

072205T4SPV

SOLAR PV INSTALLATION LEVEL 5

ENG/OS/PVI/CC/01/5/A

Apply Engineering Mathematics

March/April 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. Marks for each question are as indicated in the brackets.
3. Candidates are provided with a separate answer booklet.
4. **DO NOT** write on this question paper.

This paper consists of FIVE (5) printed pages
Candidate 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. Solve for x.

$$x^2 = 5x - 4 \quad (3 \text{ marks})$$

2. Find the value of x.

$$\log_{36} x = -\frac{1}{2} \quad (3 \text{ marks})$$

3. Solve the following simultaneous equations using the substitution method.

$$x - 2y = -1$$

$$4x + 3y = 18 \quad (4 \text{ marks})$$

3. Expand
- $(3 - 2x)^5$
- in ascending powers of x, up and including the term in
- x^3
- . (4 marks)

4. Find the value of p and q in the following equation;

$$R(p, 3) \text{ and } S(-4, -1) \text{ and } RS = 5. \quad (3 \text{ marks})$$

5. Prove that ;
- $\cos 75^\circ = \frac{\sqrt{2}(\sqrt{3}-1)}{4}$
- (4 marks)

6. Using the expansion for
- $\sin(A+B)$
- and
- $\cos(A-B)$
- , prove the following identity; (4 marks)

$$\frac{\sin(A+B)}{\cos(A+B)} = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

7. Calculate the volume of a metal sphere with a radius of 15 cm. (3 marks)

8. The times, in seconds, taken by 20 people to solve a simple numerical puzzle were

17 , 19 , 22 , 26, 28 , 31, 34 , 36 , 38 , 39 , 41, 42 , 43 , 47 , 50 , 51 , 53 , 55 , 57 , 58 .

Calculate the mean of these times. (3 marks)

9. The matrices A, B and C given below are in terms of the scalar constants;

$$A = \begin{pmatrix} -2 & 3 \\ 1 & a \end{pmatrix}, B = \begin{pmatrix} b & -1 \\ 2 & -4 \end{pmatrix}, C = \begin{pmatrix} 1 & c \\ d & 4 \end{pmatrix}$$

Given that $A + B = C$, find the value of a, b, c and d. (5 marks)

10. Find; (4 marks)

$$\frac{dy}{dx} \text{ if } y = \frac{\sqrt{x}}{2} - \frac{1}{6x^3}$$

SECTION B (60 MARKS)*Answer any THREE questions in this section.*

11.

a) Differentiate $f(x)$ from the first principles if $f(x) = -2x^2 + 3$. (4 marks)

b) A cylinder is placed in a box that is a cube of side 14 cm. Calculate the percentage of the volume of the box that is occupied by the cylinder. (4 marks)

c) If $p = 2i + j - k$ and $q = i - 3j + 2k$ determine:

i. $p \cdot q$

ii. $p + q$

iii. $|p + q|$

iv. $|p| + |q|$

(12 marks)

12.

a) The 2×2 matrices A and B are defined by;

$$A = \begin{pmatrix} 4 & 1 \\ 3 & 1 \end{pmatrix}, B = \begin{pmatrix} 2 & -1 \\ -3 & 5 \end{pmatrix};$$

i. Find A^{-1}

ii. Find $A^{-1} \times B$

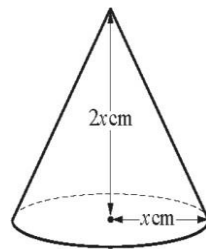
iii. Find a matrix C, so that; $(B + C)^{-1} = A$. (12 marks)

b) Solve for x and y in the following equations.

$$x - y = 3$$

$$x^2 - xy - 2y^2 - 7 = 0$$
 (4 marks)

- c) The cone below has a radius $x \text{ cm}$ and height $2x \text{ cm}$. The volume of the cone is 500cm^3 . Find the value of . (4 marks)



13.

- a) Prove that $(\tan x - 1)(\sin 2x - 2\cos^2 x) = 2(1 - 2 \sin x \cos x)$. (5 marks)
- b) Determine the general solution for, $\frac{\tan x - 1}{2} = -3$, correct to one decimal place. (5 marks)
- c) Find the first four terms, in ascending powers of x , in the binomial expansion of $(1 + 3x)^8$ (4 marks)
- d) Determine the coefficient of x^6 in the binomial expansion of $(1 + 3x)^8$ (6 marks)

14.

- a) Determine, $\int \cos(3x + 7) dx$ (4 marks)
- b) Find; $\int (2x - 5)^7 dx$ (4 marks)
- c) The frequency distribution for the value of resistance in ohms of 48 resistors is as shown.

RESISTANCE	RESISTORS
20.5–20.9	3
21.5–21.9	11
22.5–22.9	9
21.0–21.4	10
22.0–22.4	13
23.0–23.4	2

Determine the;

- I. mean value of resistance. (4 marks)
 - II. Standard deviation, correct to 3 significant figures. (4 marks)
- d) The coordinates of points R and S are $(-4,3)$ and (x, y) respectively. Point P $(-1,2)$ is the midpoint of RS. Find the values of x and y . (4 marks)