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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)	[Q	nts	Let	a = 1	(-5)	12)	and	h =	(4	6)	he	two	vectors	in	the	nlane
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(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 ${\bf b}$ onto ${\bf a}$.

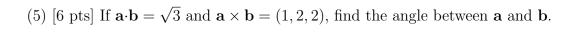
- (3) [16 pts]
- (a) Consider the plane whose level set equation is given by 4(x-1) + 2(y-5) + 6(z-3) = 0. Find a point **p** and a pair of vectors **v** and **w** so that any point **r** in this plane can be written in the form $\mathbf{r} = \mathbf{p} + s\mathbf{v} + t\mathbf{w}$ for some scalars s 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.



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

(c) Show that the curve lies on the cone z² = x² + y². (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:	This problem concerns the parametrized curve $\mathbf{r}(t) = (t \cos t, t \sin t, t)$ for $0 \le t \le 2\pi$.
Please sign the following honor statement: On my honor, I pledge that I have neither given nor received any aid on this exam.	(c) Show that the curve lies on the cone $z^2 = x^2 + y^2$.
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