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Refrigeration and Air Conditioning Craftsperson - Level 5

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

Apply Engineering Mathematics

July/August 2023



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

**WRITTEN ASSESSMENT**

**3 hours**

**INSTRUCTIONS TO CANDIDATE**

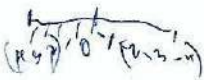
1. This paper has three sections **A, B** and **C**. Attempt questions in each section as per instructions given in the section.
2. You are provided with a separate answer booklet.
3. Marks for each question are indicated in the brackets.
4. Do not write on the question paper

*This paper consists of EIGHT (8) 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: (20 MARKS)

Attempt ALL the questions in this section.

- The midpoint of a line segment joining two points A (2, 4) and B (-2, -4) is \_\_\_\_\_.  
 A. (-2, 4)  
 B. (2, -4)  
 C. (0, 0)  
 D. (-2, -4)
 
- The diameter of a circle is 14 cm. Its circumference will be \_\_\_\_\_.  
 A. 44 cm  
 B. 22 cm  
 C. 11 cm  
 D. 55 cm
- Five equal forces of 10 N are applied at a point. The resultant force \_\_\_\_\_ if the angle between them is equal.  
 A. 10 N  
 B. 20 N  
 C. 0  
 D. 40 N
- The coordinates of a point P, where PQ is the diameter of a circle whose center is (2, -3) and Q is (1, 4) is \_\_\_\_\_.  
 A. (3, -10)  
 B. (2, -10)  
 C. (-3, 10)  
 D. (-2, 10)
- Solve for x in the equation  $x^2 - 15x + 56 = 0$   
 A.  $x = 14$  or  $x = 4$   
 B.  $x = 8$  or  $x = 7$   
 C.  $x = 28$  or  $x =$


- D.  $x = 24$  or  $x = 8$
6. If  $\cos \theta = 1/\sqrt{2}$ , then  $\theta$  is equal to \_\_\_\_\_.
- A.  $30^\circ$   
 B.  $45^\circ$   
 C.  $60^\circ$   
 D.  $90^\circ$
7. A wire is in the form of a circle. The radius of the circle is 28 cm. The wire is then molded to form a square. The side of the square formed is \_\_\_\_\_.
- A. 44 cm  
 B. 66 cm  
 C. 22 cm  
 D. 11 cm
8. The breadth of a rectangular field is 75% of its length. If the perimeter of the field is 1,050 m, then area of the field is \_\_\_\_\_.
- A. 65,000  $\text{m}^2$   
 B. 62,000  $\text{m}^2$   
 C. 67,500  $\text{m}^2$   
 D. 68,500  $\text{m}^2$
9. If A is a matrix of order  $m \times n$  and B is a matrix of order  $n \times p$  then order of AB is \_\_\_\_\_.
- A.  $p \times m$   
 B.  $p \times n$   
 C.  $n \times p$   
 D.  $m \times p$
10. The three side of a triangle are 3 cm, 4 cm and 5 cm respectively, then its area is \_\_\_\_\_.
- A.  $6 \text{ cm}^2$   
 B.  $7 \text{ cm}^2$   
 C.  $8 \text{ cm}^2$   
 D.  $9 \text{ cm}^2$
11. The observation which occurs most frequently in a sample is the \_\_\_\_\_.
- A. median  
 B. mean deviation  
 C. standard deviation

