241 Final Fall 2013 Notes

1. (a) Take two pairs of points to build two vectors and cross them to get the normal vector to the plane. Use this as well as one of the points to get the equation.
   (b) Same vector but use P specifically.
   (c) The radius of the sphere is the only missing thing and it's equal to the distance from the origin to the plane.
2. (a) Derivative and second derivative.
   (b) This is just the length of the curve from $t = 0$ to $t = 1$ which is the integral of the magnitude of the derivative of $\bar{r}$.
   (c) Formulas!
3. We didn't cover the Wave Equation specifically but all you're doing here is taking partials of the u in each part and plugging them into the equation to see if they're true. It's really just an exercise in partial derivatives.
4. Take the derivatives and set them equal to 0 to get the critical points. Plug each point into the discriminant (and perhaps f_{xx}) to categorize.
5. In this case the substitution is $u = \frac{x}{2}$ and $v = \frac{y}{5}$. The new region is a circle which then can be done with polar. The integrand looks messy but works out to be a simple substitution when you integrate.
6. (a) This is not GT, ST or FTOLI so you just need to use the first method we learned for line integrals of vector fields.
   (b) Note that this circle in polar is $r = 4\cos\theta$ so when you integrate over R use polar. The $N_x - M_y$ is not as ugly as you might think at first.
7. Parametrize the surface with $\bar{r}(x, y)$ where z is in terms of x and y and x, y are constrained in a triangle. Go from there (derivatives, cross product, etc.)
8. The sphere looks challenging but in spherical it's just $\rho^2 = 4\rho\cos\phi$ or $\rho = 4\cos\phi$. This is your outer function, the inner function is 0. The cone is just $\phi = \pi/3$ written awkwardly.