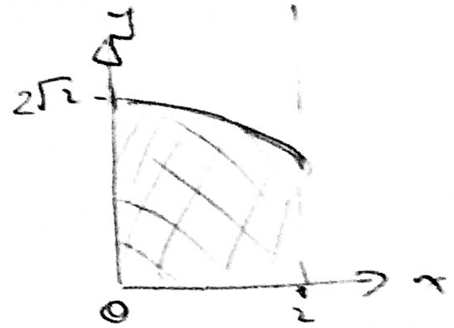
1. **(17 marks)** Use polar coordinates to find the area of the region in the first quadrant, which is bounded by the x-axis, the line $x = 2$, and the circular arc $x^2 + y^2 = 8$.

HINT: For a given choice of θ, what is the range for r?

Use the formula $\displaystyle\int \frac{du}{\cos^2 u} = \tan u + C$.



$x^2+y^2=(\sqrt{8})^2$

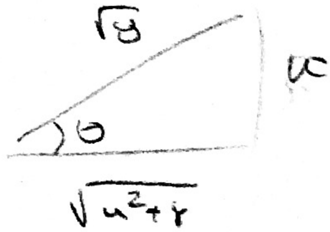
$= \int_0^2 \int_0^{\sqrt{8-x^2}} dy\,dx$

$= \int_0^2 \sqrt{8-x^2}\,dx$

=

$u=\sqrt{8}\sin\theta$

$du=\sqrt{8}\cos\theta\,d\theta$



$\frac{2}{\sqrt{8}}=\sin\theta$

$\frac{2}{2\sqrt{2}}=\frac{1}{\sqrt{2}}=\sin\theta$

$\theta=\frac{\pi}{4}$

$0=\sin\theta$

$\theta=0$

$= \int (\sqrt{8})\sqrt{1-\sin^2\theta}\,(\sqrt{8}\cos\theta)\,d\theta$

$= 8\int \cos^2\theta\,d\theta$

$= \frac{8}{2}\int (1+\cos 2\theta)\,d\theta$

$= 4\left(\theta+\frac{\sin 2\theta}{2}\right)\Big|_0^{\frac{\pi}{4}}$

$= 4\left(\frac{\pi}{4}+\frac{\sin(\frac{\pi}{2})}{2}-\left(0+\frac{\sin(0)}{2}\right)\right)$

$= 4\left(\frac{\pi}{4}+\frac{1}{2}\right)$

$= \boxed{\pi+2}$