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FACULTY OF SCIENCE

**DEPARTMENT OF APPLIED PHYSICS AND ENGINEERING
MATHEMATICS**

MODULE: MAT1AE2 MATHEMATICS I
NATIONAL DIPLOMA: FOOD AND BIO TECHNOLOGY

SUPPLEMENTARY EXAMINATION

DATE: 30 NOVEMBER 2015

SESSION:

EXAMINER
INTERNAL MODERATOR

CGJ Lock
JJ Bruyns

DURATION 2 HOURS

MARKS 70

SURNAME AND INITIALS: _____

STUDENT NUMBER: _____

CONTACT NR: TEL _____

PROGRAMME (COURSE): _____

VENUE _____ **ROW** _____ **SEAT** _____

NUMBER OF PAGES: 14 PAGES

INSTRUCTIONS:

- ANSWER ALL THE QUESTIONS IN THE SPACE PROVIDED.
- ONE NON PROGRAMMABLE CALCULATOR IS PERMITTED.
- USE THE BACK OF EACH PAGE FOR ROUGH WORK.
- IF YOU ARE OUT OF SPACE, WRITE ON THE BACK OF THE PREVIOUS PAGE, NUMBER THE QUESTION CLEARLY.
- IT IS YOUR RESPONSIBILITY TO MAKE SURE THAT THERE ARE NO MISSING PAGES.

SECTION A

INSTRUCTIONS

USE THE TABLE ON PAGE 4 TO MARK THE LETTER (X) CORRESPONDING TO THE CORRECT ANSWER. DO YOUR ROUGH WORK ON THE BLANK PAGES.

1. If $A = \begin{bmatrix} 2 & 3 & 4 \\ -1 & 7 & 9 \\ -3 & -2 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & -4 & -7 \\ 2 & 5 & -6 \\ 4 & 3 & -9 \end{bmatrix}$ then $A + B$ is equal to:

A $\begin{bmatrix} 1 & -1 & -3 \\ 1 & 12 & 3 \\ 1 & 1 & -3 \end{bmatrix}$

B $\begin{bmatrix} 1 & -5 & -10 \\ 5 & 12 & -8 \\ 8 & 12 & -3 \end{bmatrix}$

C $\begin{bmatrix} 1 & 1 & 1 \\ -1 & 12 & 1 \\ -3 & 3 & -3 \end{bmatrix}$

D None of the above

2. If $A = \begin{bmatrix} 2 & 3 & 4 \\ -3 & -2 & 6 \\ -1 & 7 & 9 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 3 & -3 \\ -1 & -4 & -2 \\ 2 & 5 & 1 \end{bmatrix}$ then $A \times B$ is equal to:

