Math 20C **Homework 4** **Due November 1, 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. Consider the circle C of radius 2, centered at the origin $(0,0)$.

(a) Find a parametrization for C inducing a counterclockwise orientation and starting at $(2,0)$.

(b) Find a parametrization for C if it is now centered at the point $(4,7)$.

(6 points) 2. The position vector for a particle moving on a helix is

$$\mathbf{c}(t) = \left(\cos(t), \sin(t), t^2\right).$$

(a) Find the speed of the particle at time $t_0 = 4\pi$.

(b) Find a parametrization for the tangent line to $\mathbf{c}(t)$ at $t_0 = 4\pi$.

(c) Where will this line intersect the xy-plane?

(6 points) 3. Find $\dfrac{\partial}{\partial s}(f \circ T)(1,0)$, where $f(u,v) = \cos(u)\sin(v)$ and $T : \mathbb{R}^2 \to \mathbb{R}^2$ is defined by $T(s,t) = \left(\cos\left(t^2 s\right), \log\left(\sqrt{1+s^2}\right)\right)$.

(6 points) 4. Let $g(u,v) = (e^u, u + \sin(v))$ and $f(x,y,z) = (xy, yz)$. Compute $\mathbf{D}(g \circ f)$ at $(0,1,0)$ using the chain rule.

(6 points) 5. Find the plane plane tangent to each of the following surfaces at the indicated point on the surface:

(a) the surface $x^2 + 2y^2 + 3xz = 10$ at the point $\left(1, 2, \dfrac{1}{3}\right)$

(b) the surface $y^2 - x^2 = 3$ at the point $(1,2,8)$

(6 points) 6. Find a unit normal vector to the surface $\cos(xy) = e^z - 2$ at the point $(1, \pi, 0)$.