Unit 2 Group Work
MultiV 2021-22 / Dr. Kessner

No calculator! Have fun!

1. Consider the general helix:

$$\mathbf{r}(t) = \langle a\cos t, a\sin t, bt\rangle$$

a. Calculate the velocity, speed, and acceleration of this curve.

b. Calculate the tangent $\mathbf{T}(t)$, normal $\mathbf{N}(t)$, and binormal $\mathbf{B}(t)$ vector functions.

c. Find the equations of the osculating (TN), normal (NB), and rectifying (TB) planes at $t = 0$ and $t = \pi/2$.

2. a. Parametrize the general helix as in #1, but this time oriented along the x-axis. (As in #1, let a be the radius and b the speed along the axis).

b. Calculate the arc length of the curve as a function of t, starting from $t = 0$.

c. Re-parametrize the curve by arc length.

3. Consider the curve given by the spherical equations:

$$\rho = 4$$

$$\theta = \frac{\pi}{4}$$

$$\phi = t$$

a. Parametrize the curve in standard rectangular coordinates $\mathbf{r}(t) = \langle x(t), y(t), z(t) \rangle$. What is this curve?

b. Find the arc length of the curve as a function of t, and re-parametrize by arc length.

4. a. Consider the following function defined in polar coordinates:

$$r = \frac{12}{2 - \sin\theta}$$

Sketch the graph of the curve. Also find the equation of the function in rectangular coordinates.

b. Consider the following function defined in polar coordinates:

$$r = \frac{12}{2 + 2\sin\theta}$$

Sketch the graph of the curve. Also find the equation of the function in rectangular coordinates.