071305T4RAC

REFRIGERATION AND AIR CONDITIONING CRAFTPERSON- LEVEL 5

ENG/OS/RAC/CC/03/5/B

APPLY ENGINEERING MATHEMATICS

July/August 2024

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

WRITTEN ASSESSMENT

3 HOURS

INSTRUCTIONS TO CANDIDATE

1. This paper consists of two sections; **A** and **B**

2. Answer **ALL** the question as guided in each section

3. Marks for each question are as indicated in the brackets

4. You are provided with a separate answer booklet to answer the questions

5. Do not write in this question paper

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. Using laws of indices and logarithms solve the following equation. (4 Marks)
$$4^{(2x-1)} = 5^{(x+2)}$$

2. Solve the following logarithms. (3 Marks)

$$\frac{\frac{1}{2}log16 - \frac{1}{3}log8}{2log\,2}$$

3. Using factorization method solve the equation. (4 Marks)
$$x^2 - 4x - 32 = 0$$

4. Express the given Cartesian coordinates$(2, -5)$ as polar coordinates correctly to 3 decimal places. (4 Marks)

5. The roots of an equation are $^1/_3$ and -2, find the quadratic equation. (3 Marks)

6. In a box of 1500 nails,125 are defective, express the non-defective nails as a ratio of the defective one in its simplest form. (3 Marks)

7. In a system of forces the relationship between two forces $f_1\,and\,f_2$ is given by the following equations

   $5f_1 + 3f_2 + 6 = 0$

   $3f_1 + 5f_2 + 18 = 0$

   Solve for $f_1\,and\,f_2$ using the elimination method. (5 Marks)

8. Solve the equation $\cos^{-1}(-0.2348) = \theta$ for the angles of θ between 0° and 360°. (4 Marks)

9. A metal solid cone has a base radius 0.5m and the perpendicular height of
   1. 20m. Determine the surface area of the cone in m². (4 Marks)

10. Given the matrix A=$\begin{pmatrix} 2 & 3 \\ 1 & -4 \end{pmatrix}$ and B=$\begin{pmatrix} -5 & 7 \\ -3 & 4 \end{pmatrix}$

    Find:

    i. $A + B$ (3 Marks)

    ii. AB (3 Marks)

SECTION B (60MARKS)

Answer any THREE questions in this section.

11. a) Determine the inverse of M given:

$$M = \begin{pmatrix} 3 & -1 \\ -4 & 7 \end{pmatrix}$$ (6 Marks)

b) Given matrix A=$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ and B=$\begin{pmatrix} 1 & 0 \\ 2 & -1 \end{pmatrix}$.Determine $(AB)^T$. (4 Marks)

c) In a closed loop of an electrical circuit in a refrigeration system, the current flowing is given by the simultaneous equations:

$$I_1 + 2I_2 + 4 = 0$$
$$5I_1 + 3I_2 - 1 = 0$$

Using the inverse matrix method solve for I_1 and I_2 (10marks)

12. a). The figure 1 below shows a hemisphere attached to a cone. Calculate the total volume in m^3 if the radius of the hemisphere and the cone is 5cm and the vertical height is 12cm. (8 Marks)
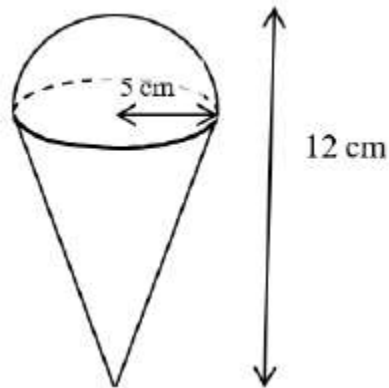
Figure 1

b) A cooling tower is in the form of a cylinder surmounted by a frustum of a cone as shown in the diagram below. Determine the volume of air space in the tower if 40% of the space is used for pipes and other structures. (12 Marks)
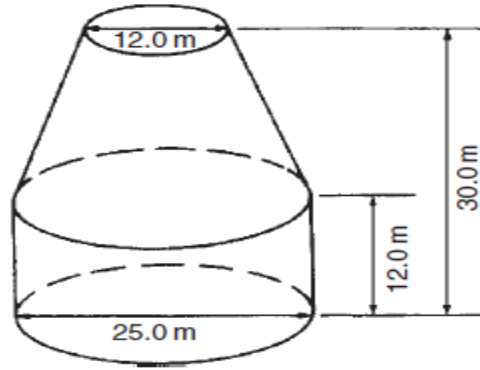
Figure 2

13.

a) Given vector $a = 2i + 4j - 5k$ and $b = 3i - 2j + 6k$

Determine

    i. $a.b$

    ii. $a \times b$

    iii. *The angle between a and b*   (13 Marks)

b) A constant force of F=10i+2j-k Newton displaces an object from $A = i + j + k$ to $B = 2i - j + 3k$ (in meters). Find the work done in Newton meters.

                                                       (7 Marks)

14. The table1 below shows the number of candidates who missed classes due to sickness in a term.

Number of days off sick	1-5	6-10	11-15	16-20	21-25
Frequency	10	11	14	8	7

Table 1

Determine from the grouped data:

    i.   mean

    ii.   median

    iii. mode

    iv. Standard deviation.   (20 Marks)