

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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 Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka
 ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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 Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
 கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
 General Certificate of Education (Adv. Level) Examination, 2025

ගණිතය I
 கணிதம் I
 Mathematics I

07 E I

පැය තුනයි
 மூன்று மணித்தியாலம்
 Three hours

අමතර කියවීම් කාලය - මිනිත්තු 10 යි
 மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள்
 Additional Reading Time - 10 minutes

Use additional reading time to go through the question paper, select the questions you will answer and decide which of them you will prioritise.

Index Number

Instructions:

- * This question paper consists of two parts;
Part A (Questions 1–10) and **Part B** (Questions 11–17).
Part A:
 Answer **all** questions. Write your answers to each question in the space provided. You may use additional sheets if more space is needed.
Part B:
 Answer **five** questions only. Write your answers on the sheets provided.
- * At the end of the time allotted, tie the answer scripts of the two parts together so that **Part A** is on top of **Part B** and hand them over to the supervisor.
- * You are permitted to remove **only Part B** of the question paper from the Examination Hall.

For Examiners' Use only

(07) Mathematics I		
Part	Question No.	Marks
A	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
B	11	
	12	
	13	
	14	
	15	
	16	
	17	
	Total	

Total

In Numbers	
In Words	

Code Numbers

Marking Examiner	
Checked by:	1
	2
Supervised by:	

Part A

1. Let $A = \{x \in \mathbb{R} : |x - 2| < 3\}$ and $B = \{x \in \mathbb{R} : (x + 5)(x - 4) \leq 0\}$. Find $A \cup B$, $A \cap B$ and $A - B$.

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2. Let A , B and C be subsets of a universal set S . Show that $A \cup (B - A) \cup (C - (A \cup B)) = A \cup B \cup C$.

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3. Using a truth table, show that $(p \wedge (p \Rightarrow q)) \Rightarrow q$ is a tautology.

Department Of Exa.

4. Let m and n be two integers. Using the method of contraposition, prove that if $m^2(n^2 - 4n)$ is odd, then m and n are both odd.

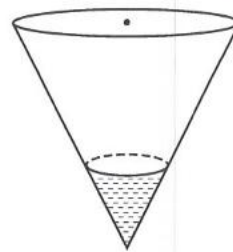
ditions, Sri Lanka

7. Let $f(x) = 2x - 3$. Solve the equation $f(f(x)) = 11$ for x .

Find the value of the real constant a such that the equation $f^{-1}(x) = ax^2$ has exactly one real solution.

8. Let l_1 and l_2 be the lines given by $y = 2mx - 5$ and $y = mx + 1$ respectively, where m is a non-zero real number. The lines l_1 and l_2 intersect at a point A . The line l_1 intersects the y -axis at a point B , and the line l_2 intersects the x -axis at a point C . Find the value of m such that the area of the triangle ABC is 42 square units.

9. A conical tank with height 12 m and radius 6 m is filled with water at a rate of $0.05 \text{ m}^3 \text{ s}^{-1}$. (See the figure.) Find the rate at which the water level is rising when the depth of water is 4 m.



10. Find the area of the region bounded by the curves $y = 3 + x - \frac{x^2}{4}$ and $y = \frac{x^2}{4} - x + 3$.

සියලු ම හිමිකම් ඇවිරිණි / முழுப் பதிப்புரிமையுடையது / All Rights Reserved

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
General Certificate of Education (Adv. Level) Examination, 2025

ගණිතය I
கணிதம் I
Mathematics I

07 E I

Part B

* Answer five questions only.

- 11.(a) For an order, a florist has prepared 150 bouquets with red, yellow and white coloured roses. These bouquets were prepared either in a single colour, two colours or three colours. Among these bouquets

- 75 had red roses and 60 had yellow roses,
- 10 had only red and yellow roses, and 40 had only yellow and white roses,
- 45 had no white roses.

Also, there were 65 single coloured bouquets.

