Question 1

$$2\int_0^{\frac{\pi}{2}}\int_0^{\sqrt{3}} e^{r^2}\cdot r\,dr\,d\theta = \left(-\frac{1}{2}+\frac{e^3}{2}\right)\pi$$

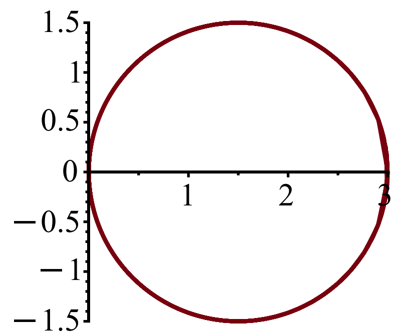
Question 2

$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}\int_0^{\sqrt{3}}\cos(r^2)\cdot r\,dr\,d\theta = \frac{\sin(3)\,\pi}{2}$$

Question 3

1. convert to polar: $z=x^2+y^2 \rightarrow z=r^2$ and $x^2+y^2=3x \rightarrow r^2=3r\cos\theta \rightarrow r=4\cos\theta$

2. then figure out bounds by drawing the circle $r=3\cos(\theta) \rightarrow$



now we can see r is bounded by $0 \le r \le 3\cos\theta$ and θ is bounded from $0 \le \theta \le \frac{\pi}{2}$

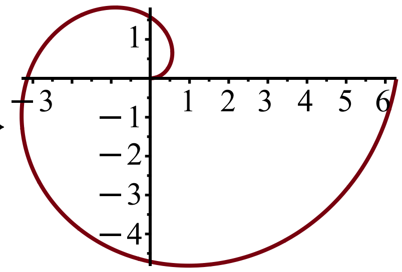
3. Set up the integral with our new bounds adding our jacobian $\int_0^{\pi}\int_0^{3\cos(\theta)}\int_{0.0}^{r^2} 1\,dz\,r\,dr\,d\theta$

or $\int_0^{\pi}\int_0^{3\cos(\theta)} r^2\cdot r\,dr\,d\theta$ (b/c $z=x^2+y^2=r^2$ is given)

6. Next evaluate the integral

$$\int_0^{\pi}\frac{1}{4}(3\cos(\theta))^4 d\theta \Rightarrow \int_0^{\pi}\frac{81}{4}\cos^4(\theta)\,d\theta = \frac{243\,\pi}{32}$$

Question 4

1. Sketch the graph of $r = \theta \rightarrow$ 

2. bounds would be $0 \leq r \leq \theta$ and $0 \leq \theta \leq \frac{3\pi}{2}$ because it is bounded by the - y axis

3. Set up the integral with our new bounds and adding the jacobian $\int_0^{\frac{3\pi}{2}} \int_0^{\theta} r \, dr \, d\theta = \frac{9\pi^3}{16}$

Question 5

1. Sketch the graph of $x^2 + y^2 = 100 \rightarrow$