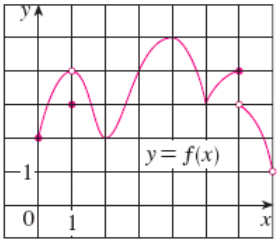
Q1

Wednesday, October 7, 2020 7:12 PM

Use the graph to state the absolute and local maximum and minimum values of the function. (Assume each point lies on the gridlines. Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)



absolute maximum value 5

absolute minimum value DNE

local maximum value(s) 4,5

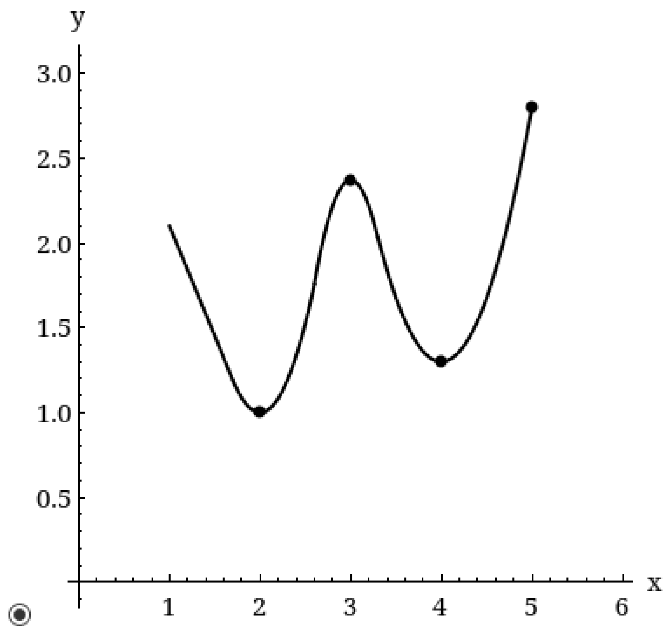
local minimum value(s) 2,3

Q2

Wednesday, October 7, 2020 7:18 PM

Sketch the graph of a function f that is continuous on [1, 5] and has the given properties.

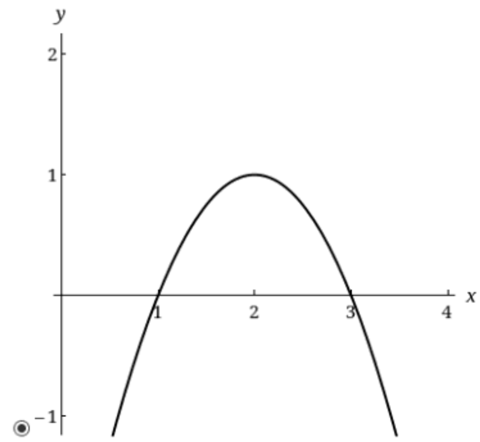
Absolute maximum at 5, absolute minimum at 2, local maximum at 3, local minima at 2 and 4



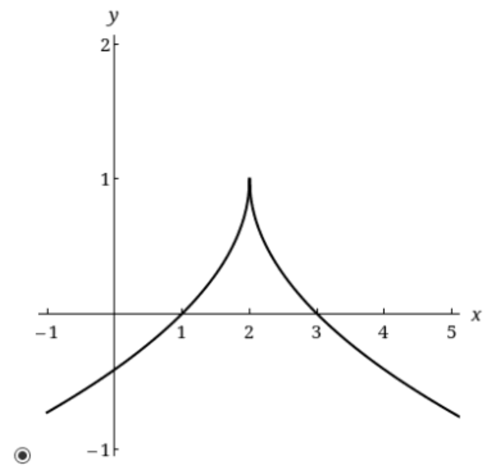
Q3

Wednesday, October 7, 2020 7:20 PM

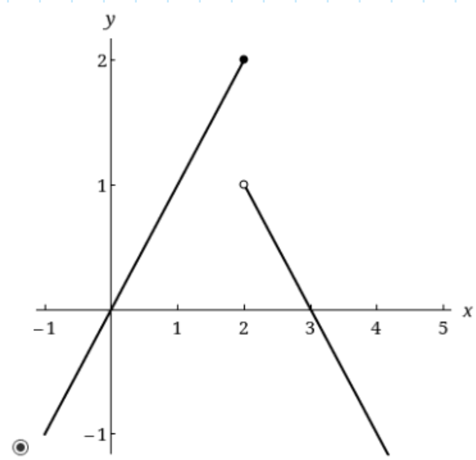
(a) Sketch the graph of a function that has a local maximum at 2 and is differentiable at 2.



