FORM TP 02025046

TEST CODE 01254020

MAY/JUNE 2025

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

ADDITIONAL MATHEMATICS

Paper 02 – General Proficiency

2 hours 40 minutes

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READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions. Answer ALL questions.
2. Write your answers in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. A list of formulae is provided on page 4 of this booklet.
5. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
6. **If you use the extra page(s), you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

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Required Examination Materials

Electronic calculator (non-programmable)
Geometry set

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

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LIST OF FORMULAE

Arithmetic Series $T_n = a + (n-1)d \qquad S_2 = \frac{n}{2}[2a + (n-1)d]$

Geometric Series $T_n = ar^{n-1} \qquad S_n = \frac{a(r^n - 1)}{r-1} \qquad S_\infty = \frac{a}{1-r}, -1 < r < 1 \text{ or } |r| < 1$

Circle $x^2 + y^2 + 2fx + 2gy + c = 0 \qquad (x+f)^2 + (y+g)^2 = r^2$

Vectors $\hat{\mathbf{v}} = \frac{\mathbf{v}}{|\mathbf{v}|} \qquad \cos\theta = \frac{\mathbf{a} \bullet \mathbf{b}}{|\mathbf{a}| \bullet |\mathbf{b}|} \qquad |\mathbf{v}| = \sqrt{(x^2 + y^2)} \text{ where } \mathbf{v} = x\mathbf{i} + y\mathbf{j}$

Trigonometry

$\sin(A \pm B) \equiv \sin A \cos B \pm \cos A \sin B$

$\cos(A \pm B) \equiv \cos A \cos B \mp \sin A \sin B$

$\tan(A \pm B) \equiv \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

Kinematics $v = u + at \qquad v^2 = u^2 + 2as \qquad s = ut + \frac{1}{2}at^2 \qquad v = \frac{dx}{dt} = \dot{x}$

$a = \frac{d^2x}{dt^2} = \frac{dv}{dt} = \ddot{x}$

Calculus $\frac{d}{dx}(ax+b)^n = an(ax+b)^{n-1} \qquad \frac{d}{dx}\sin ax = a\cos ax$

$\frac{d}{dx}\cos ax = -a\sin ax \qquad s = \int v\,dt \qquad v = \int a\,dt$

Statistics $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}, \qquad s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1} = \frac{\sum_{i=1}^{n} f_i x_i^2}{\sum_{i=1}^{n} f_i} - (\bar{x})^2$

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

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SECTION I

ALGEBRA, SEQUENCES AND SERIES

ALL working must be clearly shown.

1. (a) Solve the equation $3^{2x+1} = 21$, giving your answer in exact form.

(4 marks)

(b) Determine the values of x and y which satisfy the equations $y + 3x = 2$ and $y + 4 = x(5 - 2x)$.

(6 marks)

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(c) (i) Determine the solution set for the inequality $\frac{(3x+2)}{(x-1)} \leq 0$, giving your answer in set builder notation.

(4 marks)

(ii) State how the solution of $(3x + 2)(x - 1) \leq 0$ would differ from the solution of $\frac{(3x+2)}{(x-1)} \leq 0$.

(1 mark)

Total 15 marks

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2. (a) (i) The relationship between two variables, x and y, is $10^{2x} \times 10^{y} = 3$. Express the relationship in the form $y = \log b + ax$, where $a, b \in \mathbb{R}$.

(4 marks)

(ii) Hence, state the value of the y-intercept of a graph of y versus x.

.....

(1 mark)

(b) Determine whether the series $2 + 6 + 18 + 54 + 162 \ldots$ is arithmetic or geometric. Justify your response.

.....

.....

(2 marks)

(c) In a geometric progression, the 3rd term is 25 and the sum of the 1st and 2nd terms is 500. Find the common ratio where $r > 0$.

(4 marks)

(d) A kitchen garden has an area, A, $(10 - 3\sqrt{5})$ m^2. The length of the garden is $(5 - 2\sqrt{5})$ m. Determine the value of a, if the width of the garden, in metres, is in the form $(a + \sqrt{5})$, where a is a real number.

