1. Computations

Find the Fourier series for the function \( f(x) = x^3 - 2x^2 \), defined on \(-\pi < x < \pi\):

2. Linear Algebra

(1) In a vector space \( V \), which of the following statements is false, for vectors \( \mathbf{u} \) and \( \mathbf{v} \) in \( V \), and scalars \( c \) and \( d \)?
   (a) \( c(\mathbf{u} + \mathbf{v}) = c\mathbf{u} + c\mathbf{v} \)
   (b) \( c(d\mathbf{u}) = (cd)\mathbf{u} \)
   (c) \( \mathbf{u}(c\mathbf{u} + \mathbf{v}) = c\mathbf{u} + c\mathbf{v} \)
   (d) \( (c + d)(\mathbf{u} + \mathbf{v}) = c\mathbf{u} + d\mathbf{v} + cv + du \)

(2) Which of the following is a vector space?
   (a) The set of all polynomials \( p(x) \) such that \( p(1) \neq 1 \).
   (b) The set of all \( 3 \times 3 \) matrices of determinant one.
   (c) The set of points \( \{(x, y) \mid x = y \text{ or } x = -y\} \) in \( \mathbb{R}^2 \).
   (d) The set of all sequences of real numbers.

(3) Which of the following is a subspace of \( \mathbb{R}^2 \)
   (a) The set of all points \( (a, b) \) such that \( f(a, b) = 0 \), where \( f \) is the function \( f(x, y) = x^2 + y^2 \).
   (b) The set of eigenvectors for the matrix \( \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix} \).
   (c) The set of all \( \begin{bmatrix} x \\ y \\ z \end{bmatrix} \) such that \( x + 2y + z = 0 \).
   (d) South Dakota.