| 招 生 學 年 度 | 105 | 招 生 類 別 | 碩士班 |
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| 系 所 班 別 | 應用數學系 統計碩士班 | | |
| 科 目 名 稱 | 基礎數學 | | |
| 注 意 事 項 | 本考科禁止使用掌上型計算機；含微積分及線性代數 | | |

1. Give the matrices $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$. Find the multiplication of $A$ and $B$ (10%), and find the inverse of the matrix $A$ (10%).

2. Give four vectors $A_1, A_2, A_3, A_4$ in $\mathbb{R}^3$:

   $A_1 = (3,0,-3), \quad A_2 = (-1,1,2), \quad A_3 = (4,2,-2), \text{ and } A_4 = (2,1,1).$

   (a) Show that $A_1, A_2, A_3$ are linearly dependent in $\mathbb{R}^3$ (10%).

   (b) Select three vectors from among $A_1, A_2, A_3, A_4$ so that the three selected vectors form a basis for $\mathbb{R}^3$ (10%). The correct explanation for the answer must be included.

3. Find $\lim_{x \to 0}\{x^2 \sin(1/x)\}$ (10%) and $\lim_{x \to 0^+}\{x \ln(x)\}$ (10%).

4. Find $\int x^{-1} dx$ (10%) and $\dfrac{d}{dx} \ln\{(x^2+1)^{1/2}\}$ (10%).

5. Draw the region bounded by the graphs of $y = x^2$ and $y = x - 2$ (10%), and find the area of that region (10%).