(4 marks)

Total 15 marks

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NOTHING HAS BEEN OMITTED.

SECTION II

COORDINATE GEOMETRY, VECTORS AND TRIGONOMETRY

ALL working must be clearly shown.

3. (a) (i) Using the grid on page **11**, draw the graphs of sin $2x$ and cos $2x$, for $0 \leq x \leq \pi$.

(2 marks)

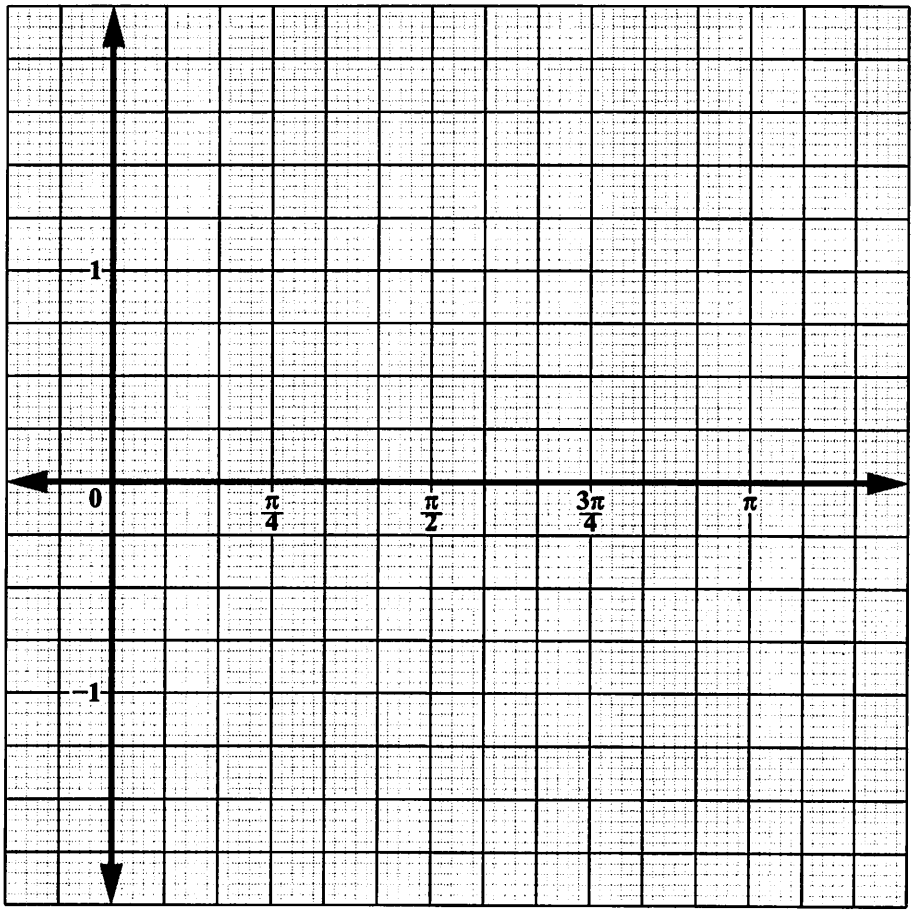
(ii) Hence or otherwise, solve the equation sin $2x$ = cos $2x$ for $0 \leq x \leq \pi$.

(4 marks)

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(b) (i) Using an appropriate double-angle formula, derive the identity for $\sin 2x$.

(2 marks)

(ii) Hence, prove the identity $\frac{1 + \sin 2x}{\sin x + \cos x} = \sin x + \cos x$.

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(4 marks)

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(c) The position vectors of two points, A and B, whose coordinates are (2, 3) and (–3, 2) respectively are relative to an origin, O.

(i) Express the unit vector $\overrightarrow{AB}$ in terms of $x\mathbf{i} + y\mathbf{j}$.

(4 marks)

(ii) Find the angle $A\hat{O}B$, in degrees.

