POLAR INTEGRALS

Do the following by changing to polar coordinates.

1. Find the area of one petal of the rose $r = \cos 2\theta$.

2. Find the area of one petal of the rose $r = \sin 3\theta$

3. Prove that the area of a circle is πr^2 by evaluating $\iint_R dA$ where R is the disk $x^2 + y^2 \le r^2$.

4. Evaluate $\iint_R \left(x^2 + y^2\right) dA$ where R is the disk $x^2 + y^2 \le 4$.

5. Evaluate $\iint_R \sqrt{x^2 + y^2}\, dA$ where R is the disk $x^2 + y^2 \le 1$.

6. Find the volume of the solid bounded above by $z = x^2 + y^2 + 1$ and below by the disk $x^2 + y^2 \le 1$.

7. Find the volume inside the paraboloid $z = x^2 + y^2$ for $0 \le z \le 4$.

8. Find the surface area of the portion of the paraboloid $z = 4 - x^2 - y^2$ that lies above the xy-plane.