

Name Solutions

- You may work with other students in this class. However each student should write up solutions separately and independently – nobody should copy someone else's work.
- You may use your notes and the textbook.
- You should not use a calculator except to do basic arithmetic.
- Show sufficient work to justify each answer.
- There is no specific time limit, but the quiz is due at the beginning of Tuesday's discussion section (Monday for Merit sections).
- Note to TA's – you should not help students with these specific problems or go over solutions until the last discussion section has turned in the quiz at 3pm Tuesday.

1. (2 points) Find a formula for the derivative  $\frac{dy}{dx}$  given that  $x^2 + 4xy + y^2 = 13$ . It is acceptable to leave your answer in terms of both  $x$  and  $y$ .

$$\frac{d}{dx}(x^2 + 4xy + y^2) = \frac{d}{dx}(13)$$

$$2x + \frac{d}{dx}(4xy) + 2y \frac{dy}{dx} = 0$$

$$2x + \left(4y + 4x \frac{dy}{dx}\right) + 2y \frac{dy}{dx} = 0$$

$$(4x + 2y) \frac{dy}{dx} = -2x - 4y$$

$$\frac{dy}{dx} = \frac{-2x - 4y}{4x + 2y} = \frac{-x - 2y}{2x + y}$$

2. (2 points) Determine a formula for the line which is tangent to the graph of  $y = \tan^{-1}(e^{6x})$  at its  $y$ -intercept.

set  $x=0$  to find  $y$ -intercept

$$y = \tan^{-1}(e^{6 \cdot 0}) = \tan^{-1}(1) \\ = \pi/4$$

~~$y = \tan^{-1}(e^{6x})$~~

point  $(0, \frac{\pi}{4})$

$$y' = \frac{1}{1 + (e^{6x})^2} \cdot e^{6x} \cdot 6$$

$$y'(0) = 3 \quad \text{slope } 3$$

$$y = 3x + \frac{\pi}{4}$$

3. (2 points) Find a formula for  $f'(x)$  given that  $f(x) = \ln(x^5 e^{x^3} (x^4 + 3)^6)$ .

$$\begin{aligned} f(x) &= \ln(x^5) + \ln(e^{x^3}) + \ln((x^4 + 3)^6) \\ &= 5 \ln x + x^3 + 6 \ln(x^4 + 3) \end{aligned}$$

$$f'(x) = 5 \cdot \frac{1}{x} + 3x^2 + 6 \cdot \frac{1}{x^4 + 3} \cdot 4x^3$$

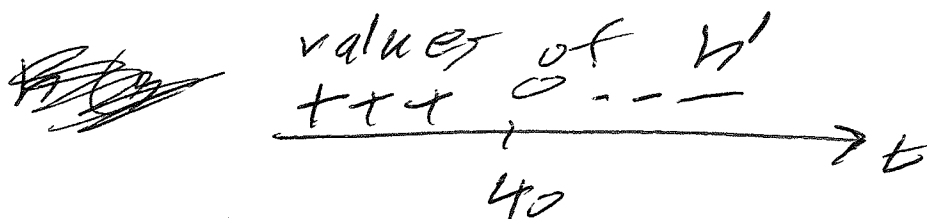
4. (4 points) Suppose that  $t$  seconds after an object is shot directly upwards from the surface of some planet its height in feet is given by  $h = 200t - 2.5t^2$ .

(a) Find a formula for the velocity of the bullet at time  $t$ .

$$h' = 200 - 5t$$

(b) What is the maximum height attained by the bullet?

$$h' = 0 \text{ when } t = 40$$



max height at  $t = 40$  is

$$\begin{aligned} h(40) &= 200(40) - 2.5(40)^2 \\ &= 4000 \text{ ft} \end{aligned}$$