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Sheet - 1st and 2nd Derivative Tests (1)

Name _____

Date _____

Find the first and second derivatives, all critical values and critical points, all points of inflection, intervals of increasing & decreasing and intervals of concavity.

$$f(x) = 1 - 9x - 6x^2 - x^3$$

$$-3x^2 - 12x - 9$$

$$x = -1, -3$$

$$(-3, -1)$$

$$(-\infty, -3) \cup (-1, \infty)$$

$$\text{Values: } (-1, 5), (-3, 1) \text{ Rel Min}$$

Graph Rel Max

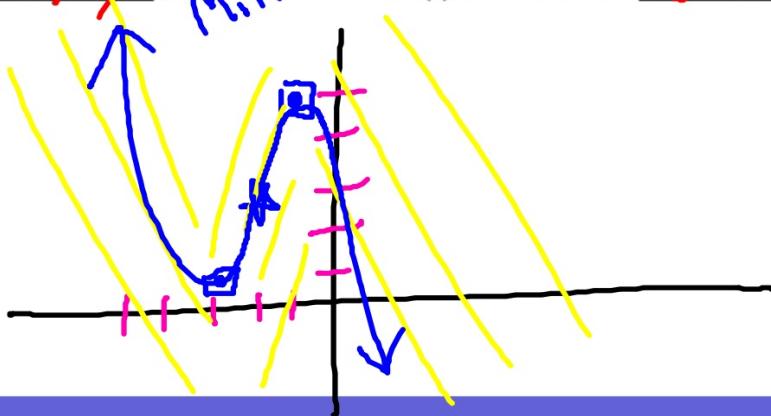
$$f''(x) = -6x - 12$$

$$C.V. \quad x = -2$$

$$C.U. \quad (-\infty, -2)$$

$$C.D. \quad (-2, \infty)$$

$$\text{Point(s) of Inflection: } (-2, 3)$$



$$y = \frac{1}{2} - \sin(x) \quad 0 \leq x \leq 2\pi$$

$$\begin{aligned} & \text{C. V. } \left(\frac{\pi}{6}, \left(\frac{5\pi}{6}, 2\pi \right) \right) \\ & \text{C. U. } \left(0, \frac{\pi}{2} \right) \cup \left(\frac{3\pi}{2}, 2\pi \right) \\ & \text{C. D. } \left(\frac{\pi}{6}, 1.128 \right), \left(\frac{5\pi}{6}, 0.443 \right) \end{aligned}$$