(b) Sketch the graph of a function that has a local maximum at 2 and is continuous but not differentiable at 2.



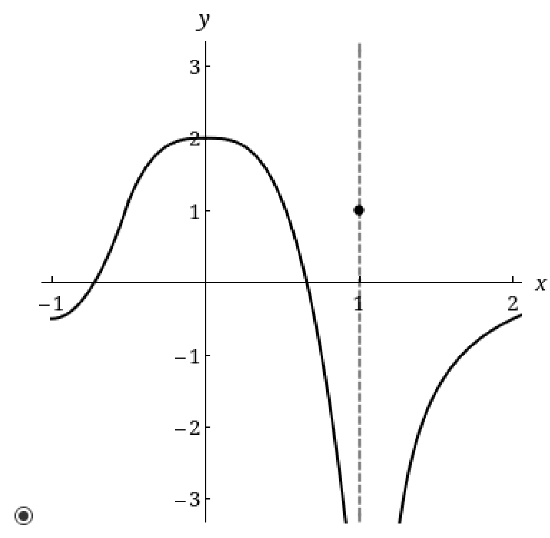
(c) Sketch the graph of a function that has a local maximum at 2 and is not continuous at 2.



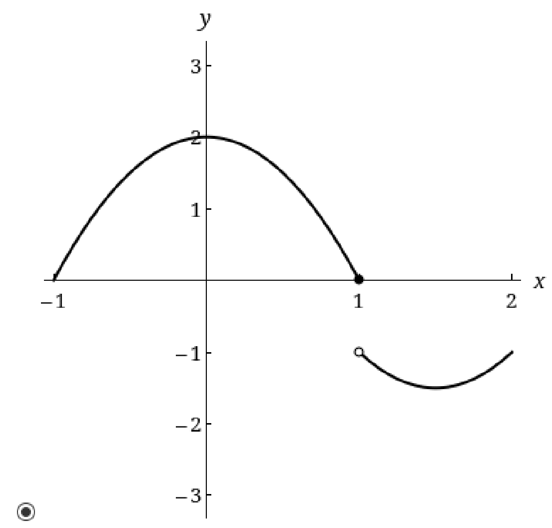
Q4

Wednesday, October 7, 2020 7:23 PM

(a) Sketch the graph of a function on [−1, 2] that has an absolute maximum but no absolute minimum.



(b) Sketch the graph of a function on [−1, 2] that is discontinuous but has both an absolute maximum and an absolute minimum.



Q5

Wednesday, October 7, 2020 7:29 PM

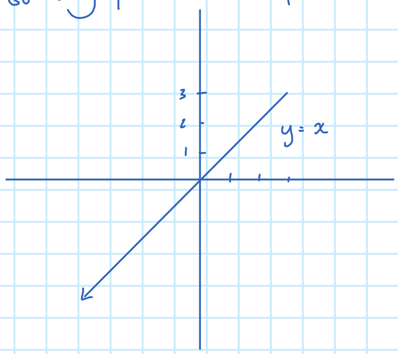
Sketch the graph of f by hand and use your sketch to find the absolute and local maximum and minimum values of f. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$f(x) = \frac{1}{2}(5x - 1), \quad x \leq 3$

absolute maximum value	7
absolute minimum value	DNE
local maximum value(s)	DNE
local minimum value(s)	DNE