A $\begin{bmatrix} 13 & 14 & 8 \\ 2 & 29 & 19 \\ 7 & 4 & 2 \end{bmatrix}$

B $\begin{bmatrix} -13 & -14 & -8 \\ 2 & -29 & 19 \\ -7 & 14 & 2 \end{bmatrix}$

C $\begin{bmatrix} 13 & 14 & -8 \\ 2 & 29 & 19 \\ 7 & 14 & -2 \end{bmatrix}$

D None of the above

3. Determine the distance between points $A(5, -3)$ and $B(-3, 3)$:

A 8

B 9

C 7

D None of the above

4. The equation of a straight line with an inclination of 75° and going through the point $(3, 5)$ is represented by:

A $y = 3,732x + 6,196$

B $y = -3,732x + 6,196$

C $y = 3,732x - 6,196$

D None of the above

5. Given that $y = t^2 \ln t^2$ then $\frac{dy}{dt}$ is equal to :
- A $2t + \ln t$ B $2t(1 + 2 \ln t)$
 C $2t + \frac{1}{t}$ D None of the above
6. Given that $y = 2^{6x^3}$, then $\frac{dy}{dx}$ is equal to:
- A $6x^3 2^{6x^3-1}$ B $2^{6x^3} \cdot 18x^2 \cdot \ln 2$
 C $2^{6x^3} \cdot 18x^2$ D None of the above
7. Given that $y = \ln(x + e)$, then $\frac{dy}{dx}$ is equal to:
- A $\frac{1}{x + e}$ B $\frac{1 + e}{x + e}$
 C $\frac{1}{x}$ D None of the above
8. $\int (e^{-x} + 2)^2 dx$ is equal to :
- A $-2e^{-2x} + 4x + c$ B $\frac{(e^{-2x} + 2)^3}{3} + c$
 C $-\frac{e^{-2x}}{2} - 4e^{-x} + 4x + c$ D None of the above
9. Determine the following integral: $\int \frac{(t^2 + 2)^2}{t} dt$
- A $\frac{t^4}{4} + 2t^2 + 4 \ln t + c$ B $\frac{t^5}{4} + 2t^2 + 4 \ln t + c$
 C $\frac{t^5}{5} + 2t^2 + 4 \ln t + c$ D None of the above
10. If the velocity v is given as $v = 5t^{\frac{1}{3}}$, then the displacement between $t = 1$ and $t = 3$ is equal to:
- A 22.178 B 17.877
 C 9.343 D None of the above

[20]

ANSWER SHEET SECTION A

1	A	B	C	D	6	A	B	C	D
2	A	B	C	D	7	A	B	C	D
3	A	B	C	D	8	A	B	C	D
4	A	B	C	D	9	A	B	C	D
5	A	B	C	D	10	A	B	C	D

SECTION B**INSTRUCTIONS**

SHOW ALL THE STEPS TAKEN AND GIVE YOUR FINAL ANSWER CORRECT TO THREE DECIMAL PLACES WHERE APPLICABLE. USE PAGE 14 TO RE-DO ANY QUESTIONS YOU MAY HAVE CANCELLED.

11 During load shedding ESCOM has to deliver electricity to 4 sites.

At each site they need to deliver 3 types of generators.

The table below gives this data:

		SITES			
		1	2	3	4
TYPES OF GENERATORS	A	2	4	0	2
	B	0	2	1	1
	C	1	3	2	4

For each of the generators they need consumables such as diesel (litre) and oil (litre).

The amount of diesel and oil per generator needed is given below:

		TYPES OF GENERATORS		
		A	B	C
CONSUMABLES	DIESEL (l)	500	300	270
	OIL (l)	20	15	12

How many litres of diesel and oil must be delivered to each site?

Give your answer in table form.

(6)

TURN OVER FOR MORE SPACE FOR Q 11

[illegible]

(7)

[illegible]

13 Find the equation of a line in the standard form with:

x intercept of -3 and a y intercept of $\frac{2}{5}$.

(3)

14 Find the equation of a line in the standard form which is:

perpendicular to $-2y - x + 3 = 0$ and through the x axis at 4.

(4)

15 Experimental data as given in the table below obey the law: $y = ax^2 + bx$

x	-1	0	1	2	4
y	5	0	-1	2	?

15.1 Find the values of a and b by linearization. (5)

15.2 Complete the table. (2)

16. Experimental data as given in the table below obey the law: $y = ax^b$

x	2	4	6	8	9	10
y	0,492	0,606	?	?	0,773	0,798

16.1 Find the values of a and b . (6)

16.2 Complete the table. (2)

17. If $f(x) = \ln\left(\frac{x}{x-2}\right)$, find $f'(x)$. (3)

18. The density of algae in a pond without any circulation is given as $D = \frac{n}{V}$, where n is the number of algae and V is the volume of water in the pond. If n and V vary with time t measured in days according to the formula $n = \sqrt{t}$ and $V = \sqrt{t} + 1$, calculate the rate of change in the density of algae after 6 days.

(5)

19. Determine $\int e + \frac{e}{z} - \sqrt[3]{z^4} dz$. (3)

20. Determine $\int_1^4 \left(-\frac{1}{3} + 8t^3 - \frac{1}{t^2}\right) dt$ (4)

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