Math 131 - Quiz 6

March 1, 2023

Name key

Score _____

Show all work to receive full credit. Supply explanations when necessary.

1. (4 points) A potato is fired upward from a potato gun in such a way that its height in feet after t seconds is given by $s(t) = -16t^2 + 80t + 96$.

   (a) Determine the maximum height of the potato.

$s'(t) = -32t + 80$

$s'(t) = 0 \Rightarrow t = \frac{80}{32} = \frac{5}{2}$

$= 2.5$ sec

$s(2.5) = -16(2.5)^2 + 80(2.5) + 96$

$= 196$ FT

   (b) Determine when the potato hits the ground.

$s(t) = 0 \Rightarrow -16t^2 + 80t + 96 = 0$

$-16(t^2 - 5t - 6) = 0$

$-16(t-6)(t+1) = 0$

$t = 6 \quad t = -1$

$t = 6$ sec

2. (6 points) Suppose that y is implicitly defined as a function of x by the equation

$$x^2 + y^3 = \frac{5}{2}xy.$$

   (a) Use implicit differentiation to find dy/dx.

$\frac{d}{dx}(x^2 + y^3) = \frac{5}{2}\frac{d}{dx}(xy)$

$2x + 3y^2\frac{dy}{dx} = \frac{5}{2}\left(y + x\frac{dy}{dx}\right)$

$3y^2\frac{dy}{dx} - \frac{5}{2}x\frac{dy}{dx} = \frac{5}{2}y - 2x$

$\frac{dy}{dx} = \frac{\frac{5}{2}y - 2x}{3y^2 - \frac{5}{2}x}$

   (b) Find an equation for the tangent line at $(2, 1)$.

$m = \left.\frac{dy}{dx}\right|_{(x,y)=(2,1)} = \frac{\frac{5}{2} - 4}{3 - 5} = \frac{-\frac{3}{2}}{-2} = \frac{3}{4}$

TAN. LINE:

$y - 1 = \frac{3}{4}(x - 2)$

OR

$y = \frac{3}{4}x - \frac{1}{2}$