

# Final Exam



Kingdom of Saudi Arabia  
AL-Imam Mohammed Bin Saud  
Islamic University  
College of Science  
Department of Mathematics

Course name: Calculus II  
Course code: MAT 102  
Semester: 1st /1437 -1438  
Duration: 2 Hours

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Name	
Student Number	
Section	

Question's number	Marks
1	/10
2	/10
3	/10
4	/10
TOTAL	/40

Note: Calculator is allowed

Number of pages (8)

**Question 1**

(a) Evaluate the following integrals

(i)  $\int x^2 \sin x \, dx$  (2 Marks)

(ii)  $\int \cos^4 x \sin^3 x \, dx$  (2 Marks)

$$(ii) \int \frac{6x}{x^2 - x - 2} dx$$

(2 Marks)

(b) Find the limits:

$$(i) \lim_{x \rightarrow \infty} \frac{x^2}{e^x}$$

(2 Marks)

$$(ii) \lim_{x \rightarrow \infty} \frac{3x^2 + 2}{x^2 - 4}$$

(2 Marks)

## Question 2

(a) Test each of the following series for convergence:

$$(i) \sum_{k=1}^{\infty} \left( \frac{1}{6} + \frac{1}{k} \right)^k \quad (2 \text{ Marks})$$

$$(ii) \sum_{k=4}^{\infty} (-1)^k \frac{10^k}{k!} \quad (2 \text{ Marks})$$

$$(iii) \sum_{k=2}^{\infty} \frac{k^2 + 1}{k^3 + 3k + 2} \quad (2 \text{ Marks})$$

- (b) Find the Maclaurin series (i.e., Taylor series with  $c = 0$ ) and its interval of convergence for  $f(x) = e^{2x}$  (4 Marks)

### Question 3

(a) Compute the arc length of the curve

$$y = 5 - 3x \quad \text{for} \quad 0 \leq x \leq 1 .$$

(4 Marks)

(b) Find the surface area of the surface generated by revolving  $y = \sqrt{x}$ , for  $1 \leq x \leq 2$ , about  $x$ -axis. (4 Marks)

(c) Find the parametric equation describing the circle of radius 2 centered at  $(3, 4)$ . (2 Marks)

## Question 4

- (a) Find the slopes of the tangent lines to the given curves at the indicated points.

$$\begin{cases} x = t^2 - 2 \\ y = t^3 - t, \end{cases}$$

at  $t = 1$ .

(3 Marks)

- (b) Find the area enclosed by the path of

$$\begin{cases} x = 3 \cos t \\ y = 2 \sin t, \end{cases}$$

for  $0 \leq t \leq 2\pi$

(3 Marks)

(c) Find the polar coordinates corresponding to

$$\frac{xy}{\sqrt{x^2 + y^2}} = 1 .$$

(4 Marks)

*The End*