※注意：請於試卷上「非選擇題作答區」標明題號並依序作答。

不得使用計算機，每題 10 分，總分 100 分

1. $\lim_{x \to -\infty}\left(3x + \sqrt{9x^2 - x}\right) = ?$

2. $\left(1 - \frac{1}{4}\right)\left(1 - \frac{1}{9}\right)\left(1 - \frac{1}{16}\right) \cdots \left(1 - \frac{1}{n^2}\right) \cdots = ?$

3. Cardiord $x = 2\sin\theta - \sin 2\theta,\ y = 2\cos\theta - \cos 2\theta$. Find its total length.

4. When $x = 2\sin\theta - \sin 2\theta$ and $y = 2\cos\theta - \cos 2\theta$, determine d^2y/dx^2.

   at $\theta = \pi/3$.

5. Consider $y = x/(1 + kx)$ which is a family of hyperbolas. Find its

   orthogonal trajectories.

6. When $x^3 + y^3 + z^3 - 3xyz = 1$, derive $\partial z/\partial x$ and $\partial z/\partial y$.

7. When $f(x, y) = 2xy - \frac{1}{2}(x^4 + y^4) + 1$, find local maxima, local minima,

   and saddle points.

8. Find the volume determined by $x^2 + y^2 + z^2 \leq 1$ and $x^2 + y^2 \leq y$.

9. When $x^2 + y^2 = z^2$ and $x + 2z = 4$, determine the maximum value of z.

10. $\Omega = \{(x, y) | x \geq 0, y \geq 0, x + y \geq 3\}$. Find $\iint_\Omega e^{-x}e^{-y}\,dxdy$.

<div align="center">試題隨卷繳回</div>