Math 251H1 - Workshop #4   Due Date: 4/16/09

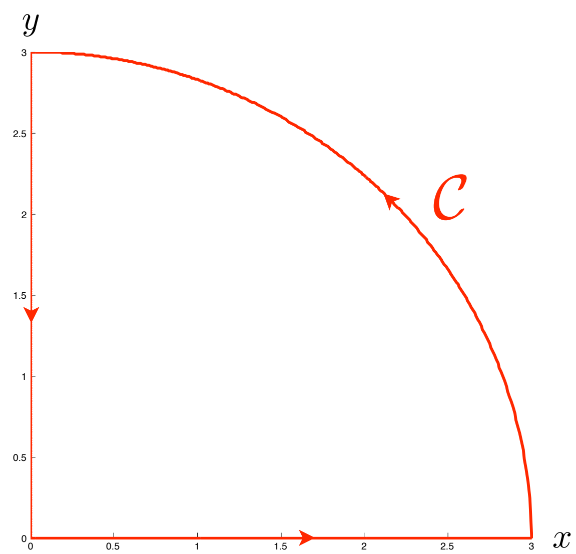
1. Use the change of coordinates $\Phi(u,v) = (u - 2v, v)$ to compute

$$\iint_{\mathcal{D}} (x + 3y)\,dx\,dy,$$

where $\mathcal{D}$ is the region bounded by $y = 1$, $y = 3$, $x + 2y = 10$ and $x + 2y = 6$.

2. Use a double integral to find the area of one loop of the rose $r = \sin 4\theta$.

3. Calculate $\int_{\mathcal{C}} y^3 dx + x^2 dy$, where the curve $\mathcal{C}$ is given by



4. Find the volume of the solid contained in the cylinder $x^2 + y^2 = 1$ below the curve $z = (x+y)^2$ and above the curve $z = -(x-y)^2$.

5. Find the work done by the force field

$$\mathbf{F}(x,y) = x\sin(y)\mathbf{i} + y\mathbf{j}$$

on a particle that moves along the parabola $y = x^2$ from $(-1, 1)$ to $(2, 4)$.

6. Integrate the function $f(x,y,x) = \sqrt{x^2 + y^2 + z^2}$ over the region $x^2 + y^2 + z^2 \leq 2z$.

7. Show that if $\mathbf{F}$ is a constant vector field in $\mathbb{R}^3$ and $\mathcal{C}$ is any oriented path connecting the two 3-dimensional points P to Q, then

$$\int_{\mathcal{C}} \mathbf{F} \cdot ds = \mathbf{F} \cdot \overrightarrow{PQ}.$$