Math 2153 – Recitation 4 September 17, 2015

1. Compute the unit tangent vector $\mathbf{T}(t)$ to the function
$$\mathbf{r}(t) = (\ln t)\,\mathbf{i} + \frac{1}{t}\,\mathbf{j} + \frac{1}{t^2}\,\mathbf{k}.$$
2. Give a definition for the vector-valued function $\mathbf{r}$ to be **continuous** at a.
3. Suppose $\mathbf{r}(t) = \langle f(t), g(t), h(t)\rangle$ and f is not continuous at $t = 3$. Can $\mathbf{r}$ be continuous at $t = 3$?
4. The acceleration of an object with initial position vector $\mathbf{r}_0 = 2\mathbf{i}$ and initial velocity vector $\mathbf{v}_0 = 3\mathbf{i} - 3\mathbf{j}$ is given by the vector-valued function
$$\mathbf{a}(t) = t^2\,\mathbf{i} + e^t\,\mathbf{j}.$$
   (a) Give the velocity function $\mathbf{v}(t)$.
   (b) Give the position function $\mathbf{r}(t)$.
5. Pam can throw a ball 20 meters on Earth where the acceleration of gravity is $9.8\,\mathtt{m/s^2}$.
   (a) How far could she throw a ball on the moon where the acceleration of gravity is $1.622\,\mathtt{m/s^2}$?
   (b) How far could she throw a ball on Mars where the acceleration of gravity is $3.711\,\mathtt{m/s^2}$?
   (c) How far could she throw a ball on Jupiter where the acceleration of gravity is $24.92\,\mathtt{m/s^2}$?
   (d) How far could she throw a ball on the sun where the acceleration of gravity is $274\,\mathtt{m/s^2}$?
6. Show that the distance between the point $\mathbf{q}$ and the line
$$\mathbf{r}(t) = \mathbf{r}_0 + t\,\mathbf{v}$$
is
$$\frac{|(\mathbf{q} - \mathbf{r}_0) \times \mathbf{v}|}{|\mathbf{v}|}.$$