INSTRUCTIONS: No calculators may be used on the test. No books, no notes, no questions, and talking allowed. You must always explain your answers and show your work to receive full credit. Use the back of these pages if necessary. Print (use CAPITAL LETTERS) and sign your name, and indicate your section below. GOOD LUCK!

Surname, Name: __________________________________________

Student ID no: ____________________________________________

Signature: ________________________________________________

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SCORE
Name:

Problem 1

(1.a) (5 pts) Find
\[
\lim_{x \to -2} \frac{\sqrt{x^2 + 5} - 3}{x + 2}
\]

(1.b) (10 pts) Find the asymptotes of the graph of
\[
y = \frac{2x - 6}{x + 1}
\]
(As usual, show your reasoning)

(1.c) 10 pts \( f(x) = \begin{cases} 
\sin^2 x / \tan x^2, & x \neq 0; \\
c^2, & x = 0.
\end{cases} \)

Find (i) \( \lim_{x \to 0} f(x) \) if it exists; (ii) Find all values for \( c \) that will make \( f \) continuous.
Problem 2

(2.a) (10 pts) Find $r'(0)$ for

$$r = \left(\frac{1 - \sin \theta}{1 + \cos \theta}\right)^2$$

(2.b) (10 pts) Find the slope of the line tangent to the curve $y^2 + 2xy + x^2 = (xy^3 + x^2)^4$ at the point $(1, 0)$.

(2.c) 5 pts Find $dy/dx$ at $t = \pi/4$ if $x = t^2 + 2, y = \tan t - 3$. 
Name:

Problem 3  Answer the following questions for \( y = 4x^3 - x^4 \)

(3.a) (5 pts) Find \( y' \) and \( y'' \).

(3.b) (5 pts) Find the critical points and characterize the function’s behavior at each one.

(3.c)(5 pts) Find where the curve is increasing and where it is decreasing.
(3.d) (5 pts) Find where the graph of $f$ is concave up and where it is concave down. Find the points of inflection, if they occur.

(3.e) (5 pts) Sketch the curve.
Name:

Problem 4 (25 pts) You want to construct a box of volume $60m^3$, whose base length is 3 times the base width. The material used to build the top and bottom cost $10YTL/m^2$ and the material used to build the sides cost $6YTL/m^2$. Argue that it is possible to minimize the cost to build the box by suitably chosen dimensions and determine these most cost efficient dimensions.