FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS	
MODULE: MATCXB1	
COURSE: ENGINEERING MATHEMATICS 1	
CAMPUS: DFC	
ASSESSMENT: MAIN EXAMINATION	

DATE: 2 NOVEMBER 2021

TIME: 8:30 - 11:30.

ASSESSOR: MR M.P. SELOANE

INTERNAL MODERATOR MR E.Z. MORAPELI

DURATION: 180 MINUTES

MARKS: 60

NUMBER OF PAGES: 4 PAGES (INCLUDING FRONT PAGE AND ONLINE INSTRUCTIONS).

ONLINE INSTRUCTIONS:

- **Write the complete solutions of the questions on paper. The steps, where applicable will be marked.**
- **Write your student number, surname, and initials on all pages.**
- **Use either blue or black pen.**
- **Non-programmable scientific calculators are allowed.**
- **The complete solutions must be in your own handwriting.**
- **All pages must be together, in sequential order, and please number the pages.**
- **Scan your work and save this as a pdf file on your device.**
- **Use the following file name when you save your work and upload your answer sheet: surname and initials_studentnumber_MAIN EXAMINATION**
- **Submit this as one pdf file on uLink: click on word "MAIN EXAMINATION". To submit you will get a screen like below – click on "Browse my Computer", then go to the file on your device and select, then click "Submit". ==You cannot upload a photo.== ==You cannot upload page-by-page, only ONE pdf document.== ==Submissions via e-mail if experiencing difficulties with bb will be accepted.== If you upload the wrong file, or no file, the exam cannot be marked, and you will get zero.**

- **You have <u>unlimited</u> submission opportunities before the deadline but only the last submission will be mark.**
- **If you experience any problems when submitting your test send an e-mail to Mr M P Seloane (<u>pseloane@uj.ac.za</u>) immediately.**
- **No late submission can be accepted.**

SECTION A (12)

CHOOSE ONE CORRECT ANSWER FROM THE ANSWERS GIVEN. WRITE DOWN ONLY THE LETTER CORRESPONDING TO YOUR CHOSEN ANSWER.

1. If one root of $ax^2 + bx + c = 0$ is $x = 1 + \sqrt{-9}$, then the other root is:

   A. $1 - 3j$ B. $1 + 3j$ C. -4 D. None of these

2. The rectangular form of $ln|2j|$ is:

   A. $1,1 + 0,69j$ B. $ln2 + 90j$ C. $1,57j + 0,69$ D. None of these

3. The value of $\lim\limits_{x \to 2} \dfrac{ln(3-x)}{2-x}$ is equal to:

   A. ∞ B. 1 C. 2 D. None of these

4. The derivative of $4 . e^{x^2-3}$ is:

A $4 . e^{x^2-3}$ B $8 . e^{x^2-3}$

C $8x . e^{x^2-3}$ D $4 \ln(x^2 - 3)$

5. If the velocity of an object is given by $v(t) = 3t^2 - 12t + 3$, then the expression of displacement is:

A. $3t^3 - 12t^2 + 3t + C$ B. $t^3 - 3t^2 + 3t + C$

C. $6t - 12 + C$ D.   None of these

6. $\int \frac{2}{\sqrt{1-x}} dx$ is equal to:

A. $-4\sqrt{1-x} + C$ B. $4\sqrt{1-x} + C$ C. $-\sqrt{(1-x)^3} + C$ D. None of these

(2 X 6 = 12)

SECTION B (48)

SHOW ALL IMPORTANT STEPS AND LEAVE ANSWERS WITH TWO DECIMAL PLACES, WHERE APPLICABLE

1. Given $z_1 = 3j + 3$ and $z_2 = 2j - 1$, use the Argand diagram to show that their sum, $z_1 + z_2$, is equal to $2 + 5j$.   (3)

2. Simplify: $\frac{1}{e^{2j}} + 4 + 1,3\angle 60°$, leave answer in exponential form.   (4)

3. If $z_1 = -3j$; $z_2 = (\cos(30°) - j\sin(30°))$ and $z_3 = 3e^{4j}$, use De Moivre's theorem and evaluate: $\frac{(\overline{z_2})^2(z_1)^4}{(z_3)^3}$.   leave your answer in rectangular form.   (5)

4. Find all the roots of $z^3 + 3j - 1 = 0$. Leave your answer in rectangular form.   (6)

5. Find $f'(x)$ using the definition if $f(x) = 3 - 4x^2$.   (4)

6. Determine $\frac{dy}{dx}$ given that:

   6.1 $y = \ln\left(3^x.\sqrt{x^2 - 2x}\right).$ (4)

   6.2 $y = ln(x^2) - cos^2(2x).$ (3)

7. Show that $f'''(x) = \frac{2f'(x)}{x^2}$ if $f(x) = x^3 - 2ln(x) + 4.$ (5)

8. Sketch the graph of $f(x) = x^3 + 3x^2$. Clearly show all turning points, a point of inflection and intercepts with the axes.   (5)

9. Determine:

   9.1 $\int_0^2 \frac{3}{x+1}\, dx.$ (2)

   9.1 $\int sin(x)cos^2(x).$ (3)

   9.2 $\int \frac{x^2 - 6x + 5}{x - 3}\, dx.$ (4)

END - OF - EXAMINATION