



UNIVERSITY
OF
JOHANNESBURG

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

MODULE	MATOCB2 / MATECB2 ENGINEERING CALCULUS 2B
CAMPUS ASSESSMENT	APK SUPPLEMENTARY EXAMINATION

ASSESSORS: **PROF. R. PANT, DR. A. GOSWAMI**

INTERNAL MODERATOR: **MR. M. SIAS**

DURATION: 120 MINUTES **MARKS: 40**

SURNAME AND INITIALS _____

STUDENT NUMBER _____

CONTACT NUMBER _____

NUMBER OF PAGES: 1 + 10 PAGES

INSTRUCTIONS:

- 1. ANSWER ALL THE QUESTIONS ON THE PAPER IN PEN.**
- 2. CALCULATORS ARE ALLOWED.**
- 3. SHOW ALL CALCULATIONS AND MOTIVATE ALL ANSWERS.**
- 4. IF YOU REQUIRE EXTRA SPACE, CONTINUE ON THE
ADJACENT BLANK “EXTRA PAGES”, AND INDICATE THIS CLEARLY.**

Question 1

[2 × 3 = 6 marks]

	Question	Answer
1.1	If $f(x, y) = y \sin^{-1}(xy)$, find $f_y(1, \frac{1}{2})$.	
1.2	Find the partial derivative $\frac{\partial^3 V}{\partial r \partial s \partial t}$ of $V = \ln(r + s^2 + t^3)$.	
1.3	Evaluate the gradient of $f(x, y, z) = \sqrt{x + yz}$ at the point $(1, 3, 1)$	

Question 2

[2 × 3 = 6 marks]

	Question	Answer
2.1	Evaluate $\int_0^1 \int_1^2 (x + e^{-y}) dx dy$.	
2.2	Evaluate $\iint_R \frac{xy^2}{x^2 + 1} dA$, where $R = [0, 1] \times [-3, 3]$.	
2.3	Evaluate $\int_{\pi/4}^{3\pi/4} \int_1^2 r dr d\theta$.	

Question 3

[2 × 2 = 4 marks]

	Question	Answer
3.1	Evaluate the line integral $\int_C xy^4 ds$, where C is the right half of the circle $x^2 + y^2 = 16$.	
3.2	Determine whether or not $F(x, y) = (ye^x + \sin y)\mathbf{i} + (e^x + x \cos y)\mathbf{j}$ is a conservative vector field. Write “Yes” or “No”.	

Question 4

[4 marks]

Find the extreme values of f on the region described by the inequality.

$$f(x,y) = x^2 + y^2 + 4x - 4y, \quad x^2 + y^2 \leq 9.$$

Question 5

[5 marks]

Evaluate the double integral $\iint_D y dA$, where D is the triangular region with vertices $(0,0)$, $(1,1)$, and $(4,0)$.

Question 6

[5 marks]

Evaluate the triple integral $\iiint_T y^2 dV$, where T is the solid tetrahedron with vertices $(0, 0, 0)$, $(2, 0, 0)$, $(0, 2, 0)$ and $(0, 0, 2)$.

Question 7

[4 marks]

Evaluate the integral by making an appropriate change of variables. $\iint_R \sin(9x^2 + 4y^2) dA$, where R is the region in the first quadrant bounded by the ellipse $9x^2 + 4y^2 = 1$.

Question 8

[3 marks]

Evaluate the line integral $\int_C \mathbf{F} \cdot d\mathbf{r}$, where $\mathbf{F}(x,y) = xy^2 \mathbf{i} - x^2 \mathbf{j}$, and C is given by the vector function $\mathbf{r}(t) = t^3 \mathbf{i} + t^2 \mathbf{j}$, $0 \leq t \leq 1$.

Question 9

[3 marks]

Find the function f such that $\mathbf{F} = \nabla f$, where $\mathbf{F}(x, y, z) = yz\mathbf{i} + xz\mathbf{j} + (xy + 2z)\mathbf{k}$.

Extra page 1

Extra page 2

Extra page 3