1. Compute the following integrals. If asked, also change the order of integration. You may use whichever coordinate system you choose.

   (a) $\int_{-3}^{2}\int_{0}^{y^2}(x^2+y)\,dxdy$

   (b) $\int_{0}^{1}\int_{x}^{1} xy\,dydx$. Change the order of integration.

   (c) $\int_{D}\cos(x^2+y^2)\,dA$, where D is the region $x^2+y^2\leq 1$.

   (d) $\int_{C} f(x,y,z)\,dV$ where C is the region inside the cylinder $x^2+y^2\leq 9$ and where $-1\leq z\leq 2$, and $f(x,y,z)=z\sqrt{x^2+y^2}$.

   (e) $\int_{C} f(x,y,z)\,dV$, where C is the unit sphere $x^2+y^2+z^2\leq 1$ and $f(x,y,z)=\frac{1}{x^2+y^2+z^2}$.

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2. For the following change of variables, compute dA.

   (a) $f(u,v)=\left(\frac{u}{2}-\frac{3v}{4},\frac{v}{4}\right)$

   (b) $x=2u+3v$ and $y=2u-3v$.

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3. Find the average value of the function $f(x,y)=3e^y\sqrt{x+e^y}$ over the rectangle $R=[0,1]\times[0,3]$.

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4. A rod has length 2 meters. At a distance x meters from the left endpoint of the rod, the density is given by $\delta(x)=2+6x$ gm/m. Find the total mass of the rod.

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5. The density of electric charge is $\rho(x,y)=xy$ distributed over a region $D=\{(x,y)|1-x\leq y\leq 1, 0\leq x\leq 1\}$. Find the total charge.

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6. Find the mass of the triangle with vertices $A(0,0)$ $B(1,0)$ and $C(0,2)$ and density $\rho(x,y)=1+3x+y$.

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7. Convert

$$\int_{0}^{3}\int_{0}^{\sqrt{9-y^2}}\int_{\sqrt{x^2+y^2}}^{\sqrt{18-x^2-y^2}}(x^2+y^2+z^2)\,dzdxdy$$

   into spherical coordinates.