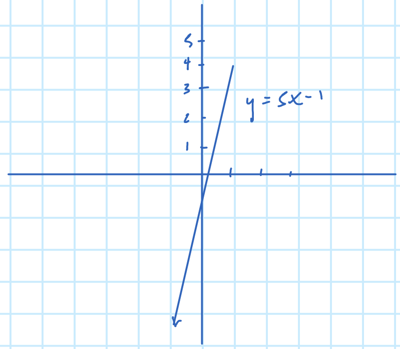
$f(x) = \frac{1}{2}(5x - 1), \; x \leq 3$

starting point with slope of x

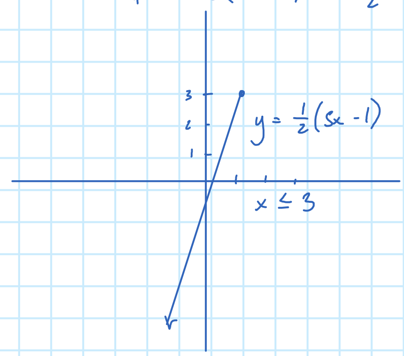


$\frac{5}{1}$ $\frac{\text{rise}}{\text{run}}$ shift down 1

with slope of $5x - 1$



with slope of $\frac{1}{2}(5x - 1)$ or $\frac{5}{2}x - \frac{1}{2}$



Absolute Maximum

$x = 3 \qquad y = f(3)$

$= f(3) = \frac{1}{2}(5(3) - 1)$

$= \frac{1}{2}(15 - 1)$

$= \frac{1}{2}(14)$

$y = 7$

$= \boxed{7}$

Since the function of f is linear for $x \leq 3$

Absolute Minimum

$= \boxed{DNE}$

Local maximum

$= \boxed{DNE}$

Local minimum

$= \boxed{DNE}$

Q6

Thursday, October 8, 2020 4:27 PM

Sketch the graph of f by hand and use your sketch to find the absolute and local maximum and minimum values of f. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$f(x) = \frac{2}{x}, \quad x \geq 2$

absolute maximum value	1
absolute minimum value	DNE
local maximum value(s)	DNE
local minimum value(s)	DNE

Absolute maximum

$f(x) = \frac{2}{x}, \quad x \geq 2$

$f(2) = \frac{2}{(2)} = 1$

$= \boxed{1}$

Since the function of f is linear for $x \geq 2$

Absolute Minimum

$= \boxed{DNE}$

Local maximum

$= \boxed{DNE}$

Local minimum

$= \boxed{DNE}$

Q7

Thursday, October 8, 2020 4:34 PM

Sketch the graph of f by hand and use your sketch to find the absolute and local maximum and minimum values of f. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$f(x) = \sin(x), \quad 0 \le x < \frac{\pi}{2}$

absolute maximum value	DNE
absolute minimum value	0
local maximum value(s)	DNE
local minimum value(s)	DNE

Absolute maximum for $0 \le x < \frac{\pi}{2}$

x is ONLY Less than $\frac{\pi}{2}$, not including $\frac{\pi}{2}$. So, the absolute maximum is infinite as x approaches $\frac{\pi}{2}$.

