



3. (6 points) Let  $F = F(u(s, t), w(s, t))$  where  $F$ ,  $u$ , and  $w$  are differentiable functions with outputs given below. Find  $\frac{\partial F}{\partial t}$  at  $s = 1$  and  $t = 0$ .  $F(1, 0) = 5$ ,  $u(1, 0) = 2$ , and  $w(1, 0) = 3$ .  
 $\nabla u(1, 0) = \langle -2, 6 \rangle$ ,  $\nabla w(1, 0) = \langle 5, 4 \rangle$ ,  $\nabla F(1, 0) = \langle 5, 7 \rangle$ , and  $\nabla F(2, 3) = \langle -1, 10 \rangle$

4. (6 points)  $f(x, y, z) = 2x + 3y - z + \sin(\pi xyz)$ . What is the equation for the tangent plane to the level surface  $f(x, y, z) = 4$  at  $Q = (1, 1, 1)$ ?