# MULTIVARIABLE CALCULUS
# EXAM 2 - PART 1
# FALL 2019

**Name:**
**Honor Code Statement:**

**Directions:** Complete all problems - each is worth 10 points. Justify all answers/solutions. Calculators are not permitted. Best of luck.

(1) A particle is travelling along the path $\mathbf{x}(t) = (\cos(e^t), 3 - t^2, t)$ when suddenly at $t = 1$ all forces acting upon it cease. What happens to the particle? That is, find the tangent line to the path at the time $t = 1$.

*Date*: November 11, 2019.

(2) Calculate the length of the path $\mathbf{x}(t) = (t^2, \frac{2}{3}(2t+1)^{3/2})$ for $0 \leq t \leq 4$.

(3) Calculate the flow line $\mathbf{x}(t)$ for the vector field $\mathbf{F}(x, y, z) = 2\mathbf{i} - 3y\mathbf{j} + z^3\mathbf{k}$ that passes through the point $\mathbf{x}(0) = (3, 5, 7)$.

(4) For the vector field $\mathbf{F} = (\cos(yz) - x)\mathbf{i} + (\cos(xz) - y)\mathbf{j} + (\cos(xy) - z)\mathbf{k}$, find:

(a) the divergence

(b) the curl.

(1) For $f(x, y, z) = e^{2x-3y}\sin(5z)$ and the point $\mathbf{a} = (0, 0, 0)$, express the second order Taylor polynomial $p_2(x, y, z)$, using the derivative matrix and the Hessian matrix

(2) Identify and determine the nature of the critical point of the function $f(x, y, z) = x^2 - xy + z^2 - 2xz + 6z$.

(3) Use Lagrange multipliers to identify the critical points of $f(x, y, z) = x^2 + y^2 + z^2$ subject to the following constraint $x + y - z = 1$.