

I. Multiple Choice. Write the capital letter of the correct answer. [1 point each]

1. Which of the following polar curves can be traced completely exactly once as θ varies from 0 to 2π ?

A) $r = 6 \sin \theta$

C) $r = 4$

B) $r = -5 \cos \theta$

D) none of the above

2. Given the parabola $(y - 2)^2 = -4x - 8$. Which of the following is the equation of its directrix?

A) $x = -3$

C) $x = -1$

B) $x = -2$

D) $x = 0$

3. An ellipse has the equation $x^2 + 9y^2 = 1$. Which of the following statements is TRUE?

A) The foci lie on a vertical line.

B) It is the graph of the parametric equations $x = \sin t$ and $y = \frac{1}{3} \cos t$.

C) The sum of the distances of any point on the ellipse from each focus is 6 units.

D) The length of the minor axis is 2 units.

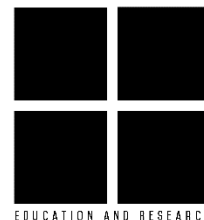
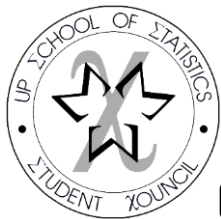
4. Which of the following curves is NOT symmetric about the polar axis?

A) $r = 2 \sec \theta$

C) $r = 4 \sin 2\theta$

B) $r = \frac{9}{3 \cos \theta}$

D) $r^2 = 4 \sin 2\theta$



5. Which of the following is true for the points $A\left(3, \frac{5\pi}{6}\right)$, $B\left(-3, \frac{-\pi}{6}\right)$, and $C\left(-3, \frac{-5\pi}{6}\right)$?

- A) They are all distinct points. C) A and B are the same.
B) A and C are the same. D) They are all the same.

II. Find two distinct polar coordinates (r, θ_1) and (r, θ_2) , with $r > 0$, for the point with Cartesian coordinates $(-2\sqrt{3}, 2)$ [2 pts]

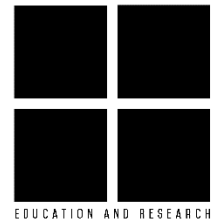
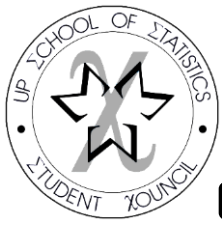
III. Given $25(x+1)^2 - 16(y+1)^2 = 400$. [7 pts]

1. Find the eccentricity, center, foci, vertices, asymptotes, and the ends of the conjugate axis of the hyperbola.
2. Sketch the graph of the hyperbola showing the auxiliary rectangle. Label all important points.

IV. Given the parametric equations $x = t^2 - t - 6$ and $y = t^2 + t^3$. [8 pts]

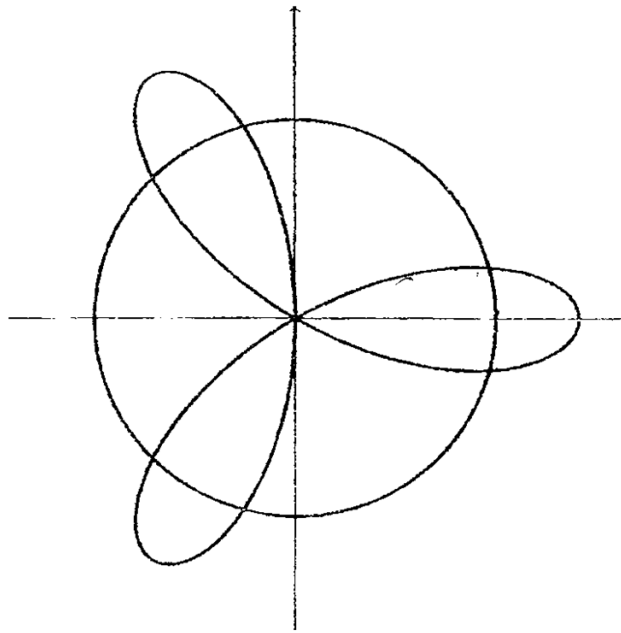
1. Find all values of t where the curve has vertical tangent lines.
2. Evaluate $\frac{d^2y}{dx^2}$ at the point where $(x, y) = (0, -4)$.
3. Set-up the integral that would give the length of the arc from $t = 1$ to $t = 2$.

V. Given $r = 3 + 2\cos\theta$. Give a Cartesian equation of the tangent line passing through the point $(r, \theta) = \left(4, \frac{\pi}{3}\right)$. [5 pts]



VI. Let C be a conic with eccentricity $e = \frac{1}{4}$. Suppose $(0,0)$ is a focus and that the farther vertex from it is the point $(8,0)$. Find a polar equation for C expressed as r in terms of θ . [4 pts]

VII. Given the polar curves $C_1 : r = 2 \cos 3\theta$ and $C_2 : r = \sqrt{2}$. [9 pts]



1. Set-up the integral that would give the perimeter of a petal of C_1 .
2. Set-up the integral that would give the area of the region outside C_1 , inside C_2 , and in the first quadrant.