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 have **THREE HOURS** to attempt all the questions.

2. Marks for each question are indicated in brackets ( ).

3. This paper consists of **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 FOUR (4) 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)

Answer ALL questions in this section

1. Determine the mean of the following set of values {2,3,7,5,5,13,1,7,4,8,3,4,3}. (2 Marks)

2. If p = 15i -10j + 30k, find the modulus of p (2 Marks)

3. The interior angle of a n-sided regular polygon exceeds its exterior angle by 132°. Calculate the number of sides. (3 Marks)

4. The diagram below shows a circle with a chord PQ = 3.4cm and angle PRQ = 40°. Calculate the area of the shaded segment. (5 Marks)
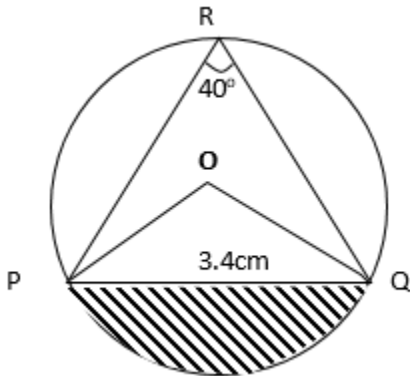
5. Given that A = $\begin{pmatrix} 2 & 1 \\ 0 & -2 \end{pmatrix}$ and

   B = $\begin{pmatrix} 1 & -2 \\ 2 & -1 \end{pmatrix}$ and that C = AB, evaluate C^{-1} (3 Marks)

6. The surface area of a sphere is 201. 1cm2.find the diameter of the sphere. (4 marks)

7. A mother is now $2\frac{1}{2}$ times as old as her daughter Mary; four years ago, the ratio of their ages was 3:1. What is the present age of the mother? (3 Marks)

8. Given that: - r = 5i – 2j and
   m = -2i + 6j – k are the position vectors for R and M respectively. Find the length of vector RM (2 Marks)

9. Use Binomial theorem to expand
   $(2 + 3x)^{\frac{1}{2}}$ as far as the term in x^3, and state the range of values of x which the expansion is valid. (4 Marks)

10. Solve $\frac{dy}{dx}$ from the first principle, given that $y = \frac{1}{x+4}$ (5 Marks)

11. Use implicit differentiation of $9x + x^3y^2 - 2xy^2 + 3y = 6$, to determine the equation of the tangent at point (1,1)   (4 Marks)

12. Two resistors when connected in Parallel, give a total resistance of 9.6 ohms. When connected in series, the total resistance was 40 Ohms. If one of the resistors is R Ohms, Show that ; $R^2 - 40R + 384 = 0$ (3 Marks)

SECTION B (60 MARKS)

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

13. study the matrices set below and use Cramer's theorem to find;

$4x + 8y + z = -6$
$2x - 3y + 2z = 0$
$x + 7y - 3z = -8$

    a) Its determinant   (4 Marks)

    b) Its inverse   (7 Marks)

    c) Solutions x, y and z of the matrix   (9 Marks)

14. The following table gives the frequency distribution of the number of orders received each day during the past 50 days at the office of a mail-ordercompany. Calculate;

No. of order	f
10 – 12	4
13 – 15	12
16 – 18	20
19 – 21	14
Total	n = 50

    i) Variance   (12 Marks)

    ii) Standard deviation   (8 Marks)

15. Given that $A = 3i + 4k$ and $B = 4i + 3k$,find;

    I.   A. B   (6 Marks)
    II.   /A/ and /B/   (5 Marks)
    III.   The angle between A and B   (9 Marks)

16. The diagram below shows a metal solid consisting of a cone mounted on hemisphere. The height of the cone is $1\frac{1}{2}$ times its radius;
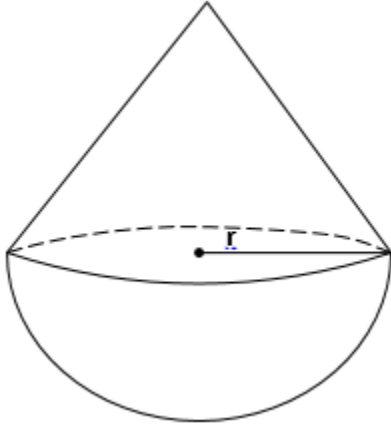
Given that the volume of the solid is 31.5π cm^3, calculate:

a) The radius of the cone (5 Marks)
b) The surface area of the solid (7 Marks)

c) How much water will rise if the solid is immersed totally in a cylindrical container which Contains some water, given the radius of the cylinder is 4cm. (5 Marks)

d) The density, in kg/m^3 of the solid given that the mass of the solid is 144 Kg.

(3 Marks)