$\therefore$ Absolute maximum $\boxed{\text{DNE}}$

Absolute minimum for $0 \le x < \frac{\pi}{2}$

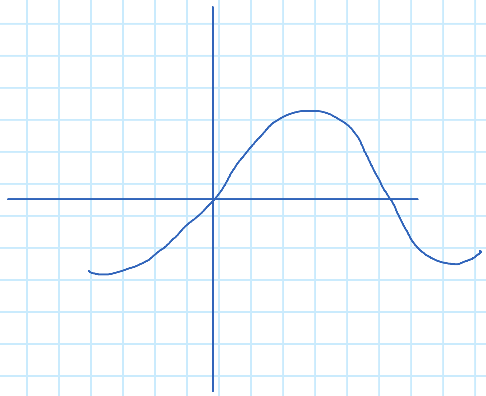
$y = f(x)$

$f(0) = \sin(x)$

$= \sin(0)$

$= \boxed{0}$

Graph of $\sin(x)$



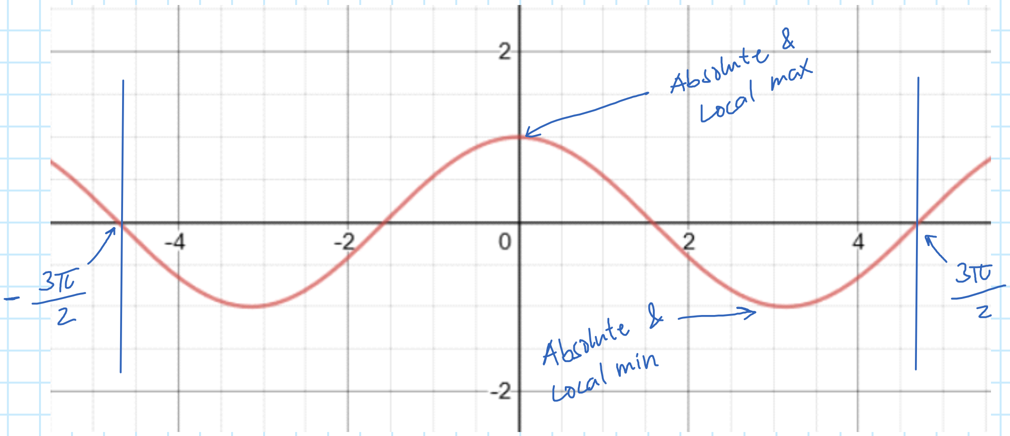
$\therefore$ Local maximum $\boxed{\text{DNE}}$

and

Local minimum $\boxed{\text{DNE}}$

Q8

Thursday, October 8, 2020 4:44 PM



$y = \cos(x)$

$f(t) = 2\cos(t), \quad \frac{-3\pi}{2} \le t \le \frac{3\pi}{2}$

Abs & Local max

$= 1(2)$

$= \boxed{2}$

Abs & Local min

$= -1(2)$

$= \boxed{-2}$

Q9

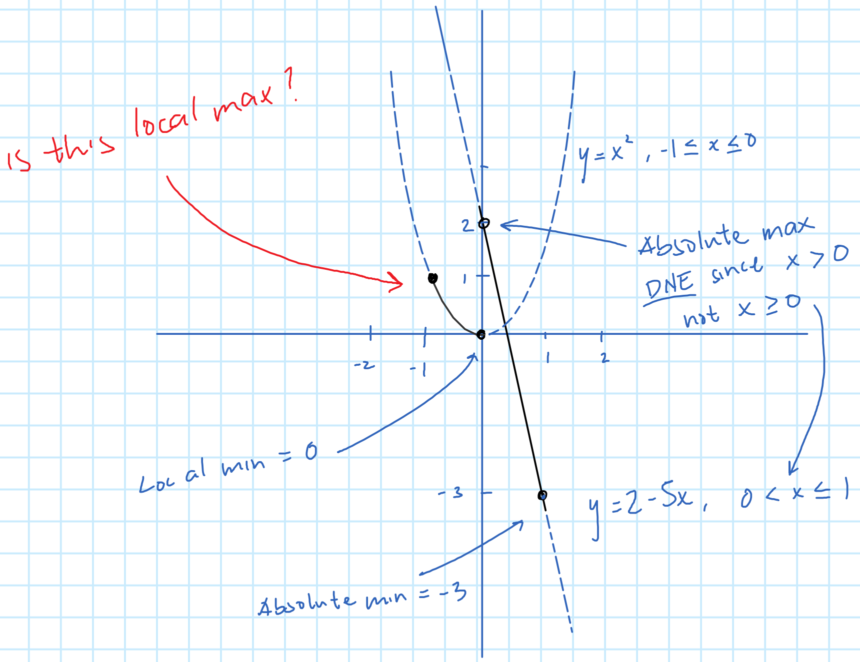
Thursday, October 8, 2020 8:54 PM

Sketch the graph of f by hand and use your sketch to find the absolute and local maximum and minimum values of f. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$$f(x) = \begin{cases} x^2 & \text{if } -1 \le x \le 0 \\ 2 - 5x & \text{if } 0 < x \le 1 \end{cases}$$

absolute maximum value	DNE ✓
absolute minimum value	-3 ✓
local maximum value(s)	DNE ✓
local minimum value(s)	0 ✓

