10. [4 points] Let a and b be constants. Consider the curve $\mathcal{C}$ defined by the equation
$$\cos(ax) + by\ln(x) = 3 + y^3.$$

Find a formula for $\frac{dy}{dx}$ in terms of x and y. The constants a and b may appear in your answer. To earn credit for this problem, you must compute this by hand and show <u>every</u> step of your work clearly.

Answer: $\dfrac{dy}{dx} =$

11. [6 points] Let $h(x) = x^x$. For this problem, it may be helpful to know the following formulas:

$$h'(x) = \ x^x\left(\ln(x) + 1\right) \qquad \text{and} \qquad h''(x) = \ x^x\left(\frac{1}{x} + (\ln(x) + 1)^2\right).$$

a. [2 points] Write a formula for $p(x)$, the local linearization of $h(x)$ near $x = 1$.

Answer: $p(x) = $ _____

b. [4 points] Write a formula for $u(x)$, the quadratic approximation of $h(x)$ at $x = 1$. (Recall that a formula for the quadratic approximation $Q(x)$ of a function $f(x)$ at $x = a$ is $Q(x) = f(a) + f'(a)(x - a) + \frac{f''(a)}{2}(x - a)^2$.)

Answer: $u(x) = $ _____