

The Open University of Sri Lanka

Department of Mathematics

Advanced Certificate in Laboratory Technology Programme

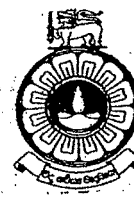
ADC2206 - Mathematics for Laboratory Technology

Final Examination 2024/2025

Duration: Two Hours

Date: 13. 10. 2024

Time: 9.30 a.m – 11.30 a.m.



Instructions:

- Answer **Four (04)** Questions Only.
- There are two sections: PART A and PART B.
- Answer **TWO** Questions from **each** section.
- A total maximum mark obtainable is 100.

PART – A

Q1) a) Simplify each of the following expressions. Show the steps clearly. (08 marks)

i) $(8 - \sqrt{16}) \times (4^2 - 7 + 5) \div 2$

ii) $\frac{2^4 + (16 - 3 \times 4)}{(6 + 3^2) \div (7 - 4)}$

b) i) Solve the following equation for x .

$$2 \log x = \log 2 + \log(3x - 4)$$

ii) If $a = \frac{25}{9}$, $b = \frac{5}{4}$ and $c = \frac{3}{2}$ then show that

$$\ln a - 2 \ln b + 3 \ln c = \ln 6.$$

(09 marks)

c) Consider the Figure 1 and assume that $AC = 13 \text{ m}$, $\hat{ACB} = 30^\circ$ and $\hat{ABC} = 90^\circ$.

Find the perimeter of the triangle ABC . (Take $\sqrt{3} = 1.732$) (08 marks)

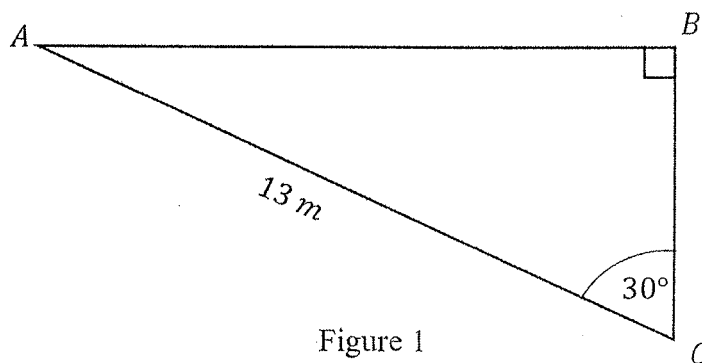


Figure 1

Q2) a) Express $y = x^2 - 10x + 16$ in completed square form and sketch the graph of y as a function of x . (07 marks)

b) i) Expand $(2 - 5x)^3$ using the binomial theorem.

ii) Find the coefficient of x^4 in the expansion of $(x^2 + 3)^5$. (08 marks)

c) i) By determining the nature of the roots, find the roots of the quadratic equation

$$3x^2 + 2x - 5 = 0.$$

ii) Solve

$$\frac{3}{x+2} + \frac{5-3x}{4} + x = -1.$$

(10 marks)

Q3) a) Let A, B and C are 2×2 matrices given below, where a, b and c are scalar constants.

$$A = \begin{pmatrix} a & 2 \\ 3 & 7 \end{pmatrix} \quad B = \begin{pmatrix} 2 & 4 \\ b & 2 \end{pmatrix} \quad C = \begin{pmatrix} -1 & c \\ 3 & 2 \end{pmatrix}$$

i) If $2A - 3B = 4C$, then find the values of a, b and c .

ii) By substituting the values obtained in part i), find $A^{-1}, \det(AB)$ and C^T .

(12 marks)

b) Five pens and three pencils cost Rs. 51. One pen and two pencils cost Rs. 20. Find the cost of twenty pens and fifteen pencils by solving simultaneous equations.

(05 marks)

c) A committee of 3 persons is to be constituted from a group of 2 men and 3 women.

i) In how many ways can this be done?

ii) How many of these committees would consist of 1 man and 2 women?

iii) How many committees contain at least 2 women?

(08 marks)

PART - B

Q4) Consider set of scores given below of a particular course.

39, 16, 30, 37, 53, 15, 16, 60, 58, 26, 28, 19, 20, 12, 14, 24, 59,
21, 57, 38, 25, 36, 34, 15, 25, 41, 52, 45, 60, 63, 18, 26, 43, 36,
18, 27, 59, 63, 46, 48, 25, 33, 46, 27, 46, 42, 48, 35, 64, 24

- a) Prepare the frequency distribution table by taking the class intervals as $(10 - 20), (20 - 30), \dots, (60 - 70)$. (02 marks)
- b) Considering the distribution in part a), draw;
- i) histogram, (06 marks)
 - ii) frequency polygon, (07 marks)
 - iii) the increasing and decreasing cumulative frequency curve. (08 marks)
- c) Hence, find the median of the given scores. (02 marks)

Q5) The grouped frequency distribution illustrated in the Table 1 represents a sample of ages of 120 randomly selected patients admitted to a hospital.

Ages of patients	Frequency
0 – 8.5	17
8.5 – 17.5	14
17.5 – 26.5	10
26.5 – 35.5	14
35.5 – 44.5	10
44.5 – 53.5	16
53.5 – 62.5	9
62.5 – 71.5	11
71.5 – 80.5	8
80.5 – 89.5	11

Table 1

Considering the grouped frequency distribution, find;

- a) mean, (05 marks)
- b) median, (06 marks)
- c) standard deviation, (08 marks)
- d) measure of skewness, (03 marks)
- e) coefficient of variation. (03 marks)

Q6) (a) Fifteen air samples from a certain region were obtained, and for each one, the carbon monoxide concentration was determined. The results (in ppm) were

9.3, 10.7, 8.5, 9.6, 12.2, 15.6, 9.2, 10.5, 9.0, 13.2, 11.0, 8.8, 13.7, 12.1, 9.8

Compute the;

- i) Inter quartile range,
- ii) Quartile deviation. (14 marks)

(b) In a sports club of 530 members, each member plays at least one of the three sports Cricket, Football and Tennis. 240 of them play Cricket, 255 play Football and 265 Tennis. 80 play Cricket and Football, 85 play Cricket and Tennis and 90 play Football and Tennis. How many members play all the three sports? (05 marks)

(c) In a class of 120 students, 36 enrolled for both Mathematics and Statistics. 66 enrolled for Statistics. If the students of the class enrolled for at least one of the two subjects, then how many students enrolled only for Mathematics but not for Statistics? (06 marks)

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