

073105T4LAS

LAND SURVEY AND MAPPING LEVEL 5

LSM/OS/LM/CC/01/5/A

Apply Engineering Mathematics

Nov/Dec 2024



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

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INSTRUCTIONS TO CANDIDATE

1. Marks for each question are indicated in the brackets.
2. The paper consists of **TWO** sections: **A** and **B**.
3. Candidates are provided with a separate answer booklet
4. **DO NOT** write on this question paper.

This paper consists of THREE (3) 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 the questions in this section.**

1. A solid metal cylinder of radius 6cm and height 15cm is melted down and recasted into a shape comprising a hemisphere surmounted by a cone. Assuming that 8% of the metal is wasted in the process, determine the height of the conical portion, if its diameter is to be 12cm. (4 Marks)

2. Determine the value of $2e^{0.3}$ correct to 5 significant figures by using the power series for e^x . (4 Marks)

3. Solve the following trigonometric equation for values of θ between 0° and 360° .

$$2 - 5\tan^2\theta = 0 \quad (5 \text{ Marks})$$

4. Determine the inverse of the matrix $A = \begin{pmatrix} 5 & -3 \\ -2 & 1 \end{pmatrix}$ (4 Marks)

5. In a construction site cement, sand and ballast are mixed in the ratio 1:2:4 to produce concrete. Calculate the volume of each material require to produce 21m^3 concrete. (3 Marks)

6. Given that $x = 2^p$ and $y = 4^q$ show that $3p + 2q$ (4 Marks)

7. If $p = i + 3j - k$ and $q = 2i + j +$ $|p + q|$ (4 Marks)

8. Find the differential coefficient of 5 (5 Marks)

9. Solve for x in the following equation. (4 Marks)

$$\log(8 - 4x) - 1 = \log(2x - 4)$$

10. Simplify fully the following expression. (3 Marks)

$$\frac{12y^{-5}}{3y^{-2}}$$

SECTION B: (60 MARKS)**Answer Any THREE Questions in This Section**

11.

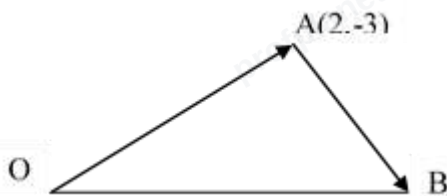
- a. Evaluate (6 Marks)

$$\tanh^{-1} 0.75$$

- b. Verify the following identity

$$\sin\theta + \sin\phi \equiv 2\sin\frac{\theta+\phi}{2}\cos\frac{\theta-\phi}{2} \quad (8 \text{ Marks})$$

- c. Relative to a fixed point O, the point A has coordinates (2,-3). The point B is such that $\overrightarrow{AB} = 3\mathbf{i} - 7\mathbf{j}$, where i and j are mutually perpendicular unit vectors lying on the same plane. Determine the distance of B from O. (6 Marks)



12. Given the matrices $P = \begin{bmatrix} 2 & 1 \\ 3 & -1 \\ 2 & 4 \end{bmatrix}$ and $Q = \begin{bmatrix} -2 & 1 \\ 1 & 1 \\ 1 & -2 \end{bmatrix}$, Determine the:

- a. $(P + Q)^2 + 3Q$; (10 Marks)

- b. Q^{-1} . (10 Marks)

13.

- a. Determine the value of; (4 Marks)

$$\frac{2}{7}x \left(1_{11}^{10} - \frac{9}{22} \right) \div 1_{11}^7$$

- b. The end radii of a solid cone frustum are 6 cm and 10 cm. The ends are separated by a distance of 22 cm. Determine its:

- (i) Volume in m^3 ; (5 Marks)

- (ii) Surface area. (7 Marks)

- c. Determine the perimeter of a minor segment is enclosed between a chord of length 7cm and a circle of radius 6cm. (4 Marks)

14.

- a. Find the first three terms in the Maclaurin's series for $f(x) = \frac{x}{1+x^2}$ (10 Marks)

- b. Find the first 4 terms of the Taylor's series for $\ln x = x$: (10 Marks)