

Name \_\_\_\_\_ Date \_\_\_\_\_

Instructions: Please show all of your work as partial credit will be given where appropriate, **and** there may be no credit given for problems where there is no work shown. All answers should be completely simplified, unless otherwise stated.

1. (10 points) Find the slope of the tangent to the curve of intersection of the surface

$$z = \frac{1}{2}\sqrt{9x^2 + 9y^2 - 36} \quad \text{and the plane } y=1 \quad \text{at the point } \left(2, 1, \frac{3}{2}\right).$$

slope = \_\_\_\_\_

2. (5 points each) Find the limit (or show that it does not exist).

(a)  $\lim_{(x,y) \rightarrow (0,0)} \frac{\sin(x^2 + y^2)}{-3x^2 - 3y^2}$ .

Answer : \_\_\_\_\_

(b)  $\lim_{(x,y) \rightarrow (0,0)} \frac{4xy}{x^2 + y^2}$

Answer: \_\_\_\_\_

3. (10 points) Find the gradient of  $f$ ,  $\nabla f$ , for  $f(x, y) = \frac{-4x^3y - x}{y^2}$

4. (10 points) Find the equation of the tangent plane to  $f(x, y) = y + 2xy - 6x^3y^2$  at  $\mathbf{p}_0 = (1, 1)$ .  
 $\nabla f =$  \_\_\_\_\_

Tangent Plane : \_\_\_\_\_