

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

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Front Page Bar Code

05 JUNE 2020 (p.m.)

FILL IN ALL THE INFORMATION REQUESTED CLEARLY IN CAPITAL LETTERS.

TEST CODE 

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SUBJECT PURE MATHEMATICS – UNIT 2 – Paper 032

PROFICIENCY ADVANCED

REGISTRATION NUMBER

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SCHOOL/CENTRE NUMBER

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NAME OF SCHOOL/CENTRE


CANDIDATE’S FULL NAME (FIRST, MIDDLE, LAST)


DATE OF BIRTH

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SIGNATURE \_\_\_\_\_

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Current Bar Code

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FORM TP 2020331



TEST CODE 02234032

MAY/JUNE 2020

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

PURE MATHEMATICS

UNIT 2 – Paper 032

ANALYSIS, MATRICES AND COMPLEX NUMBERS

*1 hour 30 minutes*

**READ THE FOLLOWING INSTRUCTIONS CAREFULLY.**

1. This examination paper consists of THREE sections.
2. Each section consists of ONE question.
3. Answer ALL questions.
4. Write your answers in the spaces provided in this booklet.
5. Do NOT write in the margins.
6. Unless otherwise stated in the question, any numerical answer that is not exact MUST be written correct to three significant figures.
7. 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.**
8. **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.**

**Examination Materials Permitted**

Mathematical formulae and tables (provided) – Revised 2012

Mathematical instruments

Silent, non-programmable electronic calculator

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

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SECTION A

Module 1

Answer this question.

1. (a) A rectangular box has dimensions,  $x, y, z$  each of which is measured with a maximum error of 0.1 cm.

Determine the maximum error of the volume,  $V$ , of the box given that  $x = 75$  cm,  $y = 60$  cm,  $z = 40$  cm and the maximum error is  $dV = \frac{\partial V}{\partial x} dx + \frac{\partial V}{\partial y} dy + \frac{\partial V}{\partial z} dz$ .

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[6 marks]

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- (b) Determine  $z$  such that  $z^2 - (6 + 2i)z + (7 + 6i) = 0$ .

[6 marks]

- (c) Given rectangles with a fixed perimeter,  $p$ , show that a square has the **maximum** area.

[8 marks]

**Total 20 marks**

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**SECTION B**

**Module 2**

**Answer this question.**

2. (a) Use mathematical induction to prove that  $\frac{1}{2} + \frac{1}{6} + \dots + \frac{1}{n(n-1)} = 1 - \frac{1}{n}, n \geq 2$ .

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[9 marks]

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- (b) The function  $f(x) = 5 \ln x - x + 2$  has a root in the interval  $[0, 1]$ . By letting  $x_1 = 1$  and using the Newton-Raphson method, show that an approximation of the root of  $f$  in the interval  $[0, 1]$  can be expressed as  $\frac{3}{4} - \frac{15}{17} \left( \frac{1}{4} + \ln \frac{3}{4} \right)$ .

[5 marks]

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(c) A series is given as  $\sum_{r=3}^n \frac{4}{r(r-2)}$ .

(i) Show that  $\left( \frac{1}{r-2} - \frac{1}{r} \right) = \frac{2}{r(r-2)}$  where  $r \in \mathbb{N}$ .

[2 marks]

- (ii) Hence, or otherwise, determine  $\sum_{r=3}^n \frac{4}{r(r-2)}$  in terms of  $n$ .

[4 marks]

**Total 20 marks**

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SECTION C

Module 3

Answer this question.

3. (a) Determine the general solution of the differential equation  $\frac{dy}{dx} + (\cos x)y = \cos x$ .

[5 marks]

- (b) Two fair coins are tossed along with a fair, six-sided die.
- (i) List the simple events of the possibility space.

[4 marks]

- (ii) Determine the probability that at least one head or a number greater than 4 is observed.

[6 marks]

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- (c) **A** and **B** are two matrices such that  $\det(\mathbf{AB}) = -880$  and  $\det(\mathbf{A}) = 88$ . Determine  $x$ , given

$$\text{that } \mathbf{B} = \begin{pmatrix} 1 & 3 & -2 \\ 2 & x & 1 \\ 3 & 1 & -1 \end{pmatrix}.$$

[5 marks]

Total 20 marks

**END OF TEST**

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

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**EXTRA SPACE**

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Question No.

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**EXTRA SPACE**

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Question No.

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## CANDIDATE'S RECEIPT

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### INSTRUCTIONS TO CANDIDATE:

1. Fill in all the information requested clearly in capital letters.

TEST CODE: 

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SUBJECT: PURE MATHEMATICS – UNIT 2 – Paper 032

PROFICIENCY: ADVANCED

REGISTRATION NUMBER: 

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FULL NAME: \_\_\_\_\_  
**(BLOCK LETTERS)**

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

2. Ensure that this slip is detached by the Supervisor or Invigilator and given to you when you hand in this booklet.
3. Keep it in a safe place until you have received your results.

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### INSTRUCTION TO SUPERVISOR/INVIGILATOR:

Sign the declaration below, detach this slip and hand it to the candidate as his/her receipt for this booklet collected by you.

I hereby acknowledge receipt of the candidate's booklet for the examination stated above.

Signature: \_\_\_\_\_  
Supervisor/Invigilator

Date: \_\_\_\_\_