

I. MULTIPLE CHOICE. Choose the best answer among the choices. **(1 pt. each)**

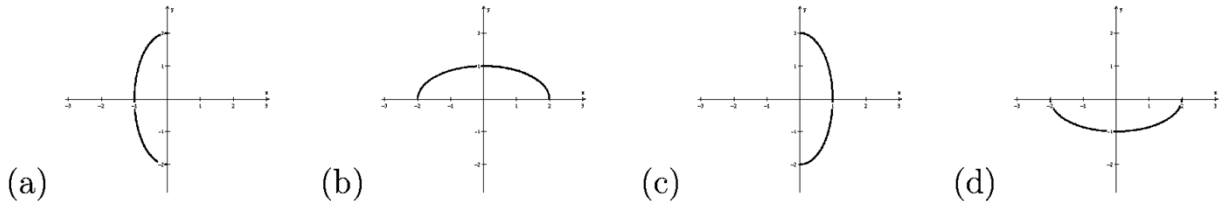
1. Which of the following points lies in the 4th quadrant?

- (a) $\left(4, \frac{7\pi}{5}\right)$ (b) $\left(-4, \frac{7\pi}{5}\right)$ (c) $\left(4, \frac{5\pi}{7}\right)$ (d) $\left(-4, \frac{5\pi}{7}\right)$

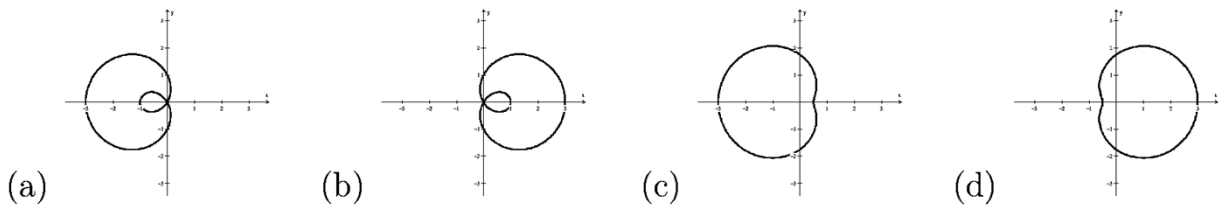
2. The directrix of the parabola $y^2 = -4(x - 1)$ is

- (a) $x = 2$ (b) $y = 0$ (c) $x = 0$ (d) $y = 2$

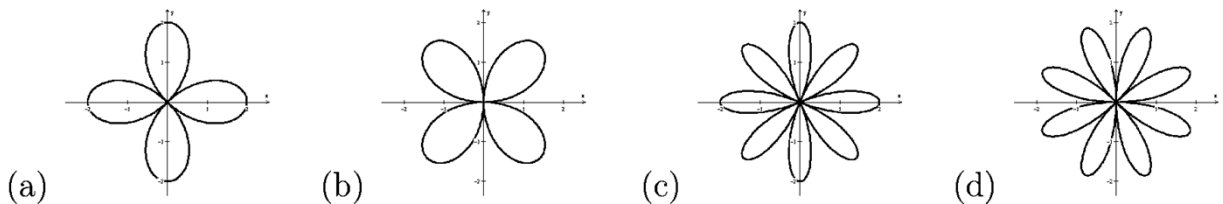
3. What is the graph of the curve defined by the parametric equations $\begin{cases} x = -\sin t \\ y = 2 \cos t \end{cases}$ with $t \in [0, \pi]$.

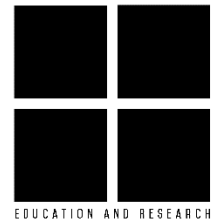


4. The curve $r = 1 - 2 \cos \theta$ is best represented by



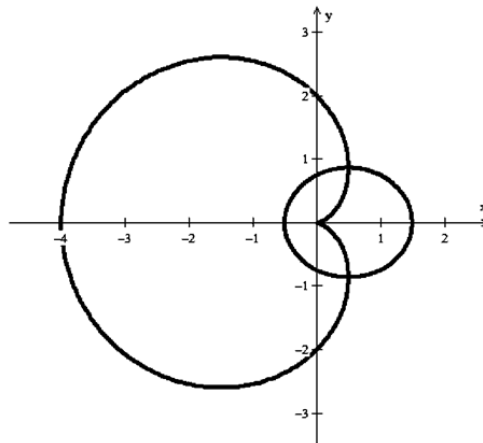
5. The curve $r = 2 \sin(4\theta)$ is best represented by





II. **PROBLEM SOLVING.** Do as indicated. Show complete and clear solution to get full points. Box your final answers.

- Find the length of the arc of the curve $\begin{cases} x = t^3 - 3t \\ y = 3t^2 - 1 \end{cases}$ from the point (2, 2) to the point (2, 11). **(5 points)**
- Consider the hyperbola whose auxiliary rectangle has vertices $(-11, 7)$, $(13, 7)$, $(13, -11)$ and $(-11, -11)$ and whose transverse axis is vertical. **(6 points)**
 - Find the equation of the hyperbola.
 - Sketch its graph.
 - Find its eccentricity.
- Find the equation of the tangent line to the parametric curve $\begin{cases} x = \sin t \cos t \\ y = \tan t \end{cases}$ at the point $(\frac{1}{2}, 1)$. **(5 points)**
- Find the polar equation of the parabola with focus at the pole and vertex at the cartesian point $(0, 3)$. Sketch the graph of the parabola. **(5 points)**
- Given the curve $r = 2 + 4 \cos \theta$, find the slope of the tangent line when $\theta = \frac{\pi}{4}$. **(5 points)**
- Consider the polar curves $C_1 : r = 2 - 2 \cos \theta$ and $C_2 : r = \frac{3}{4 - 2 \cos \theta}$, whose graphs are given below. **(9 points)**



- Find all points of intersection of C_1 and C_2 .
- Set-up the definite integral/s that represent the perimeter of C_2 .
- Set-up the definite integral/s that represent the area of the region common to both curves.