NAME:

1 /12	2 /9	3 /16	4 /16	5 /6	6 /16	T /100

MATH 2415 (Spring 2014) Exam I, Feb 28

Dr. Zweck's Class

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

(1) [12 pts]
(a) Find a vector parametrization of the line through the points $(0, 1, 2)$ and $(2, 4, -3)$.

(b) Find two unit vectors that are perpendicular to both of the vectors $\mathbf{a} = (1, 2, 3)$ and $\mathbf{b} = (-1, 1, 0)$.

(2) [9 pts] Let $\mathbf{a} = (-5, 12)$ and $\mathbf{b} = (4, 6)$ be two vectors in the plane.

(a) Draw a picture showing the vectors $\mathbf{a}$ and $\mathbf{b}$ together with the vector projection of $\mathbf{b}$ onto $\mathbf{a}$.

(b) Calculate the vector projection of $\mathbf{b}$ onto $\mathbf{a}$.

(3) [16 pts]

(a) Consider the plane whose level set equation is given by $4(x-1)+2(y-5)+6(z-3)=0$. Find a point $\mathbf{p}$ and a pair of vectors $\mathbf{v}$ and $\mathbf{w}$ so that any point $\mathbf{r}$ in this plane can be written in the form $\mathbf{r}=\mathbf{p}+s\mathbf{v}+t\mathbf{w}$ for some scalars s and t.

(b) Find the level set equation of the plane through the point $(1,5,2)$ that is perpendicular to the planes $2x+y-2z=2$ and $x+3z=4$. *Hint:* If two planes are perpendicular how are their normal vectors related?

(4) [16 pts] Make a labelled sketch of the traces of the surface

$$z = 4y^2 - x^2$$

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

(5) [6 pts] If $\mathbf{a}\cdot\mathbf{b} = \sqrt{3}$ and $\mathbf{a} \times \mathbf{b} = (1, 2, 2)$, find the angle between $\mathbf{a}$ and $\mathbf{b}$.

(6) [16 pts] This problem concerns the parametrized curve $\mathbf{r}(t) = (t\cos t, t\sin t, t)$ for $0 \leq t \leq 2\pi$.

(a) Calculate the velocity vector of the curve at $t = \pi/2$.

(b) Find a formula for the speed of the curve as a function of time.

This problem concerns the parametrized curve $\mathbf{r}(t) = (t\cos t, t\sin t, t)$ for $0 \leq t \leq 2\pi$.

(c) Show that the curve lies on the cone $z^2 = x^2 + y^2$.

(d) Sketch the cone and the curve lying on it.

Please sign the following honor statement:

On my honor, I pledge that I have neither given nor received any aid on this exam.

Signature: _____