

UNIVERSITY OF KENT

**DIVISION OF COMPUTING, ENGINEERING
AND MATHEMATICAL SCIENCES**

LEVEL 4 EXAMINATION

Foundations of Computing II

Thursday, 11 May 2023 : 14.00 - 16.00 (2 hours)

Paper Instructions
The paper contains FOUR questions. Answer THREE questions.
An approved calculator is permitted.
Answer each question in a separate book.
Students are not permitted to remove this question paper from the examination venue

1. $A = \begin{pmatrix} 3 & 9 \\ -2 & 8 \end{pmatrix} \quad B = \begin{pmatrix} a \\ -1 \end{pmatrix} \quad C = \begin{pmatrix} 9 \\ b \end{pmatrix}$

$AB = C$ a and b are constants

(a) Find the values of a and b

[8 marks]

(b) Find the inverse of A

[5 marks]

(c)
$$\begin{cases} 3x + 9y = 33 \\ -2x + 8y = 20 \end{cases}$$

Using your answer to part (b), or otherwise, find the values of x and y

[4 marks]

(d) Explain why the matrix $D = \begin{pmatrix} 3 & 6 \\ 2 & 4 \end{pmatrix}$ has no inverse

[3 marks]

2. With respect to a fixed origin, O, the straight lines L_1 and L_2 are:

$$L_1: i + 2j + \lambda(i + j)$$

$$L_2: \frac{x - 6}{3} = 3 - y$$

- (a) Find the point of intersection between L_1 and L_2

[9 marks]

- (b) Line L_3 intersects L_1 at the point $2i + 3j$ and it intersects L_2 at the point $9i + 2j$. Find the Vector equation of the line L_3

[6 marks]

- (c) Calculate the area of the triangle enclosed between the three lines

[5 marks]

3. (a) (i) The letters of the word DIVIDED are placed at random in a line. How many different orders of the letters are possible?

[3 marks]

- (ii) In how many of the possible orders are the three Ds next to each other?

[3 marks]

- (iii) Find the probability that the first two letters in the order contain at least one D

[3 marks]

- (b) In a factory a particular component is manufactured on three separate machines. Machine A makes 25% of the components, machine B produces 45% and machine C makes the remainder. Of the components made by each machine 2% of those produced by machine A are found to be faulty with the corresponding figures for machines B and C being 3% and 5% respectively.

- (i) Draw a tree diagram to represent this information

[4 marks]

- (ii) The components produced by all three machines are merged. Calculate the probability that a component picked at random is faulty

[4 marks]

- (iii) Given that the chosen component is faulty, calculate the chance that it was produced by machine B

[3 marks]

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

4. (a) Differentiate the following:

(i) $y = 4x^3$ [2 marks]

(ii) $y = (3x + 7)^5$ [4 marks]

(b) Evaluate the following:

(i) $\int_1^3 (3x^2 + 2x) dx$ [4 marks]

(ii) $\int_{y=2}^4 \int_{x=1}^3 (2x + y) dx dy$ [10 marks]