LAST NAME:	FIRST NAME:	CIRCLE: Martynova 8:30am / Martynova 1pm / Zweck

1 /10	2 /12	3 /12	4 /12	5 /12	6 /9	7 /8	T /75

MATH 2415 (Spring 2017) Exam I, Feb 17th

No books or notes! **NO CALCULATORS!** Show all work and give **complete explanations**. Don't spend too much time on any one problem. This 90 minute exam is worth 75 points.

(1) [10 pts] Let $P = (1, 1, 0)$ and $Q = (1, 2, 3)$ be two points and let $\mathbf{v} = -\mathbf{j} + 2\mathbf{k}$ be a vector.

(a) Find a parametrization for the line parallel to the vector $\mathbf{v}$ that passes through the point P.

(b) Calculate the projection of the vector $\overrightarrow{PQ}$ onto the vector $\mathbf{v}$.

(2) [12 pts] Let $A = (1, 3, 0)$ and $B = (2, 3, -4)$ and $C = (3, 3, 2)$ be three points.
(a) Find a point, D, so that A, B, C, and D are the vertices of a parallelogram.

(b) Find the area of the parallelogram in (a).

(c) Find a unit vector orthogonal to the plane containing the points A, B, and C.

(3) [12 pts]
(a) Find an equation of the form $Ax+By+Cz = D$ for the plane that passes through the point $P = (1, 3, 4)$ and contains the line L parametrized by $x = 3t$, $y = 4t$, $z = 2 + 2t$.

(b) Find the point of intersection of the line $\mathbf{r}(t) = (t, t + 1, t + 2)$ and the plane $x + y + z = 6$.

(4) [12 pts] Let C be the curve with parametrization $x = t\sin 2t$, $y = t\cos 2t$, $z = t$ for $0 \leq t \leq 2\pi$.

(a) Show that the curve, C, lies on the surface $z = \sqrt{x^2 + y^2}$. Sketch the surface and the curve.

(b) Calculate a parametrization of the tangent line to the curve C at the point where $t = \frac{\pi}{2}$.

(5) [12 pts] Make labelled sketches of the traces (slices) of the surface

$$y \;=\; 4x^2 \;+\; 9z^2$$

in the planes $x = 0$, $z = 0$, and $y = k$ for $k = 0, \pm 1, \pm 2$. Then make a labelled sketch of the surface.

(6) [9 pts] Sketch the level curves of the function $z = (y^2 - x)^3$ at levels $k = 0$, $k = \pm 8$.

(7) [8 pts] Convert the point with cylindrical coordinates $(r, \theta, z) = (3, \frac{\pi}{4}, 4)$ into spherical coordinates.