h

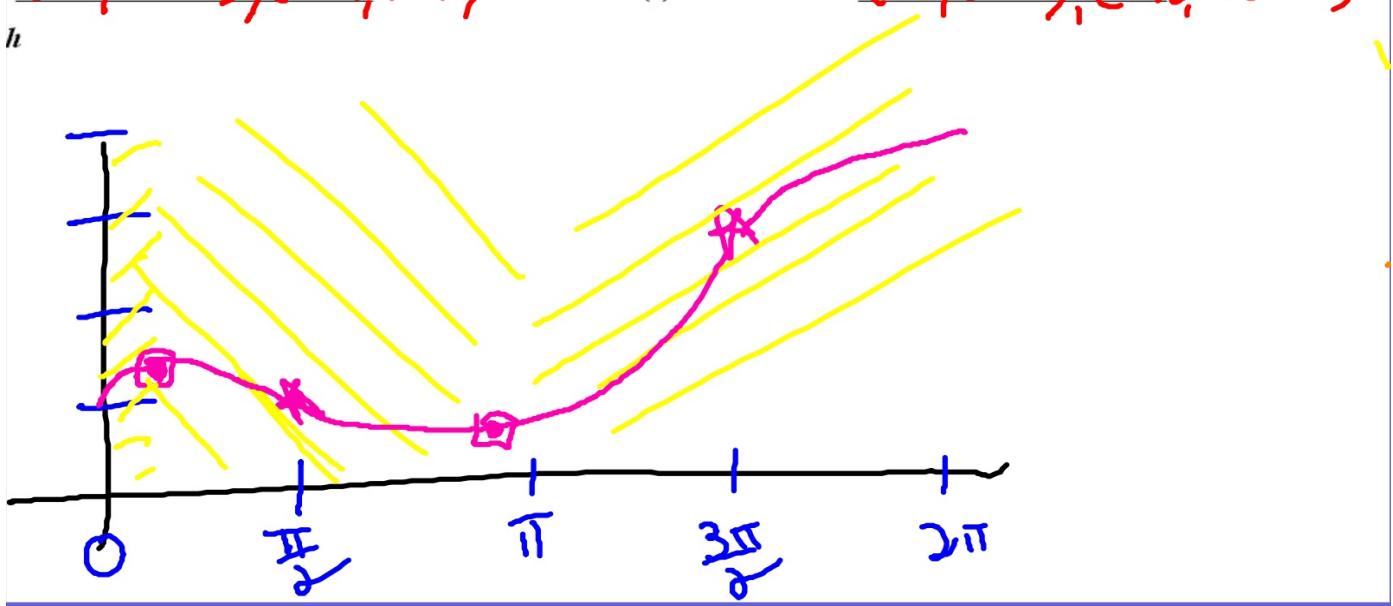
$$f''(x) = -\cos(x)$$

C. V. $x = \frac{\pi}{2}, \frac{3\pi}{2}$

C. U. $\left(\frac{\pi}{2}, \frac{3\pi}{2} \right)$

C. D. $(0, \frac{\pi}{2}) \cup (\frac{3\pi}{2}, 2\pi)$

Point(s) of Inflection: $(\frac{\pi}{2}, 0.785), (\frac{3\pi}{2}, 2.356)$



$$x^3 + 10$$

$$-12x^2$$

$$\therefore 0(DR) \ 3$$

$\infty)$

$$(0, 3) \cup (3, \infty)$$

$(3, -17)$ Abs. Min

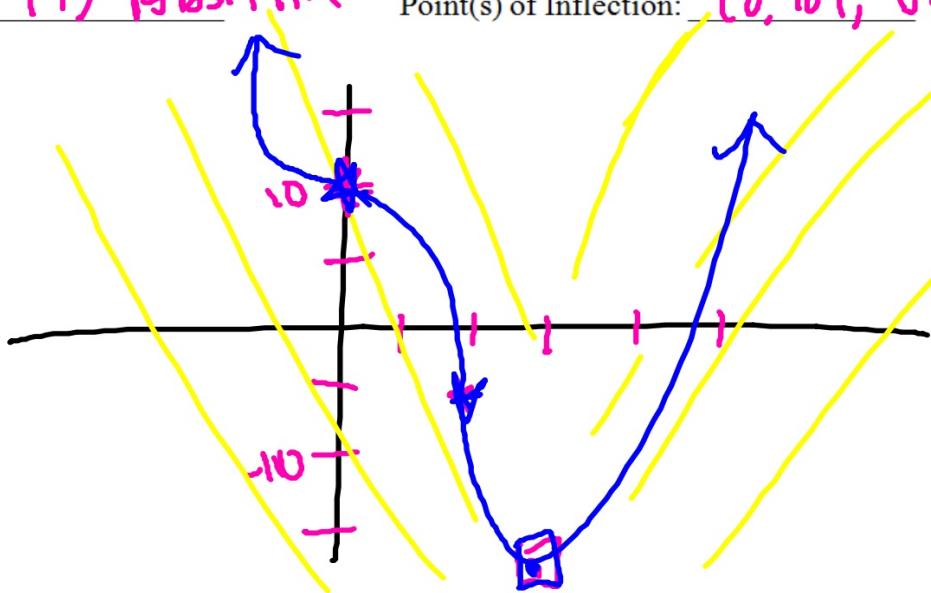
$$f''(x) = 12x^2 - 24x$$

$$C.V. \quad x = 0, 2$$

$$C.U. \quad (-\infty, 0) \cup (2, \infty)$$

$$C.D. \quad (0, 2)$$

