Tangent Planes

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Surfaces of the form z=f(x,y)

- To find a tangent plane at a point, need two tangent vectors here
- The two tangent vectors are found with the partial derivatives:
  - $[1, 0, f_x(x_0, y_0)]$
  - $[0, 1, f_y(x_0, y_0)]$
- Taking the cross product gives you the normal vector: $[-f_x(x_0, y_0), -f_y(x_0, y_0), 1]$
- The resulting equation of a plane is
  - $z = f(x_0, y_0) + f_x(x_0, y_0)(x - x_0) + f_y(x_0, y_0)(y - y_0)$

Surfaces of the form G(x, y, z) = 0

- Everything here also works for equations of the form $G(x, y, z) = K$, where K is a constant
- The gradient of G, $\nabla G(x_0, y_0, z_0)$ is the normal of the tangent plane at the point (x_0, y_0, z_0)
- The equation of this tangent plane is given by
  - $\nabla G(x_0, y_0, z_0)\dot{[}x - x_0, y - y_0, z - z_0] = 0$