0715 0654C

MECHANICAL PRODUCTION TECHNICIAN LEVEL 6

ENG/OS/MEM/CC/02/6

Apply Engineering Mathematics

November/December 2025

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 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 questions in this section

1. The surface area of a sphere is 2.01. $1cm^2$. Find the diameter of the sphere. (4 Marks)
2. The sum of 7 terms of an Arithmetic Progression (AP) series is 35 and the common difference is 1.2. Determine the first term of the series. (4 Marks)
3. Show that a in the points A (6, 0) and B (0, 12) is perpendicular to a line through points P (8, 10) and Q (4, 8). (4 Marks)

4. Find the values of a and b given that $2 - j3 = \sqrt{(a + jb}$ (4 Marks)

5. Solve the equation: $\log(x-1) + \log(x+1) = 2\log(x+2)$. (4 Marks)
6. Determine the value of $(3.039)^4$, correct to 6 significant figures using binomial theorem. (4 Marks)
7. Determine the gradient of the curve $x^2 + 2xy - 2y^2 + x = 2$ *at a point* $(-4,1)$. (4 Marks)
8. Find volume of closed cone whose perpendicular height is 40cm and its base is made up of a circle of radius 14 cm. (4 Marks)

9. Determine the Cartesian form of the following pair of parametric equations. (4 Marks)

$$x = 2t - 1$$

$$y = 12t2 - 14t + 6$$

10. Use the interpolation formula to estimate the value of $f(x)$ at $x = 2.5$, given the data points: (4 Marks)

x	2.0	3.0	4.0
$f(x)$	4.0	9.0	16.0

SECTION B (60 MARKS)

Answer Any THREE Questions in this section

11.

a. Prove the trigonometric identity.

$$\frac{1+\cot\theta}{1+\tan\theta} = \cot\theta$$

(6 Marks)

b. Solve the equation $6\cos^2\theta + 5\cos\theta - 6 = 0$ for values of θ from 0^0 to 360^0. (6 Marks)

c. Determine the area of parallelogram whose sides by the vectors $\tilde{A} = -2i - 3j + 2k$ and $B = -3i + 3j + 2k$. (4 Marks)

d. Find the locus of a point which moves so that its distance from a point (2, -3) is always 4 units. (4 Marks)

12.

a. Solve the differential equation.

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

b. Evaluate the following integrals. (8 Marks)

i. $\int 3t\, e^{2t}\, dt$

ii. $\int x^3 e^x\, dx$

13.

a. Prove the hyperbolic identities

i. $\cosh^2 x - \sinh^2 x = 1$ (4 Marks)

ii. $1 - \tanh^2 x = \operatorname{sech}^2 x$ (4 Marks)

iii. $\coth^2 x - 1 = \operatorname{cosech}^2 x$ (4 Marks)

b. Given $Ae^x + Be^{-x} = 4\cosh x - 5\sinh x$ Determine the values of A and B (5 Marks)

c. Given, $T = 2\pi\sqrt{\frac{l}{g}}$ Determine % change in T when l increases by 2% and g decreases by 1%. (3 Marks)

14.

a. Use Newton's method to find the positive root of $(x+4)^3 - e^{1.92x} + 5\cos\frac{x}{3} = 9$ Correct to three significant figures. (10 Marks)

b. Determine the first four terms of the power series for cos x. (10 Marks)