

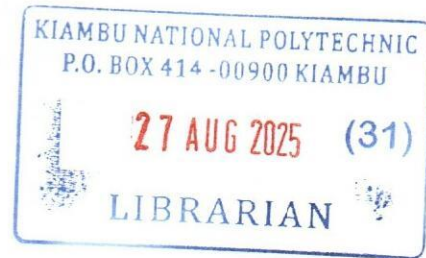
073206T4BLD

BUILDING TECHNICIAN LEVEL 6

CON/OS/BUT/CC/1/6

Apply Engineering Mathematics

July/August 2025



**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION
COUNCIL (TVET CDACC)**

WRITTEN ASSESSMENT

TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATE

1. This paper consists of **TWO** sections: **A** and **B**.
2. You are provided with a separate answer booklet
3. Marks for each question are indicated in the brackets.
4. Do not write on the question paper

This paper consists of FIVE (5) printed pages.

Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.

SECTION A (40 MARKS)

Answer ALL questions from this section

1. Given $Z1 = 2 + j4$ and $Z2 = 3 - j$ determine $Z1 + Z2$ and $Z1 - Z2$. Show the results on Argand diagram. (4 Marks)

2. If $\tan \theta = a$, show that. (4 Marks)

$$\frac{\cos \theta \sin^2 \theta + \cos^3 \theta}{\sin \theta} = \frac{1}{a}$$

3. Evaluate:

$$\int_0^{\pi} \sin^2 x dx$$
 (4 Marks)

4. Simplify the following and express the answer with positive indices only. (3 Marks)

$$\frac{d^2 e^2 f^{1/2}}{(d^{1/2} e f^{1/2})^2}$$

5. Determine the standard deviation from the mean of the set of numbers:

{5, 6, 8, 4, 10, 3}, correct to 4 significant figures. (3 Marks)

6. Resolve the force vector of 80N at an angle of 55° to the horizontal into its horizontal and vertical components. (4 Marks)

7. Write $\frac{1}{3} \log 64 + \frac{1}{2} \log 32 - 2 \log 3$ as the logarithm of a single number. (3 Marks)

8. A rectangular piece of metal having dimensions 4 cm by 5 cm by 10 cm is melted down and recast into a pyramid having a rectangular base measuring 3 cm by 4 cm. Calculate the perpendicular height of the pyramid. (3 Marks)

9. The distance x meters moved by a car in a time t second is given by

$$x = 3t^3 - 2t^2 + 4t - 1. \text{ Determine the velocity and acceleration when, } t = 1.5 \text{ s. (4 Marks)}$$

10. A batch of 40 components contains five which are defective. A component is drawn at random from the batch and tested and then a second component is drawn.

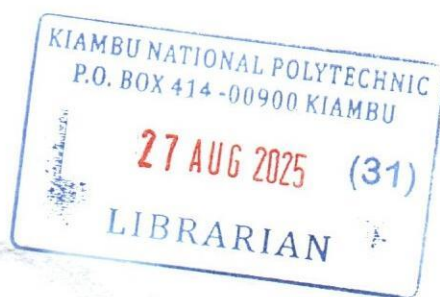
Determine the probability that neither of the components is defective when drawn, with replacement. (2 Marks)

11. Find the value of $\begin{bmatrix} 1 & -4 & 3 \\ 5 & 2 & 6 \\ -1 & -4 & 2 \end{bmatrix}$.



12. Find the derivative of $3\sqrt{x} + 2x - \frac{8}{x}$.

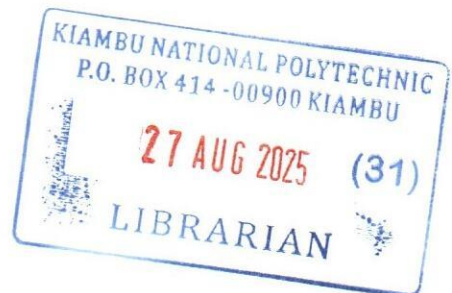
(3 Marks)



SECTION B (60 MARKS)

This section contains Four questions, Attempt Any Three questions

- 13.
- a. Find the inverse of:
- $$\begin{pmatrix} 1 & 5 & -2 \\ 3 & -1 & 4 \\ -3 & 6 & -7 \end{pmatrix}$$
- (10 Marks)
- b. Determine the volume and total surface area of a cone of radius 5 cm and perpendicular height 12 cm. (6 Marks)
- c. Let $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$, Find all the eigen values of A. (4 Marks)
- 14.
- a. Using Newton's backward difference formula, construct an interpolating polynomial of degree 3 for the data: $f(0.75) = 0.0718125$, $f(0.5) = 0.02475$, $f(0.25) = 0.3349375$, $f(0) = 1.10100$. Hence find $f(-1/3)$. (10 Marks)
- b. A production department has 35 similar milling machines. The number of breakdowns on each machine averages 0.06 per week. Determine the probabilities of having:
- One machine breaking down in any week. (7 Marks)
 - Less than three machines breaking down in any week. (3 Marks)
- 15.
- a. Locate the stationary points of $f(x, y) = x^4 + y^4 - 36xy$ (10 Marks)
- b. Expand $f(z) = \sin(z)$ about $z = \frac{\pi}{3}$ using the Taylor series. (6 Marks)
- c. The velocity of a vehicle is given by the formula $v = u + at$. If $v = 20$ when $t = 2$ and $v = 40$ when $t = 7$, form two simultaneous equations and solve them to find the initial velocity of the vehicle (u) and its acceleration (a). (4 Marks)



16.

a. The values of $f(x)$ at certain points are given as follows:

x	F(x)
1	1
2	4
4	16

Use interpolation method to find the value of $f(3)$.

(10 Marks)

b. Determine the value of $5e^{0.5}$, correct to 5 significant figures by using the power series for e^x .

(10 Marks)

