King Fahd Univ. of Petroleum and Minerals
Faculty of Sciences
Department of Mathematical Sciences

MAJOR No. 2
(MATH. 102-051 Section 4)

Name: 

ID: 

Important instructions:
- Use an HB pencil or a pen (do not use red color)
- Solve the problems completely
- Write down your answers in a clear manner
- Justify all your steps
- Use the back of the page (verso) only for scratching
Prob. 1
Find the volume of the solid that results when the region enclosed by
\( y = \cos x \), \( y = \sin x \) and \( x = 0 \) is revolved about the \( x \)-axis
Prob. 2

Find the volume of the solid that results when the region enclosed by

\[ y = \sqrt{\frac{1-x^2}{x^2}} \quad (x > 0), \quad x = 0, \quad y = 0, \quad y = 2 \]

is revolved about the \( y \)-axis.
Prob. 3
Use cylindrical shells to find the volume of the solid generated when the region enclosed by $xy = 4$, $x + y = 5$ is revolved about the $x$–axis.
Prob. 4
Find the exact arc length of \( y = \frac{x^6 + 8}{16x^2} \) from \( x = 2 \) to \( x = 3 \).
Prob. 5
Find the integrals
(a) \( \int \frac{dx}{x^2 \sqrt{x^2 + 25}} \)
(b) \( \int \frac{\cos x \, dx}{\sqrt{2 - \sin^2 x}} \)
Prob. 6
Find
(a) \( \int \csc^2 v \cot^4 v \, dv \)
(b) \( \int \cos(\ln t) \, dt \)
Prob. 7

Compute

(a) \( \int_0^2 \ln(u^2 + 1) \, du \)

(b) \( \int \frac{e^{-y}}{4-e^{-2y}} \, dy \)
Prob. 8
Write down the right decomposition for
\[
\int \frac{15x^6 - 3x^4 + 8x^3 + 8}{(x - 1)x^3(x + 2)^2(x - 3)(x^2 + x + 3)(2x^2 - 3x + 1)^2} dx
\]
and compute the integrals of the simple elements involved in the decomposition.