1. For the following functions, sketch the region of integration and evaluate the integral. You may switch the order of integration in any problem if it makes to problem easier.

   (a) $\displaystyle\int_{\pi}^{2\pi}\int_{0}^{\pi} \sin(x)+\cos(y)\ dx\,dy$

   (b) $\displaystyle\int_{0}^{\pi}\int_{0}^{\sin x} y\ dy\,dx$

   (c) $\displaystyle\int_{R} x\,dA$, where R is the triangle with vertices $(0,0),(1,1)$, and $(1,2)$.

   (d) $\displaystyle\int_{1}^{2}\int_{y}^{y^2} dx\,dy$

   (e) $\displaystyle\int_{0}^{2}\int_{x}^{2} 2y^2\sin(xy)\ dy\,dx$

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2. For each integral in problem 1, rewrite the integral by switching the order of integration, if you have not done so already. You do not have to evaluate the integral again.

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3. Evaluate the following double integrals.

   (a) $\displaystyle\int_{R} y\sin(x^3)\,dA$, where R is the triangle with vertices $(0,0),(2,2)$, and $(2,0)$.

   (b) $\displaystyle\int_{R}(y-2x^2)\,dA$, where R is the region bounded by the square $|x|+|y|=1$.

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4. A (noncircular) cylinder has its base R in the xy-plane and is bounded above by the paraboloid $z=x^2+y^2$. The volume is given by $\displaystyle\int_{0}^{1}\int_{0}^{y}(x^2+y^2)dxdy+\int_{1}^{2}\int_{0}^{2-y}(x^2+y^2)dxdy$. Sketch R, and express the volume as a single integral with the order of integration reversed. Then find the volume.

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5. Find the volume of the solid in the first octant bounded by the coordinate planes, the cylinder $x^2+y^2=4$, and the plane $z+y=4$.