241 Final Spring 2012 Notes

1. (a) Find the vector for the line containing the points (subtract) and show it's a multiple of the one for the line given.
   (b) Plug it in and see the equalities fail.
   (c) Formula! Make sure that you know how to get a point and the vector out of the symmetric equations.
2. (a) Easier than it looks. Use the product rule to take the derivative and note that a vector crossed with itself is zero.
   (b) Formula!
3. Formula. This is not so bad if you're careful.
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. (a) The normal vector for the plane would be the gradient of f at the point. Use that vector and the point to build the plane.
   (b) Gradient again, except divide by its magnitude.
   (c) Magnitude of the gradient.
6. (a) Change the order of integration.
   (b) Cylindrical coordinates are best. You'll need to set them equal to get the radius of the disk.
7. (a) FTOLI.
   (b) The curve C is not so easy to see but the surface Σ is not so bad, it's just the part of the paraboloid given. This is easiest in cylindrical coordinates, your R would be a half-disk of radius 3.
8. (a) Only one way to do this - parametrize Σ with $\bar{r}(y,\theta) = 3\cos\theta\,\hat{\imath} + y\,\hat{\jmath} + 3\sin\theta\,\hat{k}$ and go from there. The magnitude of the cross product of the derivatives turns out to be pretty nice.
   (b) This is the Divergence Theorem and it's nice because the divergence is a constant, letting you use the volume trick.