

061306T4CSC

COMPUTER SCIENCE LEVEL 6

ICT/OS/CS/CR/03/6

Understand Mathematics for Computer Science

March/April 2026



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

WRITTEN ASSESSMENT

Time: 2 HOURS

INSTRUCTIONS TO CANDIDATE

1. The paper consists of **TWO** sections: **A** and **B**.
2. Answer **ALL** questions in section A .
3. Answer question **Twelve** (12) and any other **TWO** (2) questions in section B.
4. Marks for each question are indicated in the brackets.
5. Candidates are provided with a separate answer booklet
6. Do not write on this question paper.
7. Check your booklet to ensure it has a graph grid.

This paper consists of FIVE (5) printed pages

**Candidate 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 the questions in this section

1. The following data represents test scores of students: 12, 18, 24, 30, 36, 42, 48
 - a) Calculate the range of this data set (1 mark)
 - b) If the smallest value is changed to 8, find the new range (1 mark)
 - c) What effect does changing the smallest value have on the range? (1 mark)
2. In a college, 45 students study Computer Science, 38 study Mathematics, and 15 study both subjects.
 - a) How many students study at least one of these subjects? (2 marks)
 - b) How many students study Computer Science only? (2 marks)
3. Solve the quadratic equation using factorization: $x^2 + 7x + 12 = 0$ (4 marks)
4. State **THREE** characteristics of the Normal probability distribution. (3 marks)
5. Given that $a = 5$, $b = 3$, and $c = 4$, evaluate the expression: (3 marks)

$$k = (2a^2 - b^2) / (c + 1)$$
6. Given the universal set $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ and set $P = \{2, 4, 6, 8\}$
 - a) State De Morgan's first law in Boolean algebra and give an example. (2 marks)
 - b) List the elements of P complement (2 marks)
7. Solve the equation $2x^2 + 5x - 3 = 0$ using the completing the square method.(4 marks)
8. Given the data: 12, 18, 24, 30, 36, 42, 48, 54, 60 Find the first quartile (Q_1) of this data set. (3 marks)
9. In a college, 60% of students pass Mathematics and 70% pass Computer Science. If 50% pass both subjects:
 - a) What is the probability that a randomly selected student passes at least one subject? (3 marks)
 - b) Given that a student passes Mathematics, what is the probability they also pass Computer Science? (2 marks)
10. If $\mathbf{p} = 5\mathbf{i} + \mathbf{j} - 3\mathbf{k}$, $\mathbf{q} = 2\mathbf{i} - 1\mathbf{j} + \mathbf{k}$, and $\mathbf{r} = \mathbf{i} - 2\mathbf{k}$, find; $(\mathbf{p} - 3\mathbf{q}) \times \mathbf{r}$ (3 marks)
11. A bag contains 10 oranges and some lemons. If a fruit is picked at random, the probability that it is an orange is 0.4. Find the number of lemons in the bag.(4 marks)

SECTION B (60 Marks)***Answer Any THREE (3) Questions in This Section***

12. A restaurant manager recorded the number of customers served each hour during a 10-hour shift: 45, 52, 38, 61, 47, 54, 49, 43, 58, and 53 customers respectively.

a) Calculate:

- i. The mean number of customers served per hour (2 marks)
- ii. The median number of customers served per hour (2 marks)
- iii. The mode (if any) of customers served per hour (1 mark)

b) Two students, Jane and Peter, are taking separate tests. The probability that Jane passes is 0.7 and the probability that Peter passes is 0.6. Calculate the probability that:

- i. Both pass (2 marks)
- ii. Neither passes (2 marks)

c) A mathematics club is organizing activities involving selection and arrangement.

Note that combinations involve selection (order doesn't matter) while permutations involve arrangement (order matters).

- i. In how many ways can 4 students be selected from a group of 9 students to represent the school in a competition? (3 marks)
- ii. The word "MATHS" has 5 distinct letters. How many different 5-letter arrangements can be made using all the letters? (4 marks)
- iii. If the arrangement in part (ii) must start with the letter M, how many different arrangements are possible? (4 marks)

13. Given vectors $u = 3i + 2j - k$ and $v = i - 4j + 2k$

a) Calculate

- i. $u + v$ (2 marks)
- ii. $2u - v$ (2 marks)
- iii. Find the magnitude of vector u (2 marks)
- iv. The dot product $u \cdot v$ (2 Marks)

- b) Given the function $f(x) = 3x^2 - 6x + 2$
- Find the derivative $f'(x)$ (2 marks)
 - Find the value of x where the gradient is zero (2 marks)
 - Determine whether this point is a maximum or minimum (2 marks)

c) The following table shows test scores of 50 students:

Score Range	Frequency
0 - 20	5
20 - 40	12
40 - 60	18
60 - 80	10
80 - 100	5

You are required to

- Construct a cumulative frequency table and (4 marks)
- Estimate the median score using linear interpolation. (2 marks)

14. A medical test for detecting a disease has:

- Probability of having the disease: $P(D) = 0.03$
- Test is positive if disease present: $P(+|D) = 0.95$
- Test is positive if no disease: $P(+|D') = 0.08$

Calculate:

- The probability that a randomly selected person tests positive $P(+)$ (3 marks)
 - Using Bayes' theorem, find the probability that a person has the disease given they tested positive $P(D|+)$ (3 marks)
- A committee consisting of 6 members is to be formed out from 7 men and 4 women. Determine the number of committees to be formed such that at least a third of the committee is women. (4 marks)
- A measurement is recorded as 25.4 cm, but the actual value is 25.0 cm.
 - Calculate the absolute error (2 mark)
 - Calculate the relative error as a percentage (2 marks)
- A bookshop sells novels and textbooks. Novels cost Ksh. 250 each and textbooks cost Ksh. 400 each. On a particular day, 15 books were sold for a total of Ksh. 4,500.

- i. Form two simultaneous equations from the given information (2 marks)
- ii. Solve the equations to find how many novels and textbooks were sold (4 marks)

15.

- a) Simplify the Boolean expression using Boolean algebra laws (show all steps and state the laws used): $F = AB + AB' + A'B$ (4 marks)
- b) The following data shows exam scores of 30 students: 15, 22, 28, 35, 38, 42, 45, 48, 52, 55, 58, 60, 62, 65, 68, 70, 72, 75, 78, 80, 82, 85, 88, 90, 92, 95, 96, 98, 99, 100

Calculate:

- i. The third quartile (Q_3) (2 marks)
- ii. The 90th percentile (P_{90}) (2 marks)
- c) Given the Boolean function: $F(A,B,C) = \Sigma m(1,3,5,7)$
 - i. Express in sum-of-products (SOP) form (2 marks)
 - ii. Simplify using a Karnaugh map (3 marks)
- d) Distinguish between explicit function and quadratic function as used in mathematics. (2 marks)
- e) Dataset has the five-number summary: Min=20, $Q_1=35$, Median=50, $Q_3=68$, Max=95
 - i. Calculate the interquartile range (IQR) (2 marks)
 - ii. Determine if there are any outliers using the $1.5 \times \text{IQR}$ rule (3 marks)