EXAM 1, Math 273 fall 2015 Name: ____________________ ID#: __________

Circle your instructor: Thomas Cameron Eric Remaley Lydia Miller Robert Dillon

Do any 6 of these 8 problems. **You must ex out or leave blank the work space for the two problems you do not want graded**. The numbers in the [ ] tell what each problem or part is worth. **Unsimplified answers are generally okay**, though we might take a point for leaving things like $\cos(\pi)$ or e^0 or $\ln(1)$. Show work or explanation on everything.

[15] **1.** Find the equation of the plane that contains both of the intersecting lines $\vec{\mathbf{r}}_1(t) = \langle 1+t,\ 2-3t,\ 5-4t \rangle$ and $\vec{\mathbf{r}}_2(s) = \langle 1-2s,\ 2+s,\ 5-3s \rangle$.

[15] **2.** Find parametric equations for the line that contains the point $(-2, 1, 3)$ and is perpendicular to the plane $6x - y - 3z = 10$.

[15] **3.** For the curve $\vec{\mathbf{r}}(t) = \langle t-3,\, \sqrt{t}\,\rangle$, do the following:

[5] a) Find $\vec{\mathbf{r}}'(t)$.

[10] b) Find the t value for which $\vec{\mathbf{r}}(t)$ and $\vec{\mathbf{r}}'(t)$ are orthogonal. That is, find t such that $\vec{\mathbf{r}}(t) \cdot \vec{\mathbf{r}}'(t) = 0$

[15] **4.** Suppose a particle's acceleration is $\vec{\mathbf{a}}(t) = \langle 3,\, t^2,\, e^{-t}\rangle$, and the particle's initial velocity is $\vec{\mathbf{v}}(0) = \langle 2,\, 1,\, 0\rangle$.

[10] a) Find the particle's velocity function $\vec{\mathbf{v}}(t)$.

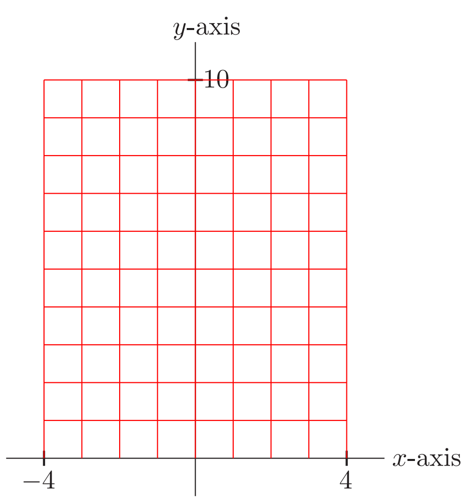
[5] b) Set up an integral whose value would give the distance travelled by the particle from $t = 0$ to $t = 1$.

[15] **5.** For the surface $x + \frac{y^2}{4} + \frac{z^2}{9} = 1$, do the following:

[10] a) Below, the surface's trace in the xy-plane has been found and graphed. Find and graph the surface's traces in the xz- and yz-planes.

[5] b) Which graph below best represents this surface? (circle your answer)

[15] **6.** For the function $f(x, y) = \sqrt{x^2 + y}$, graph the level curves (a.k.a. contours) $f(x, y) = 0$, $f(x, y) = 1$, $f(x, y) = 2$, $f(x, y) = 3$ in the window provided. Label each curve with its z-level.



[15] **7.** Let function h be defined like this: $h(x,y) = \begin{cases} \frac{3xy}{x^2+4y^2} & \text{if } (x,y) \neq (0,0) \\ 0 & \text{if } (x,y) = 0 \end{cases}$

[10] a) Prove that $\lim\limits_{(x,y)\to(0,0)} \dfrac{3xy}{x^2+4y^2}$ does not exist.

[5] b) At which points in $\mathbb{R}^2$ is h continuous? At which points in $\mathbb{R}^2$ is h discontinuous? Explain.

[15] **8.** Find $f_x(x,y)$ and $f_y(x,y)$ for the function $f(x,y) = x^2y^3 + 5x - \dfrac{x}{y^2}$.