Review Practice: Chapters 14 & 15

1. Consider $f(x, y) = x^2 + 2x - y$

   (a) Find all first and second partials

   (b) Find the gradient

   (c) What types of graphs are the level curves of f?

2. Find all critical points of $f(x, y) = x^3 - 12x + y^2$ and classify them using the second derivative test.

3. If $x = f(x, y)$ and $x = g(r, s)$ and $y = h(r, s)$ use chain rule to find $\frac{\partial z}{\partial s}$

4. Compute by changing the order of integration: $\int_0^1 \int_x^1 y^2 \sin(xy)\, dy\, dx$

5. Compute $\int\int_D x\ dA$ where D is the region in the first quadrant between $x^2+y^2=1$ and $x^2+y^2=2$.

6. Compute $\int\int\int_E z\ dV$ where E is the region in the first octant between $y^2+z^2=1$ and $x+y=2$.

7. If the cylinderical coords of a point are $(2\sqrt{3}, 3\pi/4, 2)$ find the sphereical coords of the point.