Find the number of bouquets with

- (i) only white roses,
- (ii) roses of all three colours,
- (iii) only red and white roses.

If each bouquet has 12 roses and the mixed-coloured bouquets have equal number of roses from each colour, find the number of white roses the florist has used to fulfil this order.

- (b) Using truth tables, determine whether $((p \vee q) \wedge (\sim p \vee r)) \vee (\sim q \wedge \sim r)$ and $(q \Rightarrow r) \vee \sim (p \wedge q)$ are logically equivalent.

- 12.(a) Using the **Principle of Mathematical Induction**, prove that

$$\sum_{r=1}^n \frac{1}{\sqrt{r+1} + \sqrt{r}} = \sqrt{n+1} - 1 \text{ for all } n \in \mathbb{Z}^+.$$

- (b) Let $f(r) = (Ar^2 + Br + C)2^r$ for $r \in \mathbb{Z}^+$.

Find the constants A , B and C such that $f(r+1) - f(r) = r^2 2^r$.

Deduce that $\sum_{r=1}^n r^2 2^r = (n^2 - 2n + 3)2^{n+1} - 6$.

Can there be two positive integers m and n such that $\sum_{r=m}^n r^2 2^r = 1631$? Justify your answer.

13.(a) Let α and β be the roots of $2x^2 - 5x + 3 = 0$.

Given that $\alpha > \beta$, show that $\alpha - \beta = \frac{1}{2}$ without solving the equation.

Find the quadratic equation whose roots are $\frac{\alpha + \beta}{\alpha}$ and $\frac{\alpha - \beta}{\beta}$.

(b) Let $p(x) = 2x^3 - x^2 + ax + b$, where $a, b \in \mathbb{R}$. It is given that $(x - 1)$ is a factor of $p(x)$. Further, the remainder when $p(x)$ is divided by $(x - 2)$ is 3 more than the remainder when $p(x)$ is divided by $(x + 1)$. Find the values of a and b .

14.(a) Find the first 3 terms in each of the expansions of $(1 - 3x^2)^6$ and $(1 + 2x^2)^6$ in ascending powers of x .

Hence, find the coefficient of x^4 in the expansion of $(1 - x^2 - 6x^4)^6$.

(b) A person invests Rs. 1 000 000 in an account that earns 6% per annum compounded monthly. He withdraws Rs. 50 000 from this account at the end of every year. Let Rs. A_n be the amount of money in the account after the n^{th} withdrawal.

Show that

$$A_1 = A(1.005)^{12} - B \text{ and}$$

$$A_2 = A(1.005)^{24} - B[1 + (1.005)^{12}],$$

where $A = 1\,000\,000$ and $B = 50\,000$.

Write down a similar expression for A_n and find the number of withdrawals after which the balance in the account is less than Rs. 50 000. (Answer need not be simplified.)

15. Let $A \equiv (1, 2)$ and $B \equiv (7, 2)$.

(i) Find the coordinates of the point C such that the mid point of the line segment BC is $D \equiv (4, 2 + 3\sqrt{3})$.

(ii) Show that the line AC is perpendicular to the line AB .

(iii) Show that the distance from A to B is equal to the distance from C to D .

(iv) Find the angle $\hat{ABD}$ and deduce that the triangle ABD is an equilateral triangle.

(v) Find the equation of the line l perpendicular to BC through A .

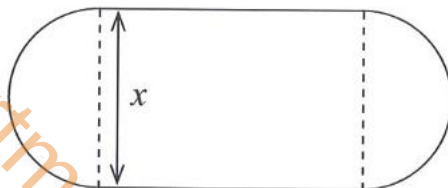
(vi) Let E be the point of intersection of l and BC . Find the area of the triangle ADE .

16. (a) Evaluate $\lim_{x \rightarrow 2} \frac{(x^2 - 2x)(x^2 - 3x + 2)}{(x - 2)(\sqrt{x - 1} - 1)}$.

