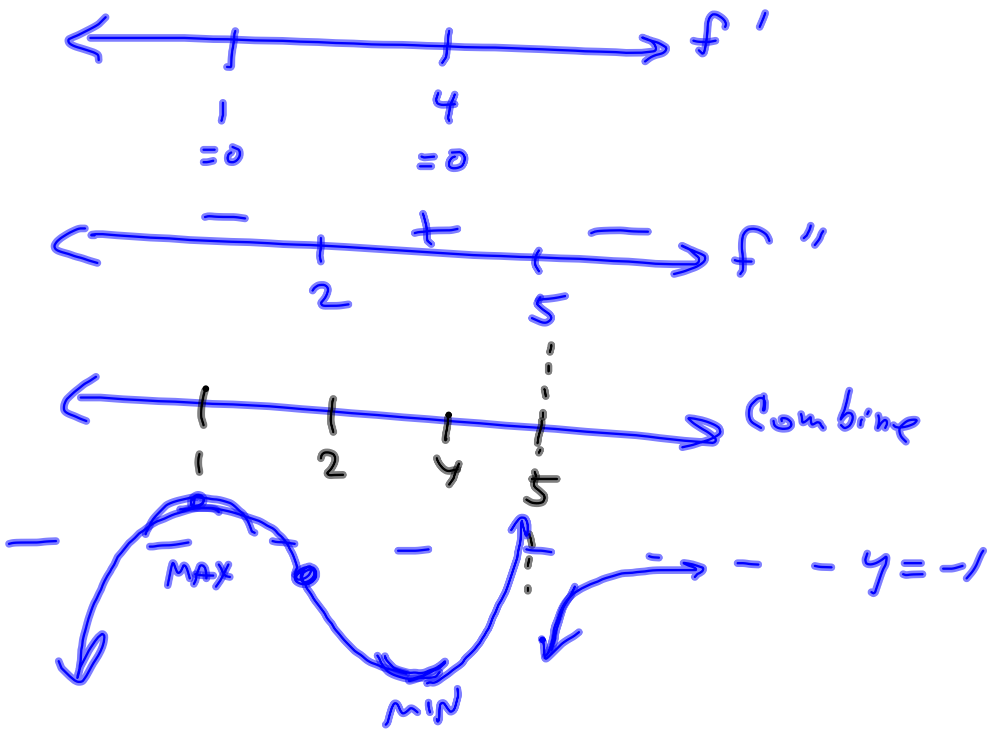
$f''(x) < 0$ for $x < 2$ OR $x > 5$

$f''(x) > 0$ for $2 < x < 5$

$\lim_{x \to 5^-} f(x) = \infty$, $\lim_{x \to 5^+} f(x) = -\infty$

$\lim_{x \to -\infty} f(x) = -\infty$, $\lim_{x \to \infty} f(x) = -1$

$f'(1) = f'(4) = 0$



§3.3 #s 20-25 for what I'm talking about.

§3.4 HA.

$$\lim_{x\to\infty} \sqrt{x^2+x+1} - x$$

$$\boxed{\lim_{x\to-\infty} \sqrt{x^2+x+1} + x}$$

$\sqrt{x^2} = |x| = -x$ when $x<0$.

§3.5 Mostly take-home.

§3.7 Setups are HUGE.
Final answers not so much.

§3.8 1st 2 iterations after I give seed.

<u>Derive</u> Newton's. Draw pic, etc.
Concave up helps

$y = f'(x_1)(x_2 - x_1) + f(x_1)$

Set $y=0$, solve for x_2 = $x_2 = x_1 - \dfrac{f(x_1)}{f'(x_1)}$

Your work Getting to here.