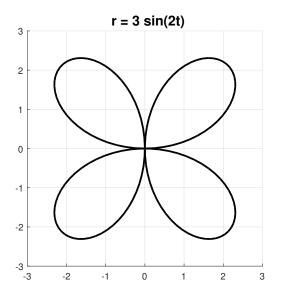# MAT 126.01, Prof. Bishop, Thursday, Dec 3, 2020
Section 7.4 Area and arclength in polar coordinates
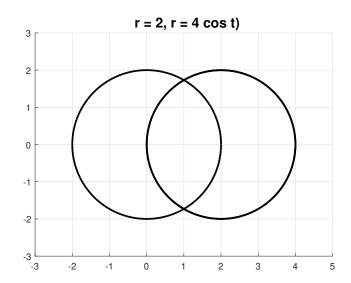## Outline of final

Polar coordinates describe point using $r = $ distance from origin, and $\theta = $ angle from positive real axis.

$$x = r\cos\theta, \quad y = r\sin\theta.$$

Area formula: If $r = f(\theta)$,

$$\text{Area} = \frac{1}{2}\int_a^b r^2 d\theta = \frac{1}{2}\int_a^b f(\theta)^2 d\theta.$$

Compute area of one petal of the rose $r = 3\sin(2\theta)$.

r = 3 sin(2t)
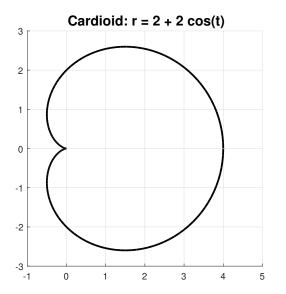
Find area outside circle $r = 2$ and inside $r = 4\cos(\theta)$.

r = 2, r = 4 cos t)

Arclength formula: If $r = f(\theta)$,

$$\text{Arclength} = \int_a^b \sqrt{r^2 + (d\theta/dr)^2}\,d\theta = \int_a^b \sqrt{f(\theta)^2 + (f'(\theta))^2}\,d\theta$$

Compute arclength of the cardioid $r = 2 + 2\cos(\theta)$.

Cardioid: r = 2 + 2 cos(t)

Final exam: 2:15pm to 5:00 pm Thursday Dec 10, 2020

On Blackboard Lumen page.

Please join Zoom meeting on Zoom page. Turn your camera on.

20 questions, some have multiple parts. 40 point total.

One attempt per answer.

Question 1, 1 part: sigma notation

Question 2, 2 parts: left and right hand sums

Question 3, 1 part: properties of left/right sums

Question 4, 1 part: fundamental theorem of calculus

Question 5, 1 part: acceleration, velocity, position

Question 6, 3 parts: trigonometric substitution

Question 7, 1 part: compute integral from graph

Question 8, 1 part: variable density disk

Question 9, 2 parts: differentiate exponential functions

Question 10, 2 parts: surface area of region of revolution

Question 11, 2 parts: volume of region of revolution

Question 12, 2 parts: arclength of graph

Question 13, 1 part: arclength of graph

Question 14, 1 part: theorem of Pappus

Question 15, 2 parts: disk method

Question 16, 4 parts: partial fractions

Question 17, 2 parts: work problem

Question 18, 4 parts: match formulas for $x(t), y(t)$ to pictures of curves

Question 19, 3 parts: tangents and arclength of parametric curve

Question 20, 5 parts: improper integrals converge/diverge?