(3 marks)

(iii) Hence, state the relationship between the vectors $\overrightarrow{OA}$ and $\overrightarrow{OB}$.

.....

.....

(1 mark)

Total 20 marks

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SECTION III

INTRODUCTORY CALCULUS

ALL working must be clearly shown.

4. (a) Differentiate the following expression with respect to x, simplifying your answer.

$$y = \sin 4x + \frac{3}{x^4}$$

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(3 marks)

(b) (i) Determine the coordinates of all the stationary points of the curve $y = \frac{1}{3}x^3 - \frac{5}{2}x^2 + 4x - \frac{1}{2}$.

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(4 marks)

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(ii) Hence, determine the nature of EACH of the stationary points found in (b) (i).

(3 marks)

(c) The length of each edge of a cube is increasing at a rate of 0.25 cm s^{-1}. Calculate the rate of change of the volume of the cube at the instant when the length is 8 cm.

(5 marks)

Total 15 marks

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5. (a) Determine

(i) $\int \sqrt{2x + 1}\, dx$

(3 marks)

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(ii) $\int \sin 2x + 5 \cos x\, dx$.

(3 marks)

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(b) Figure 1 shows the region enclosed between the x-axis, the y-axis, the curve $y = x^2 + 2$ and the line $x = 3$.

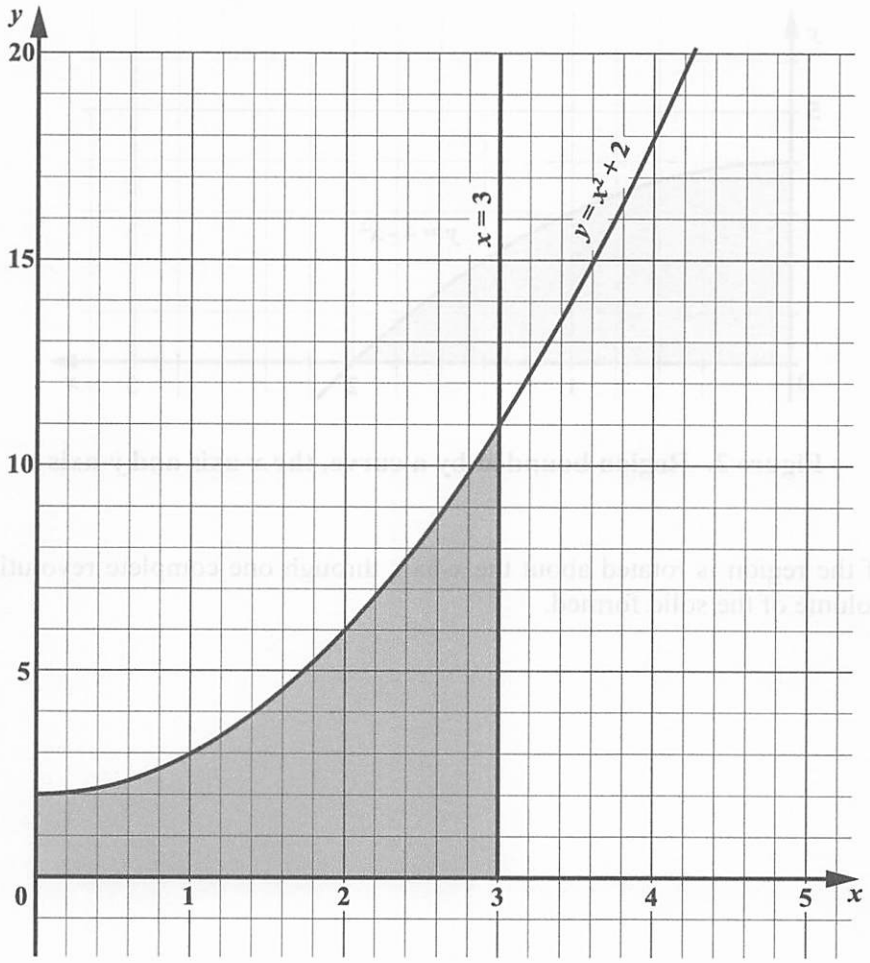


Figure 1. Region bounded by a curve, a line, the x-axis and y-axis

Calculate the area of the shaded region.

