系 所 別：系統資訊與控制研究所　　　組　別：控制組

考科代碼：1143　　　　　　　　　　　考　科：工程數學

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注意事項：

1、本科目應使用符合考選部公告核定之國家考試電子計算器。

2、請於答案卷上規定之範圍作答，違者該題不予計分。

1　Solve $2xy\,dx + (1 + x^2)dy = 0$ (10%).

2　Solve $\dfrac{dy}{dx} = \dfrac{x^2 + 2}{y}$　(10%).

3　Solve　$y'' - y' - 2y = 4x^2$　(20%).

4　Solve　$y'' - 8y' + 16y = 0$　(10%).

5　Given　$\dfrac{d}{dx}(\sin x) = \cos x$　and　$\dfrac{d}{dx}(\cos x) = -\sin x$, derive the formulas

　　(i)　　$\dfrac{d}{dx}(\tan x) = \sec^2 x$　(10%);

　　(ii)　$\dfrac{d}{dx}(\sin^{-1} x) = \dfrac{1}{\sqrt{1 - x^2}}$　(10%).

6　Determine the locus represented by (10%).
(a) $|z - 2| = 3$, (b) $|z - 2| = |z + 4|$, where $z = x + iy$ is a complex variable.　Note that the solution must include the locus parameters.

7　Solve the equations a) $x^2 - 5x + 6 = 0$, b) $2x^2 - 3x + 1 = 0$ (10%).

8　Let X be a n-dimensional vector.　Some of its norms are defined as follows

$$\|X\|_n = (|x_1|^n + |x_2|^n + ... + |x_n|^n)^{1/n}, \text{ and}$$

$$\|X\|_\infty = \max(|x_1|, |x_2|, ..., |x_n|)$$

Find the following norms of vector $X = [1\ 2\ 3]^T$

a. $\|X\|_2$　b. $\|X\|_1$　c. $\|X\|_\infty$　d. $\|X\|_5$　(10%).