Professor Wayne isn't convinced with this as well



Absolute max

$y = f(x)$

$f(1) = 2 - 5x$

$= 2 - 5(1)$

$= \boxed{-3}$

Absolute min

$= \boxed{\text{DNE}}$

Local max

$= \boxed{\text{DNE}}$

Local min

$y = f(0)$

$f(0) = x^2$

$= 0^2$

$= \boxed{0}$

Q10

Thursday, October 8, 2020 9:24 PM

Find the critical numbers of the function. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

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

$x = \frac{1}{3}$

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

critical numbers of a function are where slope = 0 or undefined

$$m = f'(x)$$

$$f'(x) = \frac{d}{dx}\left(4 + \frac{1}{3}x - \frac{1}{2}x^2\right)$$

$$= 0 + \frac{1}{3} - (2)\frac{1}{2}x$$

$$f'(x) = \frac{1}{3} - x$$

$$\frac{1}{3} - x = 0$$

$$\boxed{x = \frac{1}{3}}$$

Q11

Thursday, October 8, 2020 9:47 PM

Find the critical numbers of the function. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$f(x) = 2x^3 - 3x^2 - 12x$

$x =$ $2, -1$

$f(x) = 2x^3 - 3x^2 - 12x$

$m = f'(x)$

critical numbers of a function are where slope = 0 or undefined

$f'(x) = \frac{d}{dx}(2x^3 - 3x^2 - 12x)$

$= (3)2x^2 - (2)3x - 12$

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

$6x^2 - 6x - 12 = 0$

$6(x^2 - x - 2) = 0$

$6(x-2)(x+1) = 0$

$x - 2 = 0$ $\quad$ $x + 1 = 0$

$\boxed{x = 2}$ $\quad$ $\boxed{x = -1}$

Q12

Thursday, October 8, 2020 10:00 PM

Find the critical numbers of the function. (Enter your answers as a comma-separated list. If an answer does not exist, enter DNE.)

$$g(y) = \frac{y-1}{y^2 - 3y + 3}$$

$y =$ 0, 2

critical numbers of a function are where slope = 0 or undefined

The Quotient Rule

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)\frac{d}{dx}[f(x)] - f(x)\frac{d}{dx}[g(x)]}{[g(x)]^2}$$

$$g(y) = \frac{y-1}{y^2-3y+3}$$

$$m = g'(y)$$

$$g'(y) = \frac{d}{dy}\left(\frac{y-1}{y^2-3y+3}\right)$$

$$= \frac{(y^2-3y+3)\frac{d}{dy}(y-1) - (y-1)\frac{d}{dy}(y^2-3y+3)}{(y^2-3y+3)^2}$$

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

$$= \frac{y^2-3y+3 - (2y^2-5y+3)}{(y^2-3y+3)^2}$$

$$= \frac{y^2-3y\cancel{+3}-2y^2+5y\cancel{-3}}{(y^2-3y+3)^2}$$

$$g'(y) = \frac{-y^2+2y}{(y^2-3y+3)^2}$$

$$\frac{-y^2+2y}{(y^2-3y+3)^2} = 0 \longrightarrow$$

only way a fraction equals to 0 is if the numerator equals to 0

$$-y^2+2y = 0$$

$$-y(y-2) = 0$$

$$\boxed{y=0} \qquad y+2=0$$

$$\boxed{y=2}$$

Q13

Thursday, October 8, 2020 10:25 PM

Find the critical numbers of the function. (Enter your answers as a comma-separated list. Use n to denote any arbitrary integer values. If an answer does not exist, enter DNE.)

