King Saud university **Second semester, 1431H**

Time: 90 Minutes **Math 202**

The 2'nd midterm examination

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Question No.1

1. Sketch the curve $\mathcal{C}$ determined by $r(t) = (2 + \cos t)\vec{i} - (3 - \sin t)\vec{j}$ and indicate the orientation for $0 \leq t \leq 2\pi$.

2. Find the polar equation for $x = \sqrt{2y - y^2}$, and then sketch the graph.

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Question No.2

1. Suppose that a curve $\mathcal{C}$ is the graph of a polar equation $r = f(\theta)$. If $r' = \frac{dr}{d\theta}$ and $r'' = \frac{d^2r}{d\theta^2}$, show that the curvature K at $p(r, \theta)$ is

$$K = \frac{|2(r')^2 - rr'' + r^2|}{[(r')^2 + r^2]^{\frac{3}{2}}}$$

2. Find the curvature of the polar curve at $p(r, \theta)$, where $r = \sin 2\theta$, $0 < \theta < 2\pi$.

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Question No.2

Let $r(t) = t\vec{i} + t^2\vec{j} + t^3\vec{k}$, $1 \leq t \leq 4$ be the position vector of a moving point at time t.

1. Find the tangential component of acceleration a_T at time t.

2. Find the normal component of acceleration a_N at time t.

3. Find the curvature K at the point $p(x, y, z)$ on the curve $\mathcal{C}$ which is determined by $r(t)$.

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Good luck