



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

**Qualification Code** : 071606T4MCT  
**Qualification** : Mechatronics Technician Level 6  
**Unit Code** : ENG/OS/MC/CC/02/6/A  
**Unit of Competency** : Apply Engineering Mathematics

**WRITTEN ASSESSMENT**

**INSTRUCTIONS TO CANDIDATE**

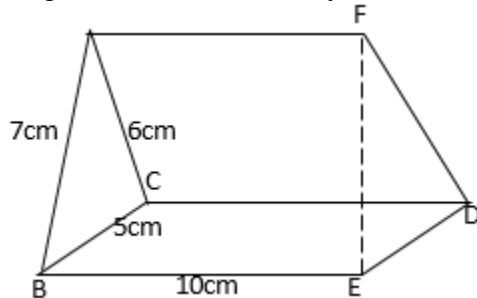
1. You are allocated **THREE HOURS** to attempt all the questions.
2. Marks for each question are indicated in brackets ( ).
3. This assessment has two sections: **A and B**
4. Do not write on the question paper.
5. You are required to have a scientific calculator in this assessment.
6. A separate answer booklet will be provided.

*This paper consists of THREE (3) printed pages  
Candidates should check the question paper to ascertain that all the pages are printed  
as indicated and that no questions are missing.*

**SECTION A (40 MARKS)**

You are required to answer ALL the questions in this section.

1. The below shows a solid prism. If the Mass of the solid used to make the above prism is 500g, Calculate the density of the material used. (4 Marks)



2. Solve the equations: (5 Marks)

$$3^{2x+3} - 7(3^{x+1}) + 2 = 0$$

3. Find the derivative of  $y = \log(x)e^x$  (3 Marks)

4. Determine the ninth, and the sixteenth terms of an arithmetic progression given the series 2, 7, 12, 17, ... (4 Marks)

5. Evaluate; (4 Marks)

$$\int \frac{2}{(9-4x^2)} dx.$$

6. Use Laplace transforms to solve the differential equation: (5 Marks)

$$\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 10y = e^{2x} + 20,$$

Given that when  $x = 0$ ,  $y = 0$  and  $dy/dx = -1/3$

7. Use Maclaurin's series to find the expansion of  $(2 + x)^4$ . (5 Marks)

8. Find the roots of  $[(5 + j3)]^{1/2}$  in rectangular form, correct to 4 significant figures. (4 Marks)

9. \_\_\_\_\_

Evaluate  $\int_1^2 4 \cos 3t dt.$

(4 Marks)

10. Find the mean of the set of numbers: {4, 5, 6, 9} (2 Marks)

**SECTION B (60 MARKS)**

Answer only **THREE (3) QUESTIONS** in this section.

11. Given that  $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 3 & 1 \\ 1 & 1 & 2 \end{bmatrix}$

i) Show that:

$$A^3 - 7A^2 + 13A - 7I = 0 \quad (8 \text{ Marks})$$

ii) Hence Determine  $A^T$  (7 Marks)

iii) Determine  $A^{-1}$  (5 Marks)

12. N is a vector Normal to the sphere  $x^2 + y^2 + z^2 = 9$  at the point (1,-2,2) and  $A = -i - 2j + 2k$ . Determine the;

i) Vector N (10 Marks)

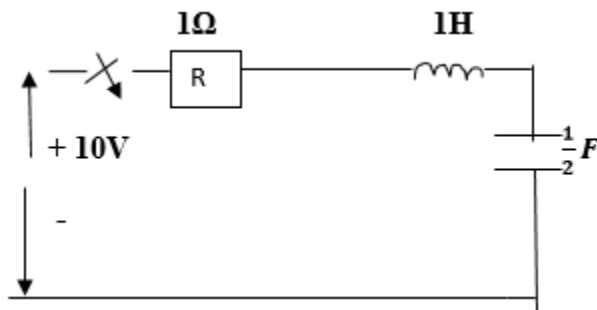
ii) Angle between N and A (10 Marks)

13.

a) Three numbers are in an arithmetic progression. Their sum is 15 and their product is 80. Determine the three numbers. (10 Marks)

b) Find the sum of all the numbers between 0 and 207 which are exactly divisible by 3. (10 Marks)

14. Trainees from Kabete Technical Training Institute set up an experiment as shown in the figure below during their electronics practical class. The circuit has a dead prior to closure at  $t = 0$ . Use Laplace transform to find the expression for the charge  $q$  for  $t > 0$ . (20 Marks)



**END**