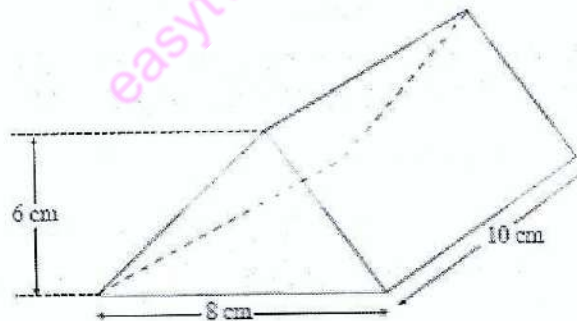
- D. mode
12. The median of the sample 5, 5, 11, 9, 8, 5, 8 is \_\_\_\_\_.
- A. 5
  - B. 6
  - C. 8
  - D. 9
13. The following scores were obtained by eleven footballers in a goal-shoot competition was 5, 3, 6, 8, 7, 8, 3, 11, 6, 3, 2, 4. The modal score was \_\_\_\_\_.
- A. 3
  - B. 6
  - C. 8
  - D. 11
14. The mean of ten numbers is 58. The mean of the other nine \_\_\_\_\_ if one of the numbers is 40.
- A. 18
  - B. 60
  - C. 162
  - D. 540
15. If two vectors  $3A$  and  $4B$  which are in same direction are added together then their resultant is given by \_\_\_\_\_.
- A.  $3A + 4B$
  - B.  $4A + 3B$
  - C.  $3A - 4B$
  - D.  $3A - 4B$
16. Two forces of 10N and 15N are acting simultaneously on an object in the same direction. Their resultant is \_\_\_\_\_.
- A. Zero
  - B. 5N
  - C. 25N
  - D. 150N


17. Two equal forces  $F$  and  $F$  makes an angle of  $180^\circ$  with each other. The magnitude of their resultant is \_\_\_\_\_.
- A. Zero
  - B.  $F$
  - C.  $2F$
  - D.  $3F$
18. If the line  $2x - 3y = 11$  is perpendicular to the line  $3x + ky = -4$ , the value of  $k$  is \_\_\_\_\_.
- A.  $-1$
  - B.  $2$
  - C.  $-2$
  - D.  $1$
19. Determine the equation of a line having slope  $-1/3$  and  $y$ -intercept equal to  $6$ .
- A.  $x - 3y = 6$
  - B.  $x + 3y = -18$
  - C.  $x + 3y = 18$
  - D.  $x - 3y = -6$
20. Calculate the scalar product of vectors  $a$  and  $b$  when the modulus of  $a$  is  $9$ , modulus of  $b$  is  $7$  and the angle between the two vectors is  $60^\circ$ .
- A.  $31.5$
  - B.  $21.5$
  - C.  $35.1$
  - D.  $25.1$

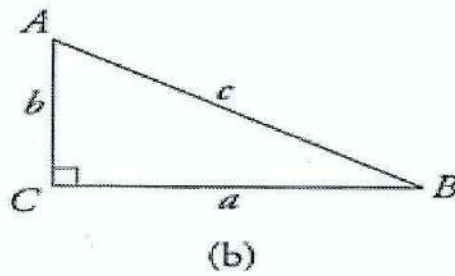


**SECTION B: (40 MARKS)***Attempt ALL the questions in this section.*

21. Solve for  $x$  in the equation  $4^{x-2} = 3^{x+4}$  (4 marks)
22. Simplify  $\log_6 216 + \frac{\log 42 - \log 6}{\log 49}$  without using a calculator (3 marks)
23. A circular road runs around a circular ground. If the difference between the circumference of the outer circle is 44. Calculate the width of the road.  (3 marks)
24. The probabilities that a particular office phone rings 0, 1, 2, 3 times in half hour are respectively: .05, .15, .21, .42. Find the probability that the phone rings at least 4 times between 3:30 - 4:00 pm. (4 marks)
25. A student has gotten the following grades on his tests: 87, 95, 76, and 88. He wants an 85 or better overall. Determine the minimum grade he must get on the last test in order to achieve that average? (3 marks)
26. A hollow iron pipe is 21 cm long and its external diameter is 8 cm. If the thickness of the pipe is 1 cm and iron weighs  $8 \text{ g/cm}^3$ , then calculate the weight of the pipe. (3 marks)
27. Calculate the volume of prism shown. (3 marks)