(b) Differentiate each of the following with respect to x :

(i) $\frac{2}{x^2} - x^2 \ln(x^2 + 4) + 5$ (ii) $(x^3 + 3)e^{2x^2} + (x^2 - 3)e^{-2x^2}$ (iii) $\frac{2x+3}{2x-3} + \sqrt{\frac{x^2-1}{x^2+4}}$

(c) A playground in the shape shown in the diagram has a rectangle and two semicircles.



The perimeter of the playground is 1000 m. If the diameter of the semicircular part is x m, show that the area of the play-ground A m² is given by $A = 500x - \frac{\pi x^2}{4}$.

Hence, find the value of x for which the area of the playground is a maximum.

17. (a) Using **partial fractions**, find $\int \frac{3x^2 + 2x + 1}{(x+1)^2(x-1)} dx$.

(b) Using **integration by parts**, find the value of $\int_1^2 4x^3 (\ln x)^2 dx$.

(c) The following table gives the values of the function $f(x) = \frac{x}{x^5 + 3x + 1}$, correct to three decimal places, for values of x between 0 and 3 at the end points of the intervals of length 0.5:

x	0	0.5	1.0	1.5	2.0	2.5	3.0
$f(x)$	0	0.198	0.2	0.115	0.051	0.024	0.012

Using **Simpson Rule**, find an approximate value for $\int_0^3 f(x) dx$.

Department Of Examinations , Sri Lanka

සියලු ම හිමිකම් ඇවිරිණි / முழுப் பதிப்புரிமையுடையது / All Rights Reserved

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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ගණිතය II
கணிதம் II
Mathematics II

07 E II

පැය තුනයි
மூன்று மணித்தியாலம்
Three hours

අමතර කියවීමේ කාලය - මිනිත්තු 10 යි
மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள்
Additional Reading Time - 10 minutes

Use additional reading time to go through the question paper, select the questions you will answer and decide which of them you will prioritise.

Index Number

Instructions:

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Part A (Questions 1–10) and Part B (Questions 11–17).
Part A:
Answer **all** questions. Write your answers to each question in the space provided. You may use additional sheets if more space is needed.
Part B:
Answer **five** questions only. Write your answers on the sheets provided.
- * At the end of the time allotted, tie the answer scripts of the two parts together so that Part A is on top of Part B and hand them over to the supervisor.
- * You are permitted to remove **only** Part B of the question paper from the Examination Hall.
- * Statistical tables will be provided.

For Examiners' Use only

(07) Mathematics II		
Part	Question No.	Marks
A	1	
	2	
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	4	
	5	
	6	
	7	
	8	
	9	
	10	
B	11	
	12	
	13	
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	16	
	17	
Total		

Total

In Numbers

In Words

Code Numbers

Marking Examiner

Checked by:

Supervised by:

Part A

1. Let $x, y, z \in \mathbb{R}$.

Show that
$$\begin{vmatrix} x & x & x \\ x & y & z \\ x^2 & y^2 & z^2 \end{vmatrix} = x(x-y)(y-z)(z-x).$$

2. Let $A = \begin{pmatrix} 1 & 0 \\ 2 & 3 \end{pmatrix}$. Find A^2 and A^3 .
Find $a \in \mathbb{R}$ such that $A^3 - 2A^2 = \begin{pmatrix} a & a^3+1 \\ 9+a^2 & 9 \end{pmatrix}$.

3. The median and the mean of five observations arranged in ascending order are 18 and 20, respectively. If the interquartile range of these observations is 29, find the first and third quartiles.

4. Two students independently analyzed a dataset of 10 observations. Both of them computed the mean incorrectly, and then applied the formula $\sigma^2 = \frac{1}{n} \sum_{i=1}^n (x_i - \mu)^2$ for the variance correctly, obtaining two incorrect values for the variance. The table below shows their results:

Student	Mean	Variance
A	2	65
B	5	50

Find the correct mean.



5. The time that a student takes to walk from his home to school follows a normal distribution with a mean of 20 minutes and a standard deviation of 4 minutes.

