

Practice for Math 252 Test 1

1. Find a unit vector that is orthogonal to the vector $\mathbf{v} = (2, -1, 2)$ and to the line
$$\begin{aligned}x &= 3 - t \\y &= 4 \\z &= 2 + 2t.\end{aligned}$$
2. The toxicity of an environment is given by the formula $T(x, y) = \sin(x^3 - 2y^3)$. If a bug is located at the point $(1, -1)$ and wishes to go in the direction of least toxicity, in what direction should it go?
3. Find an equation of the plane that passes through the point $(0, 2, -3)$ and is parallel to the vectors $2\mathbf{i} - \mathbf{j} + 4\mathbf{k}$ and $3\mathbf{i} - \mathbf{k}$.
4. A particle following the path $c(t) = (3t^2, -\sin t, -e^t)$ flies off on a tangent line at $t_0 = \frac{1}{2}$. What is its location at $t_1 = 1$?
5. Use the chain rule and derivative matrices to find $Df \circ g(1,1)$ if
$$F(u, v) = \frac{u^2 + v^2}{u^2 - v^2} \text{ and } G(x, y) = (e^{-x-y}, e^{xy}).$$
6. Find the tangent plane to the surface $x^3 + y^3 + z^3 = 3$ at the point $(1, 1, 1)$.