

You are encouraged to work in groups of two to four on this assignment and make a single group submission. Each problem is worth 5 points for correct and clearly justified answers.

1. Do #67 in §12.3. Explain well why your answer makes sense.
2. A study of frost penetration found that the temperature T at time t (measured in days) at depth d (measured in feet) could be modeled by the function

$$T(d, t) = T_0 + T_1 e^{-\lambda d} \sin(\omega t - \lambda d)$$

where $\omega = 2\pi/365$ and λ is a positive constant.

- a) Find $\partial T/\partial d$. What is its sign? What is its physical significance?
 - b) Find $\partial T/\partial t$. What is its sign? What is its physical significance?
3. Find an equation for the line through the origin and the point $(1, 2, 3)$. Determine where this line intersects the paraboloid $z = x^2 + y^2$, and describe the angle at which the line intersects the surface.

4. Show that the equation of the tangent plane to the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ at the point

$$(x_0, y_0, z_0) \text{ can be written as } \frac{x x_0}{a^2} + \frac{y y_0}{b^2} + \frac{z z_0}{c^2} = 1.$$