$f(\theta) = 4\cos(\theta) + 2\sin^2(\theta)$

$\theta =$ $k\pi$

$$f(\theta) = 4\cos(\theta) + 2\sin^2(\theta)$$

$$m = f(\theta)$$

critical numbers of a function are where slope = 0 or undefined

$$f'(\theta) = \frac{d}{dx}\left[4\cos(\theta) + 2\sin^2(\theta)\right]$$

$$= 4\frac{d}{dx}\left[\cos(\theta)\right] + 2\frac{d}{dx}\left[(\sin(\theta))^2\right]$$

Chain Rule

$u = \sin(\theta)$

$f(u) = u^2 = y$

$\frac{dy}{du}$ $\frac{du}{dx}$

$$= 4(-\sin(\theta)) + 2\frac{dy}{du}(u^2)\frac{du}{dx}(u)$$

$$= -4\sin(\theta) + 2\left[2\sin(\theta)\right]\frac{d}{dx}\left[\sin(\theta)\right]$$

$$= -4\sin(\theta) + 4\sin(\theta)\cos(\theta)$$

$$f'(\theta) = 4\sin(\theta)\left[-1 + \cos(\theta)\right]$$

$$4\sin(\theta)\left[-1 + \cos(\theta)\right] = 0$$

$\downarrow$ $\downarrow$

$\sin(\theta) = 0$

$0, \pi, 2\pi,$

$-1 + \cos(\theta) = 0$

$\cos(\theta) = 1$

$0, 2\pi, 4\pi, \ldots$

$$\boxed{\theta = k\pi}$$

Q14

Thursday, October 8, 2020 10:43 PM

Find the absolute maximum and absolute minimum values of f on the given interval.

$f(x) = 12 + 2x - x^2, \quad [0, 5]$

absolute minimum value -3

absolute maximum value 13

$f(x) = 12 + 2x - x^2, \quad [0, 5]$

critical numbers of a function are where slope = 0 or undefined

Get all critical numbers

$f'(x) = \frac{d}{dx}(12 + 2x - x^2)$

$= 0 + 2 - 2x$

$f'(x) = 2 - 2x$

$2 - 2x = 0$

$-2x = -2$

$x = 1$

$f(5) = 12 + 2(5) - (5)^2$

$= 12 + 10 - 25$

$= 22 - 25$

$= \boxed{-3}$ = Absolute min

$f(0) = 12 + 2(0) - (0)^2$

$= 12$

$f(1) = 12 + 2(1) - (1)^2$

$= 12 + 2 - 1$

$= \boxed{13}$ = Absolute max

Q15

Thursday, October 8, 2020 10:53 PM

Find the absolute maximum and absolute minimum values of f on the given interval.

$f(x) = 2x^3 - 6x^2 - 18x + 3, \quad [-2, 4]$

absolute minimum value: -51

absolute maximum value: 13

$f(x) = 2x^3 - 6x^2 - 18x + 3, \quad [-2, 4]$

Get all critical numbers

critical numbers of a function are where slope = 0 or undefined

$$f'(x) = \frac{d}{dx}\left(2x^3 - 6x^2 - 18x + 3\right)$$
$$= (3)2x^2 - (2)6x - 18 + 0$$
$$f'(x) = 6x^2 - 12x - 18$$

$$6x^2 - 12x - 18 = 0$$
$$6(x^2 - 2x - 3) = 0$$
$$6(x-3)(x+1) = 0$$

$x - 3 = 0 \qquad x + 1 = 0$

$\underline{\underline{x = 3}} \qquad \underline{\underline{x = -1}}$

$$f(4) = 2x^3 - 6x^2 - 18x + 3$$
$$= 2(4)^3 - 6(4)^2 - 18(4) + 3$$
$$= -37$$

$$f(-2) = 2x^3 - 6x^2 - 18x + 3$$
$$= 2(-2)^3 - 6(-2)^2 - 18(-2) - 3$$
$$= -1$$

$$f(-1) = 2x^3 - 6x^2 - 18x + 3$$
$$= 2(-1)^3 - 6(-1)^2 - 18(-1) - 3$$
$$= \boxed{13} \rightarrow \text{Absolute max}$$

$$f(3) = 2x^3 - 6x^2 - 18x + 3$$
$$= 2(3)^3 - 6(3)^2 - 18(3) + 3$$
$$= \boxed{-51} \rightarrow \text{Absolute min}$$