Point(s) of Inflection: $(0, 10), (2, -6)$



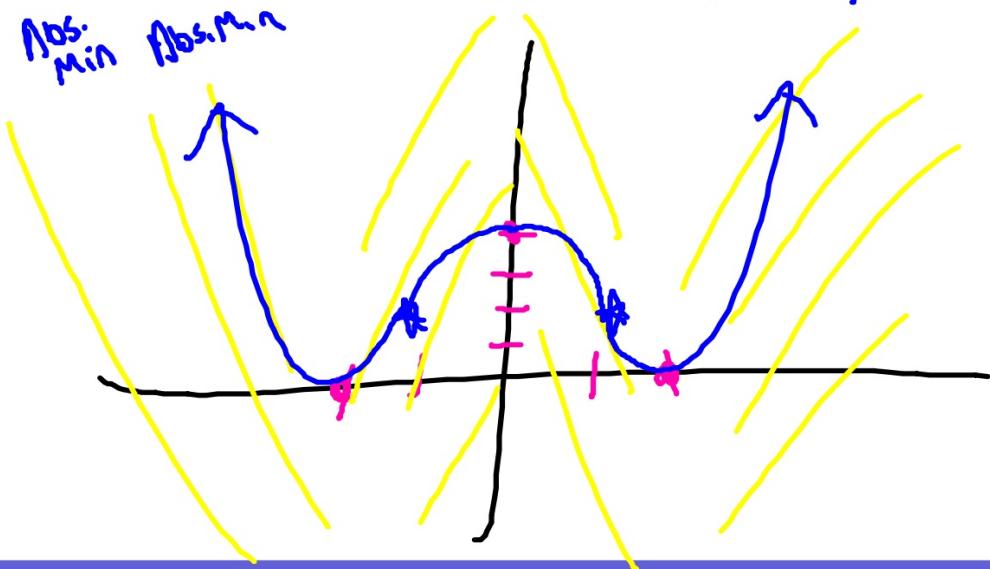
$$-2x^2 + 4$$

$$\begin{array}{r} 3 - 4x \\ \hline 0, -2, 2 \\ 1, (2, \infty) \\ 2, (-2)(0, 2) \\ 0, 4) (2, 0) (-2, 0) \end{array}$$

R_{part} Abs. min f(Abs. min)

$$\begin{aligned} f''(x) &= 3x^2 - 4 \\ \text{C. V. } x &= \pm 2\sqrt{3}/3 \quad (\pm 1.155) \\ \text{C. U. } &(-\infty, -2\sqrt{3}/3) (2\sqrt{3}/3, \infty) \\ \text{C. D. } &(-2\sqrt{3}/3, 2\sqrt{3}/3) \end{aligned}$$

Point(s) of Inflection: $(-2\sqrt{3}/3, 1.77), (2\sqrt{3}/3, 1.77)$



Graph the function from the given information.