28. Find the nature of roots for the equation  $x^2 + x + 12 = 0$ . (3 marks)
29. Solve for  $x$ :  $11x^2 + 18x + 7 = 0$  (3 marks)
30. The area of a trapezium shaped field is  $480 \text{ m}^2$ , the distance between two parallel sides is 15 m and one of the parallel sides is 20 m. Find the other parallel side. (3 marks)
31. Calculate the height of a cylinder whose radius is 7 cm and the total surface area is  $968 \text{ cm}^2$ .  (3 marks)
32. Solve the right triangle in (b) if  $\angle B = 22^\circ$  and  $b = 16$ . (5 marks)



$$\frac{22}{7} \times 968 = \frac{22 \times 2 \times 7}{7} \times 7$$

$$968 = 154 \times 7$$

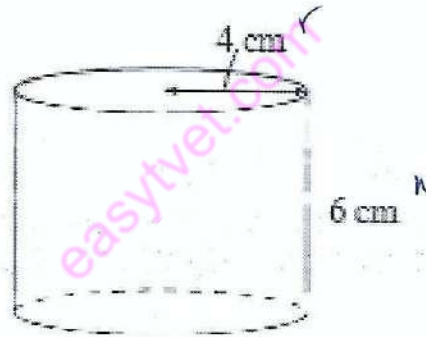
$$\approx 6.29 \text{ cm}$$

**SECTION C: (40 MARKS)**

Attempt any TWO questions in this section.

33. (a) Calculate the volume and total surface area of the cylinder radius 4cm and height 6cm.

(10 marks)

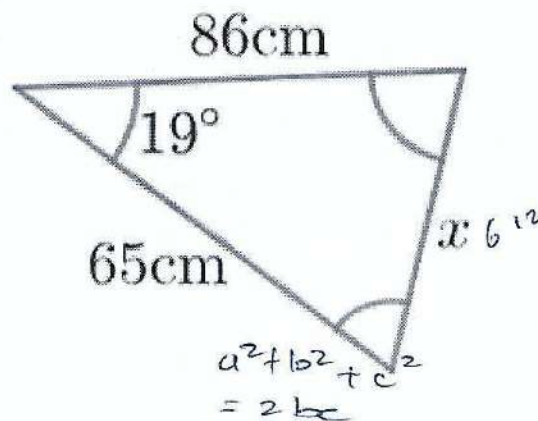


(b) Given that  $A = \begin{pmatrix} 1 & 0 \\ 2 & 4 \end{pmatrix}$  and  $B = \begin{pmatrix} 6 & 8 \\ 4 & 3 \end{pmatrix}$  Find the product of matrices A and B

(10 marks)

34. (a) Use the cosine rule to find the side-length marked x below to 2sf.

(8 marks)



$$\frac{11621}{22801} \div 19$$

1200

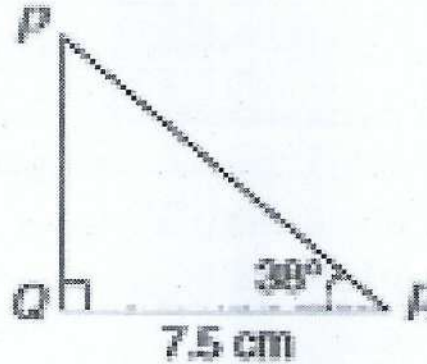
$$65^2 + 86^2 - 2 \times 65 \times 86 \times \cos 19^\circ = x^2$$

(b) Prove:  $(1 - \cos^2\theta) \csc^2\theta = 1$

(8 marks)

(c) In triangle  $PQR$  shown below, calculate the lengths  $PQ$  and  $PR$ .

(4 marks)



35. Calculate Mean, Median, Mode from the following grouped data

(20 marks)

Class	Frequency
2 – 4	3
4 – 6	4
6 – 8	2
8 – 10	1

36. (a) A ball is thrown with an initial velocity of 70 feet per second at an angle of  $35^\circ$  with the horizontal. Find the vertical and horizontal components of the velocity. (10 marks)

(b) Solve the simultaneous equations

(10 marks)

$$3x + 2y = 36 \dots\dots\dots i$$

$$5x + 4y = 64 \dots\dots\dots ii$$