

Math 2001 Midterm

1. Consider a curve whose equation in polar coordinates is $r = e^{-\theta}$ with $0 < \theta < 2\pi$.
 - (a) [2 points] Sketch this curve.
 - (b) [2 points] Compute the equation of the line tangent to this curve at $\theta = 0$.
 - (c) [2 points] Find all values of θ for which this curve has a vertical tangent.
2. [3 points] Determine the equation of the plane that passes through the origin and is perpendicular to the planes $x + z = 2001$ and $y + z + 2017 = 0$.
3. (a) [2 points] Sketch the graph of a curve $4x^2 - y^2 + 4y - 5 = 0$. What kind of a curve is it?
(b) [3 points] Sketch the graph of a surface $x^2 + y^2 = z^2 - 1$. What kind of a surface is it?
4. Consider a space curve $\vec{r}(t) = (t, t^2, 2t)$.
 - (a) [2 points] Compute the curvature of this curve at $t = 0$.
 - (b) [2 points] Compute T , N and B at $t = 0$.
 - (c) [2 points] Suppose that an airplane follows the curve \vec{r} and passes through $(0, 0, 0)$ with a constant speed of 1. Determine its velocity and its acceleration.