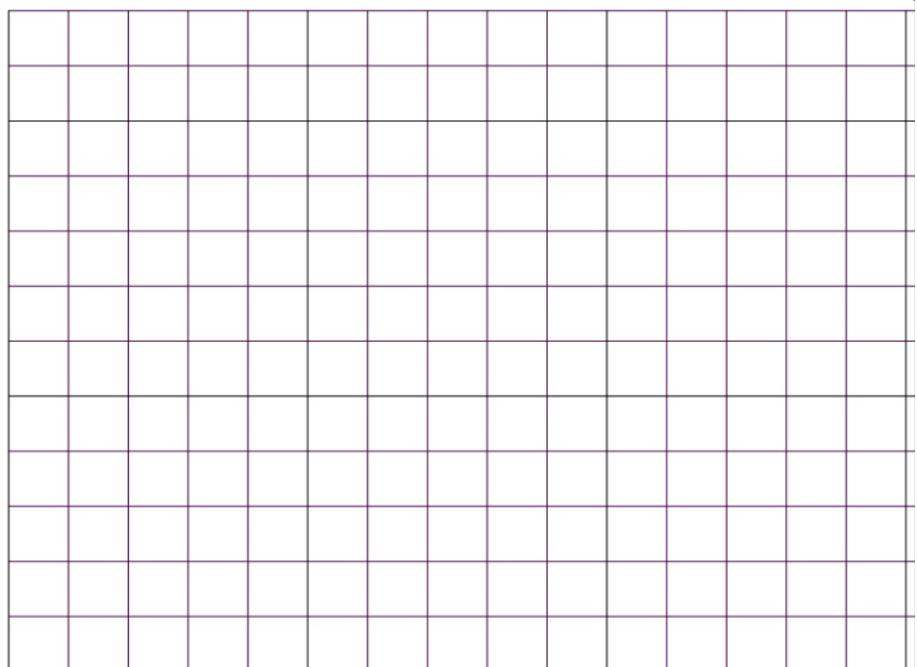
3

$\frac{1}{2}, 5$ y -intercept = 2

$(0, 2)$

(∞)

$(0, \infty)$



State the extrema values and their classification.

: 2, $f(8) = 3$, $f(6) = 1$

∞)

$(-\infty, 1) \cup (1, 6)$

4)

$(-\infty, 1) \cup (4, \infty)$

State the extrema values and their classification.

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$$) = 1, \quad f(4) = 2,$$

$f'(1) = \text{undefined}$

$$(-\infty, 0) \cup (0, 3)$$

$$(\infty)$$

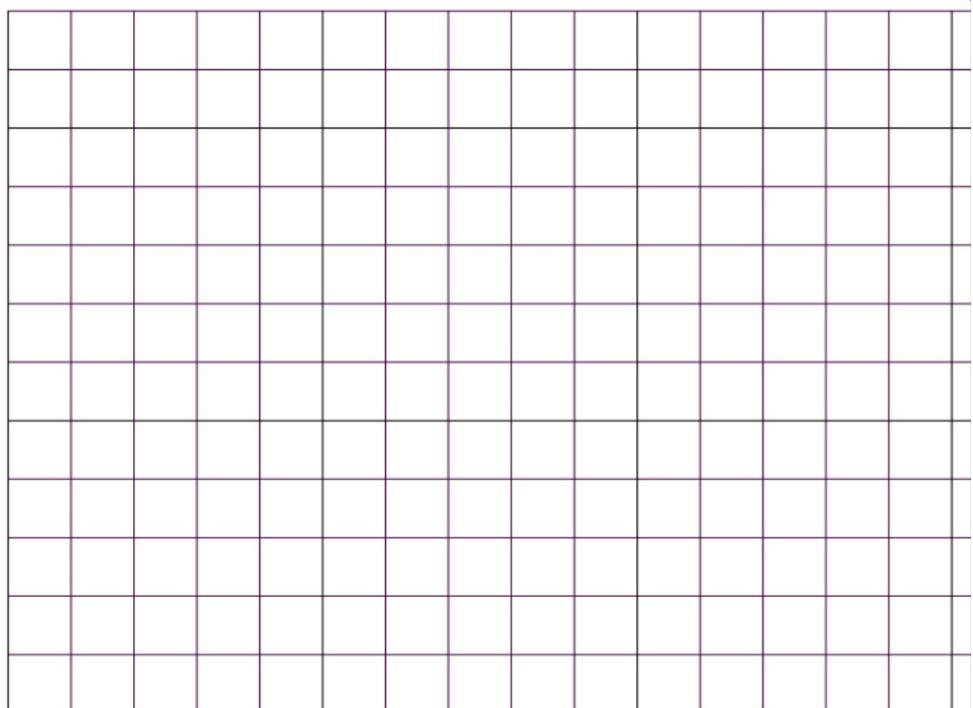
$$f''(3) = \text{undefined}$$

$$(3, 0)$$

$$(-\infty, -3) \cup (0, 3) \cup (3, \infty)$$

$$\lim_{x \rightarrow \infty} f(x) = 0$$

$$\lim_{x \rightarrow 3^+} f(x) = \infty$$



State the extrema values and their classification.