(i) If the student leaves home at 7.00 am, find the probability that he reaches the school between 7.20 am and 7.25 am.

(ii) Find the probability that the student takes more than 25 minutes to reach the school.

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6. A fruit basket has three oranges, two pears and one woodapple. Three fruits are randomly taken from the basket without replacement.

Find the probability that

(i) all three fruits taken are oranges,

(ii) none of the fruits taken is a woodapple.

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7. Two numbers are randomly chosen, one from each of the two sets $S_1 = \{1, 2, 3, 4\}$ and $S_2 = \{1, 2, 4, 5\}$ respectively.

Find the probability that

- (i) exactly one of the two chosen numbers is odd,
- (ii) the sum of the two chosen numbers is greater than 3.

8. Let A and B be two mutually exclusive events defined on a sample space S such that $P(A) = 0.2$, and $P(A' \cap B') = 0.4$. Find $P(B)$ and $P(A' \cap B)$.

9. The probability mass function of a discrete random variable X is as follows:

x	1	2	3	4
$P(X=x)$	0.1	a	b	0.3

If $P(X > 2) = 4P(X \leq 2)$, find the values of a and b .
With these values of a and b , find the mean of X .

10. The probability density function $f(x)$ of a continuous random variable X is given by

$$f(x) = \begin{cases} \frac{k}{2}(kx-1) & ; \quad 1 \leq x \leq 3 \\ 0 & ; \quad \text{otherwise} \end{cases}$$

where $k > 0$.

Find the value of k and the value of $P(2 < X < 3)$.

සියලු ම හිමිකම් ඇවිරිණි / முழுப் பதிப்புரிமையுடையது / All Rights Reserved

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
General Certificate of Education (Adv. Level) Examination, 2025

ගණිතය II
கணிதம் II
Mathematics II

07 E II

Part B

* Answer five questions only.

11. A delivery company has received an order to transport 1400 boxes of equal dimensions from a factory to a warehouse. The delivery company has two types of delivery vehicles, vans and lorries. Each van has a capacity to load 40 of these boxes and each lorry has a capacity to load 100 of these boxes. The operating costs for each van and each lorry to deliver boxes from this factory to the warehouse are Rs. 15,000 and Rs. 30,000 respectively, and the company has 20 vans and 12 lorries for deliveries. The number of lorries deployed for this delivery order should not exceed the number of vans deployed. It is required to find the number of vehicles from each type to be allocated to fulfil this order with the minimum total operational cost.

- Formulate this as a linear programming problem.
- Sketch the feasible region.
- Using the graphical method, find the optimum solution for this problem.
- If the restriction that the number of lorries deployed should not exceed the number of vans deployed is removed, find the new optimum solution.

12.(a) Let $A = \begin{pmatrix} a & 0 \\ -2 & 2 \\ 3 & b \end{pmatrix}$, $B = \begin{pmatrix} 2 & c & 4 \\ 0 & d & 1 \end{pmatrix}$ and $C = \begin{pmatrix} 1 & -1 & 2 \\ -2 & 5 & -3 \\ 3 & 3 & 8 \end{pmatrix}$ where $a, b, c, d \in \mathbb{R}$.

Find the values of a, b, c and d such that, $AB = 2C$.

For these values of a, b, c and d , let $D = BA + 2I$ where I is the identity matrix of order 2.

Find D and write down D^{-1} .

Find the matrix E such that $ED = 69(BA)^T$.

(b) Let $a, b \in \mathbb{R}$. Write down the system of equations

$$2x + ay = 6$$

$$bx + 2y = 3$$

in the form $\mathbf{AX} = \mathbf{B}$, where $\mathbf{X} = \begin{pmatrix} x \\ y \end{pmatrix}$, and $\mathbf{A}$ and $\mathbf{B}$ are matrices to be determined.

