Math 117
Answers to Exam 3 Practice Problems

1. $2\pi$

2. (a) $x = u, y = v, z = 6 - 1/2u - 2v; 0 \leq u \leq 12 - 4v, 0 \leq v \leq 3$
   
   (b) $x = 3 \sin u \cos v, y = 3 \sin u \sin v, z = 3 \cos u; 0 \leq u \leq \pi, 0 \leq v \leq 2\pi$

3. Since $\mathbf{F}$ is conservative, $\mathbf{F} = \nabla \phi$ for some function $\phi$. Then $g = \frac{\partial \phi}{\partial y}$ and $h = \frac{\partial \phi}{\partial z}$, so $\frac{\partial g}{\partial z} = \frac{\partial^2 \phi}{\partial z \partial y}$ and $\frac{\partial h}{\partial y} = \frac{\partial^2 \phi}{\partial y \partial z}$. Since $\frac{\partial^2 \phi}{\partial z \partial y} = \frac{\partial^2 \phi}{\partial y \partial z}$, it follows that $\frac{\partial g}{\partial z} = \frac{\partial h}{\partial y}$.

4. (a) $\phi(x, y) = x^2y^2 + e^{3y}$
   
   (b) $4 + e^{-3} - e^3$

5. $-9/2$

6. $6\pi$

7. $(\pi^3/2) + 1$; Hint: Use the Fundamental Theorem of Line Integrals.

8. $\frac{128\sqrt{2\pi}}{3}$

9. $5\sqrt{14}$