Aids Allowed: Casio 260, Sharp 520 or Texas Instrument 30 calculator.

Instructions: Fill in the information on this page, and make sure this test contains 4 pages. Present your solutions in the space provided. Use the back of the preceding page if you need more space. The value for each question is indicated in square brackets beside each question number.

TOTAL MARKS: 40

NAME:  

STUDENT NUMBER:  

SIGNATURE:  

TUTORIAL: (eg Tut0107)  

TUTOR:  

MARKER’S REPORT:

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1. [13 marks] Find \( \int \frac{2 - x}{x^4 + x^2} \, dx \)
2. [12 marks] Plot the two curves with polar equations

\[ r = 4 + 2 \sin \theta \text{ and } r = 3 \]

and find the area inside \( r = 4 + 2 \sin \theta \) but outside \( r = 3 \).
3. [15 marks] Find the following:

(a) [8 marks] \( \frac{dy}{dx} \) and \( \frac{d^2y}{dx^2} \) at the point \( (x, y) = (0, 0) \) if

\[
x = t^2 + t \quad \text{and} \quad y = t^3 - 3t.
\]

(b) [7 marks] \( \frac{du}{dt} \times v + \int v \, dt \), if \( u = t \, \mathbf{i} + e^t \, \mathbf{j} + 4 \, \mathbf{k} \) and \( v = \cos t \, \mathbf{i} + \sin t \, \mathbf{j} + 2t \, \mathbf{k} \).