(4 marks)

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(c) Figure 2 shows the shaded region enclosed between the x-axis, the y-axis and the curve $y = 4 - x^2$.

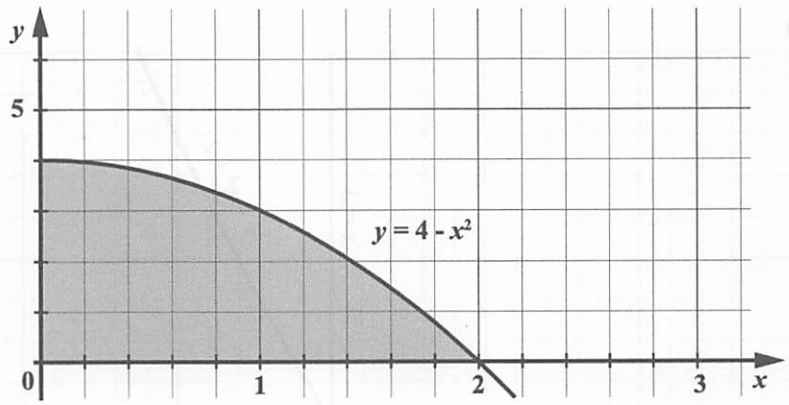


Figure 2. Region bounded by a curve, the x-axis and y-axis

If the region is rotated about the x-axis through one complete revolution, calculate the volume of the solid formed.

(5 marks)

Total 15 marks

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SECTION IV

PROBABILITY AND STATISTICS

ALL working must be clearly shown.

6. (a) If $P(A) = 0.8$, $P(B) = 0.5$ and $P(A \cup B) = 0.9$, calculate $P(B \mid A)$.

(5 marks)

(b) A fair, blue dice has each of the numbers 1, 3, 5, 7, 9 and 11 on its faces. A second, fair, red dice has each of the numbers 2, 4, 6, 8, 10 and 12 on its faces. The dice are rolled simultaneously and the sum of the numbers on their faces is recorded.

(i) Complete the possibility space table below by inserting the sum of the two dice on each roll. The first sum and the last sum have been inserted for you.

		Red Dice					
	+	2	4	6	8	10	12
Blue Dice	1	3					
	3						
	5						
	7						
	9						
	11						23

(3 marks)

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(ii) State the probability that the sum of the scores from throwing the dice at (b) (i) is

- prime

.....

(1 mark)

- even

.....

(1 mark)

(c) Calculate the interquartile range of the data set represented in the stem-and-leaf diagram below.

Stem	Leaf					
3	0	1	3	3		
4	2	4	5			
5	1	6	6	8	9	9
6	4	7	7			
7	3	6				
8	5					
9	2					

Key: 3|0 means 30

(3 marks)

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(d) Figure 3 shows a box-and-whisker plot which represents a set of numerical data.

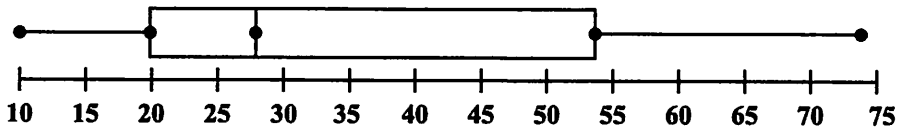


Figure 3. Box-and-whisker plot

(i) State the median of the data set.

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(1 mark)

(ii) Determine the range of the data set.

(1 mark)

(iii) Describe the shape of the distribution.

.....

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(1 mark)

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(e) Five out of 30 students in a class were randomly selected and their heights recorded in centimetres as shown below.

Student	Height
A	135
B	144
C	137
D	146
E	153

Calculate the variance of their heights, in square centimetres.

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(4 marks)

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Total 20 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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