Show that the above system of equations has

- (i) a unique solution, when $ab \neq 4$,
- (ii) infinitely many solutions, when $a = 4$ and $b = 1$,
- (iii) no solutions, when $ab = 4$ and $a \neq 4$.

13. (a) Two letters are obtained by randomly selecting one letter from each of the two words 'STATISTICS' and 'MATHEMATICS'. Suppose that each selection is independent of any other selection. Let A be the event that at least one of the letters obtained is an 'A'. Let B be the event that the word 'AT' can be formed from the two letters obtained. Find $P(A)$, $P(A \cap B')$ and $P(A \cup B')$.

(b) Suppose letters in the two words 'STATISTICS' and 'MATHEMATICS' are put together and three letters are randomly selected from this collection.

Find the probability that

- (i) all three selected letters are identical,
- (ii) two of the selected letters are 'S' and the other letter is 'M' or 'A'.

(c) Three numbers are selected from a set of 7 numbers consisting of 4 even numbers and 3 odd numbers.

Find the number of different ways in which

- (i) the sum of the three numbers selected is even,
- (ii) at most two of the selected numbers are even.

14. A multiple choice question paper in a computer based competition consists of 25 questions. Each question has five choices of which only one choice is correct. A candidate is given at most two attempts to choose the answer to each question.

4 marks are awarded for the correct answer in the first attempt and 2 marks are awarded for the correct answer in the second attempt. If a candidate fails to make the correct choice within the first two attempts to a question, he/she has to quit the competition. Suppose that a certain candidate randomly guesses answers to each question. If the choice in the first attempt is incorrect, an answer is randomly selected from the remaining four choices in the second attempt.

- (i) Find the probability that the candidate correctly answers a question within the first 2 attempts.
- (ii) Find the expected total score of the candidate if he has correctly answered the 25th question.
- (iii) Find the probability that the candidate will incorrectly answer the 4th question.
- (iv) Given that the candidate incorrectly answered the 4th question, find the probability that he receives a total score of 10 marks.

15. The diameter X of onions in a lot, follows a normal distribution with mean 50 mm and standard deviation 12 mm. These onions are graded according to the diameter, as 'small', 'medium' and 'large' depending on whether the diameter is less than 35 mm, between 35 mm and 65 mm and greater than 65 mm respectively.

- Find the percentage of 'medium' grade onions in the lot.
- Given that there is at most one 'small' grade onion among three randomly selected onions from this lot, find the probability that exactly one of the three selected onions is of 'small' grade.
- A farmer formed a lot L by selecting all onions with diameter exceeding d mm. This lot L consists of 33% of the onions of the original lot. Find the value of d .
- Find the percentage of 'medium' grade onions in the lot L .

16. A company recorded the number of hours its employees worked in a certain week. The following frequency distribution was obtained from this data:

Hours worked	Number of employees
5 – 15	4
15 – 25	7
25 – 35	12
35 – 45	5
45 – 55	2

- Estimate the total number of hours the employees worked in that week.
- Calculate the mean, and the standard deviation of the frequency distribution.
- Draw the histogram of the frequency distribution.
- Each employee's weekly wage w is calculated using the formula $w = 15h + 25$, where h is the number of hours worked in that week. Find the mean and the standard deviation of the wages.
- Based on this data, estimate how much money the company should set aside for wages of these employees over the next 3 months.

17. The demand for activities of a project and the flow of activities are given in the following table:

Activity	Preceding Activity/ Activities	Duration (in days)
A	—	4
B	A	3
C	B	2
D	B	8
E	C	4
F	C	5
G	C, D	6
H	D, E, F	7
I	G, H	2

- (i) Construct the project network.
- (ii) Prepare an activity schedule that indicates earliest start time, earliest finish time, latest start time, latest finish time and the float for each activity.
- (iii) Find the total duration of the project.
- (iv) Write down the critical path of the project.
- (v) How is the project completion time affected by each of the following?
 - (a) Activity E delayed by 2 days,
 - (b) Activity D delayed by 3 days.
