Math 131 - Homework 3

March 3, 2021

Name __key__

Score _____

The following problems are from the suggested homework. Show all work to receive full credit. Supply explanations when necessary. This assignment is due on March 24.

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1. (3 points) A potato is launched vertically upward with an initial velocity of $100\,\text{ft/s}$ from a potato gun at the top of an 85-foot-tall building. The distance in feet that the potato travels from the ground after t seconds is given by $s(t) = -16t^2 + 100t + 85$.

   (a) Determine when the potato reaches its maximum height.

$$s'(t) = -32t + 100$$

$$s'(t) = 0 \quad \text{AT MAX HEIGHT}$$

$$-32t + 100 = 0 \implies t = \frac{100}{32} = \boxed{\frac{25}{8}\ \text{SEC}}$$

   (b) Determine the velocity of the potato as it hits the ground.

$$s(t) = 0 \implies -16t^2 + 100t + 85 = 0$$

$$t = \frac{-100 \pm \sqrt{100^2 + 4(16)(85)}}{-32} \approx 7.008 \quad \text{or} \quad -0.7581$$

$$s'(7.008) \approx \boxed{-124.26\ ^{FT}/_{SEC}}$$

2. (1 point) Find $\dfrac{dy}{dx}$ if $y = \dfrac{\tan x}{1 - \sec x}$.

$$\boxed{\frac{dy}{dx} = \frac{(1 - \sec x)(\sec^2 x) - (\tan x)(-\sec x \tan x)}{(1 - \sec x)^2}}$$

Turn over.

3. (4 points) Find $\frac{dy}{dx}$.

CHAIN RULE.

(a) $y = (2x^3 - x^2 + 6x + 1)^3$

$$\frac{dy}{dx} = 3(2x^3 - x^2 + 6x + 1)^2 (6x^2 - 2x + 6)$$

CHAIN RULE TWICE.

(b) $y = \sin(\cos 7x)$

$$\frac{dy}{dx} = \cos(\cos 7x) \cdot \frac{d}{dx} \cos 7x$$

$$= \cos(\cos 7x)(-\sin 7x)(7)$$

4. (2 points) Find an equation of the line tangent to the graph of the equation $x^2 y^2 + 5xy = 14$ at the point $(2, 1)$.

$$\frac{d}{dx}(x^2 y^2 + 5xy) = 0$$

$$2xy^2 + x^2\left(2y\frac{dy}{dx}\right) + 5x\frac{dy}{dx} + 5y = 0$$

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

$$\frac{dy}{dx} = \frac{-5y - 2xy^2}{2x^2 y + 5x} \quad , \quad m = \frac{dy}{dx}\bigg|_{(2,1)} = \frac{-5-4}{8+10} = -\frac{1}{2}$$

TANGENT LINE :

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