General Direction: *Use black or blue ballpen. Show neat and complete solution to obtain full points.*

I. Write TRUE if the statement is always true. Otherwise, write FALSE. **1 point each**

1. The asymptotes of the hyperbolas $x^2 - y^2 = a^2$ and $y^2 - x^2 = a^2$ are the same.
2. Suppose that the parametric curve is smooth on $[a, b]$, then for $c \in [a, b]$, the curve is smooth on $[a, c]$.
3. The graph of a polar equation $r = 2\cos^2(\theta/2)$ is a limacon.
4. The graph of $r = 1 + 3\sin\theta$ is similar to the graph of $r = -1 + 3\sin\theta$.
5. There exists a rose polar curve with 30 petals.

II. Do as indicated.

1. Consider the parametric equations given by $C : x = te^t$ and $y = e^{2t}$. Determine the value(s) of t in which C is concave up or down. **5 points**
2. An ellipse is located at QII and QIII. The points $(-2, 1)$ and $(-1, -4)$ are the vertex and endpoint of the minor axis, respectively.
   a. Determine the center and foci of the ellipse. **3 points**
   b. Give the standard equation of the ellipse. **1 point**
3. Determine the conic: $4x^2 - 24x - 40 - y^2 = 0$. Sketch the conic and label its focus and vertex. **4 points**
4. Determine the cartesian equation of the line normal to $r = 1 + \cos^2\theta$ at $\theta = \pi/4$. **4 points**

MORE AT THE BACK

Mathematics 54 **Second Long Exam**

General Direction: *Use black or blue ballpen. Show neat and complete solution to obtain full points.*

I. Write TRUE if the statement is always true. Otherwise, write FALSE. **1 point each**

1. The asymptotes of the hyperbolas $x^2 - y^2 = a^2$ and $y^2 - x^2 = a^2$ are the same.
2. Suppose that the parametric curve is smooth on $[a, b]$, then for $c \in [a, b]$, the curve is smooth on $[a, c]$.
3. The graph of a polar equation $r = 2\cos^2(\theta/2)$ is a limacon.
4. The graph of $r = 1 + 3\sin\theta$ is similar to the graph of $r = -1 + 3\sin\theta$.
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II. Do as indicated.

1. Consider the parametric equations given by $C : x = te^t$ and $y = e^{2t}$. Determine the value(s) of t in which C is concave up or down. **5 points**
2. An ellipse is located at QII and QIII. The points $(-2, 1)$ and $(-1, -4)$ are the vertex and endpoint of the minor axis, respectively.
   a. Determine the center and foci of the ellipse. **3 points**
   b. Give the standard equation of the ellipse. **1 point**
3. Determine the conic: $4x^2 - 24x - 40 - y^2 = 0$. Sketch the conic and label its focus and vertex. **4 points**
4. Determine the cartesian equation of the line normal to $r = 1 + \cos^2\theta$ at $\theta = \pi/4$. **4 points**

MORE AT THE BACK

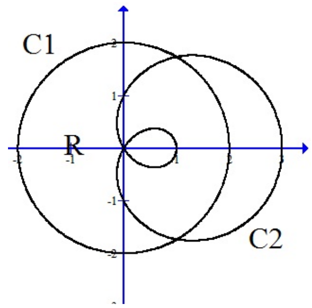
5. Let $C_1 : r = 2$ and $C_2 : r = 1 + 2\cos\theta$.

a. Find the angle θ such that C_2 passes the pole. **1 point**

b. Find the angle θ such that C_2 intersects C_1. **1 point**

c. Setup the definite integral for the area of the region R outside the limacon but inside the circle. **3 points**

d. Setup the circumference of the region. **3 points**



6. Let $r = \dfrac{4}{2 + 2\cos\theta}$.

a. Describe the conic and determine the polar equation of its directirx (directrices). **2 point**

b. Give its cartesian equation. **3 points**

END OF EXAM
TOTAL: 35 POINTS

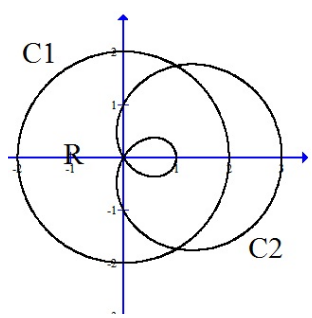
5. Let $C_1 : r = 2$ and $C_2 : r = 1 + 2\cos\theta$.

a. Find the angle θ such that C_2 passes the pole. **1 point**

b. Find the angle θ such that C_2 intersects C_1. **1 point**

c. Setup the definite integral for the area of the region R outside the limacon but inside the circle. **3 points**

d. Setup the circumference of the region. **3 points**



6. Let $r = \dfrac{4}{2 + 2\cos\theta}$.

a. Describe the conic and determine the polar equation of its directirx (directrices). **2 point**

b. Give its cartesian equation. **3 points**

END OF EXAM
TOTAL: 35 POINTS