

0715 0654C

MECHANICAL PRODUCTION TECHNICIAN LEVEL 6

ENG/OS/MEM/CC/02/6

Apply Engineering Mathematics

March/April 2026



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

WRITTEN ASSESSMENT

Time: 3 HOURS

INSTRUCTIONS TO CANDIDATE

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

This paper consists of FOUR (4) 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 in this section*

1. Evaluate the following expression without using a calculator: (4 Marks)

$$\frac{\frac{2}{7} \times \frac{1}{6} \div \frac{5}{9} + \frac{3}{4} \text{ of } \frac{1}{2}}{(\frac{1}{5} + \frac{2}{3}) \times \frac{1}{7} \div \frac{2}{3}}$$

2. Solve for x in the equation: $\log_3(x + 2) + \log_3 9 = 3$. (4 Marks)

3. Given that $B \sinh x + C \cosh x = 8e^x - 6e^{-x}$, where B and C are constants, determine the values of B and C. (4 Marks)

4. Determine the fifth term of $(3+x)^7$ without fully expanding. (4 Marks)

5. Compute the angle between two vectors $3i + 4j - k$ and $2i - j + k$ (4 Marks)

6. Calculate the area of a cylinder with a radius of 10cm and a height of 50 cm. (4 Marks)

7. The sum of 7 terms of an AP is 35 and the common difference is 1.2. Determine the first term of the series. (4 Marks)

8. Solve the value of x (4 Marks)

$$3^{2x+1} - 10(3^x) + 3 = 0$$

9. An overhead crane in company ABC has a force of 12N and is inclined at an angle of 35° to a second force of 18N both forces acting at a point. Determine the magnitude and the direction of the resultant force relative to the 18N force. (4 Marks)

10. Given $Z_1 = 6 + 10j$, $Z_2 = 10 + 8j$, and $Z_3 = 4 - 10j$; determine: $Z = Z_3 - \frac{Z_1 + Z_2}{Z_1 - Z_2}$

(4 Marks)

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

11.

a.

i. Use the binomial theorem to expand $\sqrt{\frac{1+4x}{1-4x}}$ as far as the term in x^2 (6 Marks)

ii. By setting $x = \frac{1}{20}$ in the result in (i), determine the approximate value of $\sqrt{6}$ correct to 5 decimal places. (4 Marks)

b. Find the directional derivative of $f(x, y, z) = xy^2 + yz^3$ at the point (2, -1, 1) in the direction of the vector $i + 2j + 2k$. (10 Marks)

12.

a. Differentiate with respect to x , $y = 5x^4 + 4x - \frac{1}{2x^2} + \frac{1}{\sqrt{x}} - 3$. (4 Marks)

b. Use factorization method to solve the following equation:

$$6x^2 - x - 1 = 0 \quad (6 \text{ Marks})$$

c. Table 1 shows length in centimeters of 230 cables used in a welding workshop.

Length in (cm)	70 - 80	80 - 90	90 - 100	100 - 110	110 - 120	120 - 130	130 - 140	140 - 150
Frequency(f)	12	18	35	42	50	45	20	8

Using the assumed mean of 105, determine the following;

- Mean
- Mode
- Standard deviation (10 Marks)

13.

a. A lampshade is in the shape of a frustum as shown in Figure 1 below. The vertical height of the shade is 25.0 cm and the diameters of the ends are 20.0 cm and 10.0 cm, respectively. Determine the area of the material needed to form the lampshade, correct to 3 significant figures. (5 Marks)

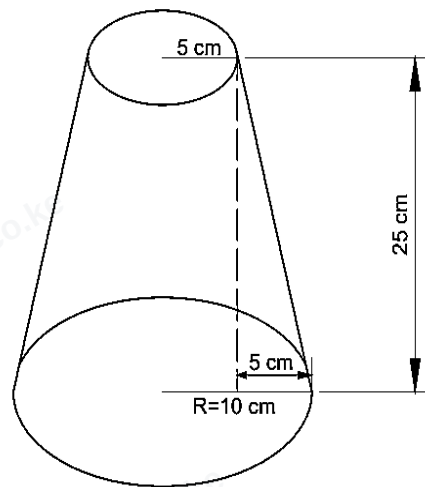


Figure 1

b. If $\tan B = \frac{8}{15}$, determine the value of the other five trigonometric ratios. (5 Marks)

c. Solve the differential equation.

$$2 \frac{d^2 y}{dx^2} - 11 \frac{dy}{dx} + 12y = 3x - 2 \quad (10 \text{ Marks})$$

14.

a. Locate the stationary points on the curve $y = 2x^3 - 3x^2 - 12x + 6$ and determine their nature. (8 Marks)

b. Given the matrices; $A = \begin{bmatrix} 12 & 22 \\ -14 & 15 \end{bmatrix}$ $B = \begin{bmatrix} 12 & -15 \\ 10 & 19 \end{bmatrix}$

Determine;

- i. $4A + 3B$ (3 Marks)
- ii. AB (2 Marks)
- iii. $A^{-1}B$ (4 Marks)
- iv. $B^T B$ (3 Marks)