Name: _____

1. Let
$$f(x, y, z) = \frac{x}{y} - yz.$$

Let P_0 be the point with coordinates $(-4, -1, 3)$.

(a) Compute
$$\nabla f\big|_{P_0}.$$

(b) i. In what direction does f increase most rapidly at P_0?

    ii. What is the derivative of f in this direction at P_0?

(c) i. In what direction does f decrease most rapidly at P_0?

    ii. What is the derivative of f in this direction at P_0?

2. Consider the surface defined by the equation

$$3\cos(\pi x) - 2x^2 y + 5e^{xz} + 3yz = 17.$$

At the point $P_0(0, 3, 1)$,

- find an equation for the tangent plane to this surface, and
- find equations for the normal line to this surface.