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

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

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

Solution:

$$\frac{d}{dx}\left(xy^n\right) = \frac{d}{dx}\left(\cos(ax)\right)$$

$$x \cdot \left(ny^{n-1}\frac{dy}{dx}\right) + 1 \cdot y^n = -a\sin(ax)$$

$$\left(nxy^{n-1}\right)\frac{dy}{dx} = -a\sin(x) - y^n$$

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

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

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?

$(-2, 0)$ $(0, 1)$ $(1, 5)$ $\boxed{(5, 7)}$ NONE OF THESE

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

$(-\infty, -2)$ $(-2, 1)$ $(1, 3)$ $\boxed{(3, 7)}$ 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.

$x = 0$ $x = 1$ $\boxed{x = 5}$ $x = 6$ 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.

$x = -2$ $x = 0$ $x = 2$ $x = 5$ $\boxed{\text{NOT ENOUGH INFO}}$