1) Evaluate the integral.

a) $\int_{\pi}^{2\pi}\int_{4}^{7} r\,dr\,d\theta$

b) $\int_{0}^{\pi/2}\int_{0}^{4\cos\theta} r\,dr\,d\theta$

c) $\int_{0}^{\pi/2}\int_{0}^{1-\cos\theta} (\sin\theta)\, r\,dr\,d\theta$

a) $\boxed{\frac{33\pi}{2}}$

b) $\boxed{2\pi}$

c) $\boxed{\frac{1}{6}}$

2) Evaluate the given integral by changing to polar coordinates.

a) $\iint_D xy\ dA$ Where D is the disk with center at the origin and radius 3.

b) $\iint_R \cos\left(x^2+y^2\right)\ dA$, where R is the region that lies above the x-axis within the circle $x^2+y^2=9$

c) $\iint_R \arctan\left(\frac{y}{x}\right)\ dA$, where $R=\left\{(x,y)\,|\,1\le x^2+y^2\le 4,\ 0\le y\le x\right\}$

d) $\iint_D x\ dA$, where D is the region in the first quadrant that lies between the circles $x^2+y^2=4$ and $x^2+y^2=2x$

a) $\boxed{0}$

b) $\boxed{\frac{\pi}{2}\sin 9}$

c) $\boxed{\frac{3}{64}\pi^2}$

d) $\boxed{\frac{16-3\pi}{6}}$

3) Use a double integral to find the area of the region.

   a) One loop of the rose $r = \cos 3\theta$.

   b) The region within both of the circles $r = \cos\theta$ and $r = \sin\theta$.

   a) $\boxed{\dfrac{\pi}{12}}$

   b) $\boxed{\dfrac{1}{8}(\pi - 2)}$

4) Use polar coordinates to find the volume of the given solid.

   a) The solid bounded by the paraboloid $z = 10 - 3x^2 - 3y^2$ and the plane $z = 4$.

   b) The solid inside the hemisphere $z = \sqrt{16 - x^2 - y^2}$ and outside the cylinder $x^2 + y^2 = 1$.

   a) $\boxed{6\pi}$

   b) $\boxed{10\sqrt{15}\pi}$

5) Evaluate the iterated integral by converting to polar coordinates.

a) $\int_0^1 \int_0^{\sqrt{1-x^2}} e^{x^2+y^2} \, dy\, dx$

b) $\int_0^2 \int_{-\sqrt{4-y^2}}^{\sqrt{4-y^2}} x^2 y^2 \, dx\, dy$

a) $\boxed{\frac{1}{4}\pi(e-1)}$

b) $\boxed{\frac{4\pi}{3}}$