Math 2415 Fall 2016

Friday Problem Session on 13.3, 14.1, 14.2

1. If you didn't do one of these projects last week do it today:
   (a) Active Learning Models Project #2: Saddle Surfaces.
   (b) Active Learning Models Project #1: Circular Paraboloids
2. 13.3.3
3. 13.3.11
4. Let $z = f(x, y) = e^{-x-y}$. Sketch the contours of $f(x, y) = k$ for $k = -1$, $k = 0$, $k = 1$, $k = 2$. Use this information to help you sketch the graph of f.
5. 14.1.47
6. 14.1.45
7. 14.1.61
8. 14.1.62
9. 14.2.9
10. $\lim_{(x,y)\to(0,0)} \frac{xy}{\sqrt{x^2+y^2}}$.
11. $\lim_{(x,y)\to(0,0)} \frac{3x+y}{\sqrt{x^2+y^2}}$.
12. 14.2.39
13. 14.2.16
14. $\lim_{(x,y)\to(0,0)} \frac{x^2\sin(y^2)}{(x^2+y^2)^2}$.
15. $\lim_{(x,y)\to(0,0)} \frac{y^2+2\sin^2 x}{\sqrt{x^4+y^4}}$.
16. 14.2.29
17. 14.2.33
18. (From Fall 2010, Exam 1) Find the traces (i.e., slices) of the surface

$$x^2 = 1 + \frac{y^2}{4} + \frac{z^2}{9}$$

    in the planes $y = 0$, $z = 0$, and $x = k$, for $k = 0, \pm 1, \pm 2, \pm 3$. Then sketch the surface and name it.
19. (From Fall 2009, Exam 1)

(a) Find a vector parametric equation for the line through the point $(1, 2, -1)$ that is normal to the plane $2x - y + 3z = 12$.

(b) Find a parametrization of the plane containing the point $(1, -2, 1)$, $(2, -1, 0)$ and $(3, -2, 2)$.

20. (From Fall 2011, Exam II) Consider the curve, C, in the plane parametrized by

$$(x, y) = \mathbf{r}(t) = (2\sin t, \cos t) \qquad \text{for } 0 \leq t \leq 2\pi.$$

(a) Find $\mathbf{r}'(\pi/4)$.

(b) Find a parametrization for the tangent line to the curve, C, at $t = \pi/4$.

(c) Sketch the curve, C, and include in your sketch the vectors $\mathbf{r}(\pi/4)$ and $\mathbf{r}'(\pi/4)$.

21. 13.2.27

22. (From Fall 2006 Exam 1) Suppose that

$$\mathbf{r}(s, t) \ = \ (1 + 2s - 3t, 5 + s, -3 + 4s - t)$$

is a parametrization of a plane. Find a level set equation for this plane, *i.e.*, an equation of the form $ax + by + cz = d$.

23. (From Fall 2006 Exam 1) Show that the parametrized curve $\mathbf{r}(t) = (\cos t, \sin t, 1)$ lies on the following two surfaces:

(a) $\rho = \sqrt{2}$ (in spherical coordinates)

(b) $z = r$ (in cylindrical coordinates).

Also sketch both surfaces and the curve in the same figure.

24. (From Fall 2006 Exam 1) Show that the volume of the parallelipiped determined by the three vectors $\mathbf{u}$, $\mathbf{v}$ and $\mathbf{w}$ is $|\mathbf{u} \cdot (\mathbf{v} \times \mathbf{w})|$.