Math 20C **Homework 6** **Due November 15, 2019**

Note: *The score you earn will be based on the correctness of your solutions. A "right answer" will earn no credit without a correct solution to support it.*

(6 points) 1. Find the velocity vector, acceleration vector, and the equation of the tangent line for the curve $\mathbf{r} = \sqrt{2}\,t\,\mathbf{i} + e^t\,\mathbf{j} + e^{-t}\,\mathbf{k}$ at $t = 0$.

(6 points) 2. Determine which of the following paths are regular:

(a) $\mathbf{c}(t) = (\cos(t),\ \sin(t),\ t)$

(b) $\mathbf{c}(t) = \big(t^3,\ t^5,\ \cos(t)\big)$

(c) $\mathbf{c}(t) = \big(t^2,\ e^t,\ 3t+1\big)$

(6 points) 3. The acceleration, initial velocity, and initial position of a particle traveling through space are given by by

$$\mathbf{a}(t) = (2,-6,-4), \quad \mathbf{v}(0) = (-5,1,3), \quad \mathbf{r}(0) = (6,-2,1).$$

The particle's trajectory intersects the yz plane exactly twice. Find these two intersection points.

(6 points) 4. A body of mass 2 kilograms moves on a circle of radius 3 meters, making one revolution every 5 seconds. Find the magnitude of the centripetal force acting on the body. (Be sure to correctly state the units of the force.)

(6 points) 5. Find the arc length of the curve $\big(t,\ t,\ t^2\big)$ for $1 \le t \le 2$.

(6 points) 6. Let $\mathbf{c}$ be the path $\mathbf{c}(t) = \big(2t,\ t^2,\ \log(t)\big)$, defined for $t > 0$. Find the arc length of $\mathbf{c}$ between the points $(2,1,0)$ and $(4,4,\log(2))$.