

1. Demonstrate how to use the cheer to evaluate $\int \sin^2 x dx$.

2. *The Circle Roll*: Start (see Figure 1) with a unit circle centered at $(0, 1)$ and point P at the origin. Now roll the circle along the x -axis and record the path taken by point P . As seen in Figure 2, the (dotted) path is a nice curve. Point O' is the intersection of the circle with the x -axis.

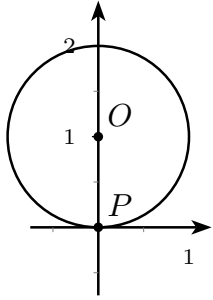


Figure 1: start

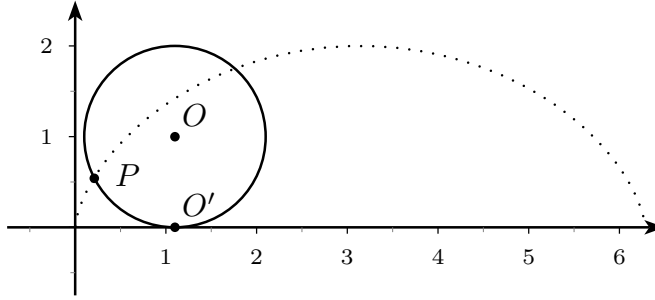


Figure 2: roll and path

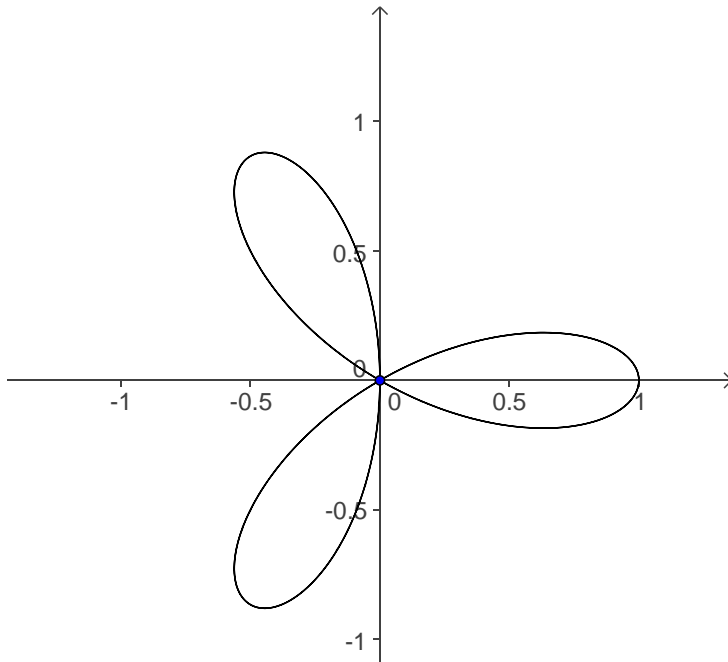
- (a) Consider figure 2. Using t as the measure of $\angle O'OP$,
- i. develop coordinates for point O in terms of t
 - ii. develop coordinates for point P in terms of t

Be sure you can explain why your answers are correct.

- (b) Check your equations for $x(t)$ and $y(t)$ using parametric mode on your TI.
(What is the domain for t ?)
- (c) Find $y'(t)$ and $x'(t)$.
- i. Does point P ever go backwards?
 - ii. Why is your answer correct?
- (d) How long is the curve in figure 2? Be sure to start with an arc length element ds .
(You can express ds in terms of dt .)
- (e) Find the area under the curve in figure 2. Be sure to start with an area element dA .

Using Polar Area

3. The polar graph of $r = \cos(3\theta)$ has three petals. We want to find the area of a single petal.
- Develop an integral to find the area of a petal. Be sure to start with a polar area element, dA .
 - The petal is not a circle. Explain why we can use a polar area element to compute the area.
 - Setup an integral to get the area of one petal. Explain why the bounds on your integral are correct.
 - Evaluate the integral.



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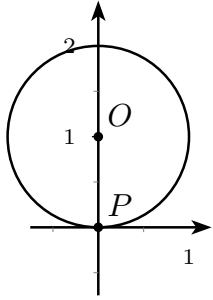


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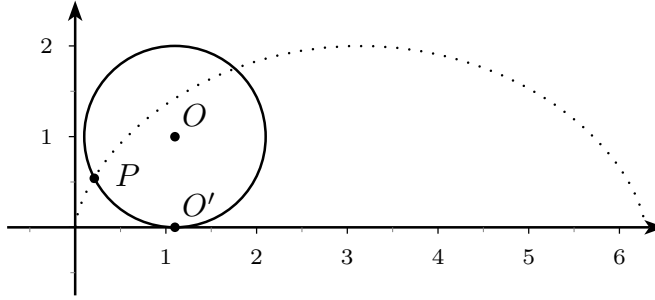


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