

## Practice Problem Set

1. The ellipsoid  $4x^2 + 2y^2 + z^2 = 16$  intersects the plane  $y = 2$  in an ellipse. Find parametric equations for the tangent line to this ellipse at  $(1, 2, 2)$ .

(Solution:  $x = 1 + t, y = 2, z = 2 - 2t$ )

2. Car A is travelling north on Highway 16 and car B is travelling west on Highway 83. Each car is approaching the intersection of these highways. at a certain moment, car A is 0.3 km from the intersection and travelling at 90 km/h while car B is 0.4 km from the intersection and travelling 80 km/h. How fast is the distance between the cars changing at that moment?

(Solution: -118 km/h)

3. Find the normal direction to the surface given by the equation  $x - z = \arctan(yz)$ .

(Solution:  $\langle 1 + y^2z^2, z, -(1 + y + y^2z^2) \rangle$ )

4. Can there exist a function  $f(x, y)$  for which  $f_x(x, y) = y + x^2y$  and  $f_y(x, y) = x + xy^2$ ?

(Solution: no, by Clairauts' theorem)

5. If  $f(x, y) = x(x^2 + y^2)^{-\frac{3}{2}}e^{\sin(x^2y)}$ , find  $f_x(1, 0)$ .

(Solution: -2.)

6. Find the equation of the tangent plane and the normal line to the surface  $xy + yz + zx = 3$  at  $(1, 1, 1)$ .

(Solution:  $x + y + z = 3, x = y = z$ )