

18.022 Recitation Quiz (with solutions)

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1. Find the equation for the plane tangent to the graph of  $z = \cos(xy) + 2y^2$  at the point whose  $x$ -coordinate is 0 and whose  $y$ -coordinate is 2.

*Solution.* Let  $f(x, y) = \cos(xy) + 2y^2$ . The plane tangent to  $z = \cos(xy) + 2y^2$  at a point  $(x_0, y_0, f(\mathbf{a}))$  (where  $\mathbf{a} = (x_0, y_0)$ ) is normal to the vector  $\left(\frac{\partial f}{\partial x}(\mathbf{a}), \frac{\partial f}{\partial y}(\mathbf{a}), -1\right)$ . We calculate  $\frac{\partial f}{\partial x} = -y \sin(xy)$  and  $\frac{\partial f}{\partial y} = -x \sin(xy) + 4y$  and substitute to find that  $(0, 8, -1)$  is a normal vector. Substituting into  $\mathbf{n} \cdot ((x, y, z) - P)$  with  $P = (0, 2, f(0, 2)) = (0, 2, 9)$ , we find that the tangent plane is  $\boxed{8y - z = 7}$ .