Q16

Friday, October 9, 2020 6:13 PM

$f(x) = x + \frac{1}{x}$, $[0.2, 4]$

critical numbers of a function are where slope = 0 or undefined

Get all critical numbers

$f'(x) = \frac{d}{dx}\left(x + \frac{1}{x}\right)$

$= \frac{d}{dx}\left(x + x^{-1}\right)$

$= 1 + (-x^{-2})$

$f'(x) = 1 - x^{-2}$

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

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

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

$1 = x^2$

$x = \sqrt{1}$

$x = \pm 1$

Domain of f is $[0.2, 4]$

$\therefore$ $x = 1$ is the only critical point

$f(4) = x + \frac{1}{x}$

$= (4) + \frac{1}{(4)}$

$= \frac{17}{4} = 4.25$

$f(0.2) = x + \frac{1}{x}$

$= (0.2) + \frac{1}{(0.2)}$

$= \boxed{5.2}$ $\longrightarrow$ Absolute max

$f(1) = x + \frac{1}{x}$

$= (1) + \frac{1}{(1)}$

$= \boxed{2}$ $\longrightarrow$ Absolute min

Q17

Friday, October 9, 2020 6:53 PM

After the consumption of an alcoholic beverage, the concentration of alcohol in the bloodstream (blood alcohol concentration, or BAC) surges as the alcohol is absorbed, followed by a gradual decline as the alcohol is metabolized. The function

$$C(t) = 1.35te^{-2.802t}$$

models the average BAC, measured in mg/mL, of a group of eight male subjects t hours after rapid consumption of 15 mL of ethanol (corresponding to one alcoholic drink). What is the maximum average BAC during the first 2 hours? (Round your answer to three decimal places.)

0.177 ✔ mg/mL

When does it occur? (Round your answer to two decimal places.)

0.36 ✔ h

Domain of $C(t)$ in hours

$$C(t) = 1.35te^{-2.802t}, \quad [0, 2]$$

Get all critical numbers

$$C'(t) = \frac{d}{dx}\left(1.35te^{-2.802t}\right)$$

$$= 1.35\frac{d}{dx}\left(te^{-2.802t}\right)$$

$$= 1.35\left[t\frac{d}{dx}\left(e^{-2.802t}\right) + e^{-2.802t}\frac{d}{dx}(t)\right]$$

$$= 1.35\left[t\left(e^{-2.802t}\right)\frac{d}{dx}(-2.802t) + e^{-2.802t}(1)\right]$$

$$= 1.35\left(te^{-2.802t}(-2.802) + e^{-2.802t}\right)$$

$$= 1.35\left(-2.802te^{-2.802t} + e^{-2.802t}\right)$$

$$C'(t) = 1.35\left(e^{-2.802t}\right)\left(-2.802t + 1\right)$$

this will never be zero for any value of t

this can be made zero

$$-2.802t + 1 = 0$$

$$-2.802t = -1$$

$$t = \frac{1}{2.802}$$

$$\boxed{t \approx 0.357h}$$

$$f(2) = 1.35te^{-2.802t}$$

$$= 1.35(2)e^{-2.802(2)}$$

$$\approx 0.009$$

$$f(0) = 1.35te^{-2.802t}$$

$$= 1.35(0)e^{-2.802(0)}$$

$$= 0$$

$$f(0.357) = 1.35te^{-2.802t}$$

$$= 1.35(0.357)e^{-2.802(0.357)}$$

$$\approx \boxed{0.177} \rightarrow \text{Absolute max within 2 hours}$$