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**FACULTY OF SCIENCE**

**DEPARTMENT OF APPLIED PHYSICS AND ENGINEERING  
MATHEMATICS**

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

**YEAR END EXAMINATION**

**DATE:** 13 NOVEMBER 2015

**SESSION:** 08:30

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

A  $\begin{bmatrix} 4 & 11 & 5 \\ 0 & 1 & 1 \end{bmatrix}$

B  $\begin{bmatrix} 0 & 1 & 5 \\ 4 & 11 & 1 \end{bmatrix}$

C  $\begin{bmatrix} 4 & 1 & 5 \\ 0 & 11 & 1 \end{bmatrix}$

D None of the above

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

A  $\begin{bmatrix} 10 & 3 \\ 0 & 8 \\ 4 & -30 \end{bmatrix}$

B  $\begin{bmatrix} -10 & 3 \\ 0 & 8 \\ 4 & -30 \end{bmatrix}$

C  $\begin{bmatrix} -10 & 3 \\ 0 & 8 \\ 4 & 30 \end{bmatrix}$

D None of the above

3 If  $\begin{vmatrix} 3 & -2 \\ 5 & x \end{vmatrix} = -11$  then  $x$  is equal to

A  $-7$

B  $\frac{-1}{7}$

C  $\frac{-1}{3}$

D None of the above

4 Determine the distance between the following points on the Cartesian plane:  $A(9,3)$   $B(-2,6)$

A 6,32

B 10,58

C 11,4

D None of the above

5 If a line passes through the points  $(-4,7)$  and  $(-2,6)$ , the equation of the line is:

A  $y = 5 - \frac{1}{2}x$

B  $y = -5 + \frac{1}{2}x$

C  $y = \frac{2}{7} - \frac{1}{14}x$

D None of the above

6 If  $y = \sqrt{x+1}$  then  $\frac{dy}{dx} =$

A  $\frac{1}{2\sqrt{x+1}}$

B  $\frac{\sqrt{x+1}}{2}$

C  $\frac{y}{2}$

D None of the above

7 If the acceleration  $a$  of a body is given by  $a = t^2 + 2$ , then the displacement  $s$  is given by

A  $s = 2t$

B  $s = \frac{t^3}{3} + 2t + C$

C  $s = \frac{t^4}{12} + t^2 + c_1t + C$

D None of the above

8 If  $y = 3^{-x^2}$  then  $\frac{dy}{dx}$  is equal to

A  $-x^2 3^{-x^2-1}$

B  $-x 6^{-x^2} \ln 3$

C  $-2x 3^{-x^2} + \ln 3$

D None of the above

9  $\int (1+x)^{-1} dx$  is equal to

A  $\left(\frac{1}{1+x}\right)^2 + C$

B  $\ln|1+x| + C$

C  $-\ln|1-x| + C$

D None of the above

10. If the velocity  $v$  is given as  $v = et^2$ , then the displacement between  $t = 0$  and  $t = e$  is equal to:

A 18,199

B 17.879

C 9.343

D None of the above

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**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 TWO DECIMAL PLACES WHERE APPLICABLE. USE PAGE 12 TO RE-DO ANY QUESTIONS YOU MAY HAVE CANCELLED.**

11 A building contractor has to build 3 different types of houses for a housing project.

There are 4 different locations in where the building will take place.

The table below gives this data:

		SITES			
		A	B	C	D
TYPES OF HOUSES	1	2	5	0	4
	2	3	7	6	4
	3	1	0	2	4

For each of the houses material in the form of cement (kg) and bricks are needed.

The amount of cement and bricks per house is given below:

		TYPES OF HOUSES		
		1	2	3
MATERIAL	CEMENT	200	250	300
	BRICKS	4000	5000	6000

What amount of cement and bricks must be delivered to each site? Give your answer in table form. (6)


TURN OVER FOR MORE SPACE FOR Q 11


- 12 By making use of Cramer's Rule determine the values of  $x$  and  $y$  in the following set of equations:

$$2x + 3y - 2z = -5$$

$$-4x + 5z + 4y = 4 \quad (7)$$

$$3z + 3y - x = 2$$


TURN OVER FOR MORE SPACE FOR Q 12


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

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


- 14 Find the equation of a line in the standard form which is perpendicular to  $2y - 3x - 4 = 0$  and through point  $(2,5)$ . (3)


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

$x$	-2	0	2	4
$y$	5	-3	12*	29

- 15.1 Find the values of  $a$  and  $b$  by linearization, also complete the table above and write down the final equation. (5)




15.2 Rectify the errors that may have occurred in the experimental data. (2)


16. The number of elephants ( $E$ ) in the wild, that are being killed over a period of time  $t$ , measured in years, is given in the table below and the killing rate follows the model  $E = Ae^{kt}$ .

$t$	0	2	4	5	6
$E$	8500	8166	7846	7691	7538

16.1 Find the values of  $A$  and  $k$  and write down the final equation. (5)


16.2 If  $t = 0$  is taken as 2005, determine the year when there will be 3000 elephants left in the wild? (2)


17. If  $y = \frac{x}{\sqrt{1-2x}}$ , find  $\frac{dy}{dx}$  and simplify. (4)


18. If  $y = z^2(z^3 + 5)^{\frac{4}{5}}$ , find  $\frac{dy}{dz}$  and simplify. (4)


19. Determine  $\int_1^3 \left( \frac{1}{4} + 9t^2 - \frac{1}{t} + e^{3t} \right) dt$  (4)


20. The velocity of an arrow shot from a bow is represented by  $v(t) = 0.3t^2 + 3t - 2$ .

20.1 Find an expression for the displacement  $s$  at any time  $t$ . (3)


20.2 Find the distance travelled, in meters, by the arrow between  $t = 2$  and  $t = 4$  seconds. (2)


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