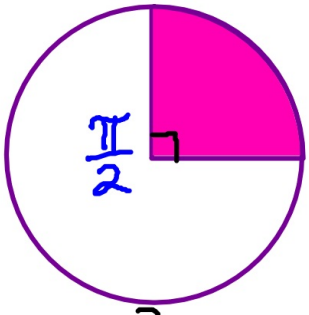
Find the area enclosed by $r = 2(1 + \cos\theta)$

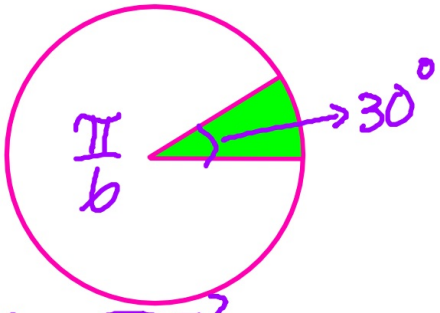
Let's simplify it and look at a circle:



$$A = \frac{\pi r^2}{4}$$

$$A = \frac{\pi}{4} r^2$$

$$A = \frac{1}{2} \cdot \frac{\pi}{2} r^2$$



$$A = \frac{\pi r^2}{12}$$

$$A = \frac{\pi}{12} r^2$$

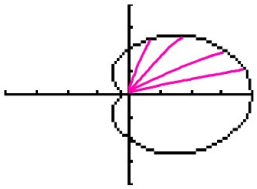
$$A = \frac{1}{2} \cdot \frac{\pi}{6} r^2$$

Area of a sector

$$\frac{1}{2}\theta r^2 = \frac{1}{2} r^2 \theta$$

↑ radians

Find the area enclosed by $r = 2(1 + \cos\theta)$



Area of sectors with θ as small as possible $(d\theta)$

$$A = \int_{\alpha}^{\beta} \frac{1}{2} r^2 \, d\theta$$

$$A = \int_{0}^{2\pi} \frac{1}{2}\left(2(1+\cos\theta)\right)^2 d\theta = 18.849$$

Area of Polar Curves

$$A = \frac{1}{2}\int_{\alpha}^{\beta} (r_2)^2 - (r_1)^2 \, d\theta$$

r_2: outside radius

r_1: inside radius

Find the area inside the smaller loop of $r=2\sin\theta-1$

when does $r=0$

$0=2\sin\theta-1$

$1=2\sin\theta$

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

$\theta=\frac{\pi}{6},\frac{5\pi}{6}$

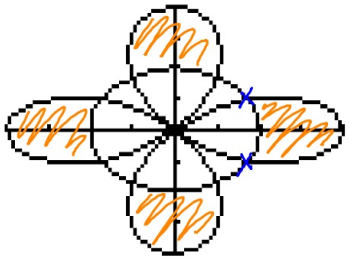
$$A=\frac{1}{2}\int_{\frac{\pi}{6}}^{\frac{5\pi}{6}}(2\sin\theta-1)^2\,d\theta$$

0.543

or

0.544

Find the area inside $r=4\cos2\theta$ and outside $r=2$



$2=4\cos2\theta$

$\frac{1}{2}=\cos(2\theta)$

$\frac{\pi}{3},\frac{4\pi}{3}=2\theta$

$\frac{\pi}{6},\frac{4\pi}{6}=\theta$

$$A_1=\frac{1}{2}\int_{0}^{\frac{\pi}{6}}(4\cos2\theta)^2-2^2\,d\theta$$

$A_1=1.913$

$A_T=8(A_1)$

$=15.304$

Test ~~Friday:~~ Tuesday April 2nd
~ open note

Sample Exam 2
Due Wed 4/3

Assignment
#13, 14
Quiz 4/3

~ parametric function:
- first derivatives
- second derivatives
- arc length
- interpreting

~ vectors
- position ←→ velocity ←→ acceleration
- distance traveled
- displacement
- speed

~ polar functions
- derivatives
- slope of tangent line
- area

~ series