9. [13 points] A curve $\mathcal{C}$ is defined implicitly by the equation

$$2x(y^2 - 4y) + 5x = 15.$$

Note that the curve $\mathcal{C}$ satisfies

$$\frac{dy}{dx} = \frac{-2y^2 + 8y - 5}{4xy - 8x}.$$

a. [4 points] Find all points on $\mathcal{C}$ with a vertical tangent line. Give your answers as ordered pairs (coordinates). Justify your answer algebraically. Write NONE if no such points exist.

Answer: ________________________________

b. [4 points] There is one point on $\mathcal{C}$ with a coordinate $(k, 0)$. Find the value of k and write the equation of the tangent line to $\mathcal{C}$ at the point $(k, 0)$. Your equation should not include the letter k.

Answer: $k =$ __________ Equation of tangent line: ____________________

c. [5 points] Another curve $\mathcal{D}$ is defined implicitly by the equation

$$\cos(Wy^3 + Vxy) = \frac{1}{6}$$

where W and V are constants. Find a formula for $\frac{dy}{dx}$ in terms of x, y, W, and V. To earn credit for this problem, you must compute this by hand and show every step of your work clearly.

Answer: $\frac{dy}{dx} =$ ______________________________

10. [7 points] The function g has the property that $g(x)$, $g'(x)$, and $g''(x)$ are defined for all real numbers. The quadratic approximation of $g(x)$ at $x = -2$ is

$$Q(x) = 4(x+2)^2 + \frac{1}{2}(x+2) - 5.$$

a. [5 points] Find the exact value of each of the following quantities. If there is not enough information to answer the question, write NI.

$g(-2) =$ ________ $g'(-2) =$ ________ $g''(-2) =$ ________

$g(0) =$ ________ $Q'(0) =$ ________

b. [2 points] Write a formula for $L(x)$, the tangent approximation of $g(x)$ near $x = -2$.

Answer: $L(x) =$ ________________________