

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

LEVEL 4 EXAMINATION

Foundations of Computing II

Monday, 17 May 2021

Paper Instructions
<p>The paper contains FIVE questions. Answer FOUR questions.</p> <p>This examination is designed to take 2 hours but you can take longer if you wish. Please ensure that you submit your answer booklet within 24 hours of the exam release time.</p>
Notes to Candidates
<p>This is an open book examination to be completed and submitted within 24 hours.</p> <p>As you will have access to resources to complete your assessment, any content you use from external source materials should be cited. Full academic referencing is <u>not</u> required.</p> <p>You are reminded of your responsibility to act with honesty, integrity and fairness in completing assessment requirements for your course, and to demonstrate good academic practice when undertaking this assessment.</p> <p>This is an individual piece of work and collusion with others is strictly prohibited.</p> <p>Plagiarism detection software will be in use.</p> <p>Breaches of academic integrity will be considered to be academic misconduct.</p> <p>Where the University believes that academic misconduct has taken place the University will investigate the case and apply academic penalties as published in Annex 10 of the Credit Framework.</p>

1. (a) Solve the simultaneous equations:

$$\begin{cases} 3x + 2y = 19 \\ 2x + 5y = -2 \end{cases}$$

[3 marks]

(b) $M = \begin{pmatrix} 3 & 2 \\ 2 & 5 \end{pmatrix} \quad N = \begin{pmatrix} 19 \\ -2 \end{pmatrix}$

Find:

(i) M^{-1}

[6 marks]

(ii) $M^{-1}N$

[3 marks]

(c) $A = \begin{pmatrix} 2 & 4 \\ 6 & 8 \end{pmatrix} \quad B = \begin{pmatrix} 3 & 5 \\ 7 & 9 \end{pmatrix}$

Find AB and BA

[8 marks]

2. $\underline{r}_1: \frac{x+2}{4} = \frac{y-2}{3} = z - 1$

$$\underline{r}_2 = 3i + 4j - 3k + \mu(i + j + k)$$

- (a) Convert both equations to their parametric form

[6 marks]

- (b) Find the point of intersection of the two lines

[8 marks]

- (c) Find the size of the angle between the two lines.

[6 marks]

$$\underline{a} \cdot \underline{b} = |\underline{a}| \times |\underline{b}| \times \cos \theta$$

$$\underline{a} \cdot \underline{b} = (a_i \times b_i) + (a_j \times b_j) + (a_k \times b_k)$$

3. (a) Explain in words the meaning of $P(A|B)$

State the relationship between A and B when:

(i) $P(A|B) = P(A)$

(ii) $P(A|B) = 0$

[6 marks]

- (b) The events A and B are such that:

$$P(A) = \frac{5}{8}, \quad P(A|B) = \frac{1}{2}, \quad P(A \cup B) = \frac{7}{8}.$$

By drawing a Venn diagram, or otherwise, calculate:

(i) $P(B|A)$

(ii) $P(A \cap B)$

(iii) $P(A \cup \bar{B})$

(iv) $P(\bar{A} \cap \bar{B})$

- (v) Are events A and B independent?

[10 marks]

- (c) Event C is independent of event A and $P(A \cap C) = \frac{1}{4}$

Find $P(C|A)$ and $P(C)$

[4 marks]

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

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

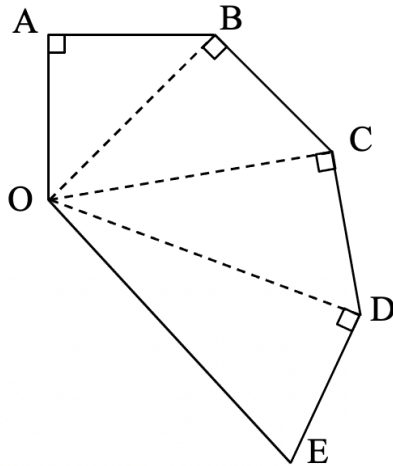
4. (a) Sketch the following graphs for values of θ , where $-\pi \leq \theta \leq \pi$

(i) $y = \sin 2\theta$

(ii) $y = 2 \sin \theta$

[10 marks]

- (b) OABCDE is a hexagon with $OA = AB = BC = CD = DE = 1\text{cm}$.



- (i) Calculate the lengths OB, OC, OD, OE, correct to 1 d.p.

[8 marks]

- (ii) Calculate the perimeter of OABCDE

[2 marks]

5. (a) Find the equation of the tangent to the curve $y = x^2 + x + 1$ when it passes through the point (1,3)

[8 marks]

- (b) Evaluate $\int_{y=3}^4 \int_{x=1}^2 (2x + 4y) dx dy$

[12 marks]