

10. [4 points] An implicit curve is described by the equation

$$xy^n = \cos(ax)$$

where a and n are positive constants. Compute $\frac{dy}{dx}$. Your answer may include a and n . You must show every step of your work.

Solution:

$$\begin{aligned} \frac{d}{dx}(xy^n) &= \frac{d}{dx}(\cos(ax)) \\ x \cdot \left(ny^{n-1} \frac{dy}{dx} \right) + 1 \cdot y^n &= -a \sin(ax) \\ (nxy^{n-1}) \frac{dy}{dx} &= -a \sin(ax) - y^n \\ \frac{dy}{dx} &= \frac{-a \sin(ax) - y^n}{nxy^{n-1}} \end{aligned}$$

Answer: $\frac{dy}{dx} = \frac{-a \sin(ax) - y^n}{nxy^{n-1}}$

11. [8 points] The differentiable function $f(x)$ is defined for all real numbers. Additionally, $f(x)$ has **exactly two** critical points, at $x = 0$ and $x = 5$. A table of values of $f(x)$ is given below.

x	-2	1	3	7
$f(x)$	2	4	9	5

For parts **a.–d.**, circle **all** correct choices.

- a. [2 points] On which of the following interval(s) must $f'(x)$ always be negative?

(-2, 0) (0, 1) (1, 5) (5, 7) NONE OF THESE

- b. [2 points] On which of the following interval(s) must there be a point c for which $f'(c) = -1$?

$(-\infty, -2)$ $(-2, 1)$ $(1, 3)$ $(3, 7)$ NONE OF THESE

- c. [2 points] On the interval $[0, 6]$, at which of the following point(s) does $f(x)$ attain its global maximum? If there is not enough information to determine this, circle NOT ENOUGH INFO.

$x = 0$ $x = 1$ $x = 5$ $x = 6$ NOT ENOUGH INFO

- d. [2 points] On the interval $[-2, 5]$, at which of the following point(s) does $f(x)$ attain its global minimum? If there is not enough information to determine this, circle NOT ENOUGH INFO.

$x = -2$ $x = 0$ $x = 2$ $x = 5$ NOT ENOUGH INFO