

Practice for Math 252 Test 1

1. Find a unit vector that is orthogonal to the vector $\mathbf{v} = \langle 2, -1, 2 \rangle$ and to the line

$$\begin{aligned}x &= 3 - t \\y &= 4 \\z &= 2 + 2t.\end{aligned}$$

2. 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 $3\mathbf{i} - \mathbf{k}$.
3. A particle following the path $c(t) = \langle 3t^2, -\sin t, -e^t \rangle$ flies off on a tangent line at $t_0 = \frac{1}{2}$. What is its location at $t_1 = 1$?
4. Find the arclength of $c(t) = \langle 4, t^2, t^3 \rangle$ for $0 \leq t \leq 1$.
5. Find the curvature of the curve $y = x^4$ at the point $(1, 1)$.
6. A particle starts at the origin with initial velocity $\langle 1, -1, 3 \rangle$. Its acceleration is $a(t) = \langle 6t, 12t^2, -6t \rangle$. Find its position function.
7. Write in cylindrical and in spherical coordinates:

$$x^2 + y^2 + z^2 = 9.$$

8. Find the acute angle between two diagonals of a cube.