

## Problem 1

Let  $f(x, y, z) = 2x^2 + y^2 - 3z^2$ . Show that  $(1, 1, 1)$  is on the level surface  $f(x, y, z) = 0$ . Find an equation of the tangent plane to the level surface  $f(x, y, z) = 0$  at the point  $(1, 1, 1)$ . Give parametric equations of the normal line to the surface at this point.

## Problem 2

Let  $f(x, y) = e^{xy}x^2 + y^2$ . Determine an equation of the tangent plane on the surface  $z = f(x, y)$  when  $(x, y) = (1, 1)$ . Give an equation of the normal line to the surface at this point.

### Problem 3

Find an equation for the plane that is tangent to the surface  $z = e^{x^2+y^2} + 2xy - x^2 - y^2$  at the point  $(1, 1, e^2)$ .

### Problem 4

Consider the surfaces  $x^3 - xyz + y^3 = 1$  and  $x^2 + y^2 + z^2 = 3$ . Find parametric equations for the line which is tangent to the curve of intersection at the point  $(1, 1, 1)$ .

**Problem 5**

Let  $f$  and  $g$  be functions of 2 variables. Show that

$$\nabla(fg) = g\nabla f + f\nabla g \quad \text{and} \quad \nabla\left(\frac{f}{g}\right) = \frac{g\nabla f - f\nabla g}{g^2}.$$