

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

“*”Barcode Area”*”
Front Page Bar Code

13 JUNE 2017 (p.m.)

FILL IN ALL THE INFORMATION REQUESTED CLEARLY IN CAPITAL LETTERS.

TEST CODE

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SUBJECT PURE MATHEMATICS – UNIT 1 – Paper 032

PROFICIENCY ADVANCED

REGISTRATION NUMBER

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SCHOOL/CENTRE NUMBER

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NAME OF SCHOOL/CENTRE

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

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DATE OF BIRTH

D	D	M	M	Y	Y	Y	Y
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SIGNATURE _____

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Current Bar Code

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Sequential Bar Code

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CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

PURE MATHEMATICS

UNIT 1 – Paper 032

ALGEBRA, GEOMETRY AND CALCULUS

*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 lined 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

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SECTION A

Module 1

Answer this question.

1. (a) Let p , q and r be any three propositions.

(i) Complete the following truth table.

p	q	r	$p \wedge q$	$(p \wedge q) \wedge r$	$q \vee r$	$p \wedge (q \vee r)$
T	T	T				
T	T	F				
T	F	T				
T	F	F				
F	T	T				
F	T	F				
F	F	T				
F	F	F				

[4 marks]

(ii) Hence, state whether the compound statements $(p \wedge q) \wedge r$ and $p \wedge (q \vee r)$ are logically equivalent. **Justify your answer.**

[2 marks]

GO ON TO THE NEXT PAGE

- (b) Solve the equation $1 - 7(4)^{-x} + 6(16)^{-x} = 0$.

[6 marks]

(c) Use mathematical induction to prove that

$$\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \frac{1}{3 \cdot 4} + \dots + \frac{1}{n \cdot (n+1)} = \frac{n}{n+1} \text{ for } n \in \mathbf{N}.$$

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[8 marks]

Total 20 marks

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SECTION B

Module 2

Answer this question.

2. (a) (i) If \mathbf{a} and \mathbf{b} are any two vectors such that $|2\mathbf{a} + \mathbf{b}| = 2|\mathbf{a}|$,
prove that $4\mathbf{a} \cdot \mathbf{b} + \mathbf{b} \cdot \mathbf{b} = 0$.

[3 marks]

- (ii) Hence, show that the vector $4\mathbf{a} + \mathbf{b}$ is perpendicular to vector \mathbf{b} .

[2 marks]

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(b) A , B and C are angles in a triangle such that $A + B + C = 180^\circ$.

(i) Prove that $\tan(A + B) = -\tan C$

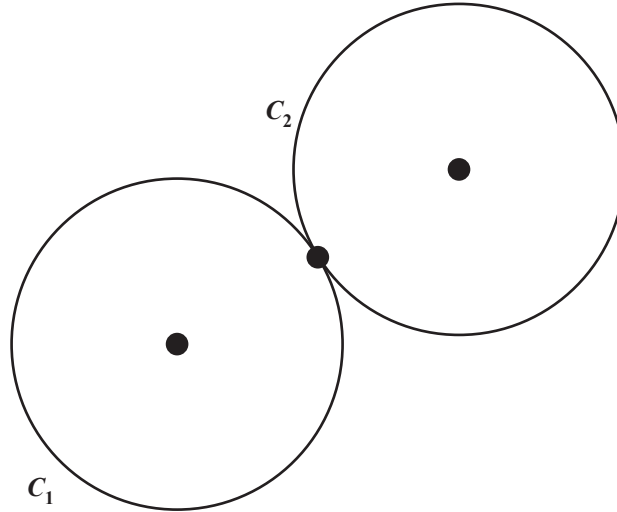
[3 marks]

(ii) Hence, or otherwise, prove that $\tan A + \tan B + \tan C = \tan A \tan B \tan C$.

[4 marks]

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- (c) The following diagram shows two circles, C_1 and C_2 , touching at the point $P(5, 5)$. The equation of the circle C_1 is given by $x^2 + y^2 - 2x - 4y - 20 = 0$. The radius of C_2 is 5. Determine the equation of the circle, C_2 .



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[8 marks]

Total 20 marks

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SECTION C

Module 3

Answer this question.

3. (a) (i) Using first principles, show that the derivative of $f(x) = x^{-2} + 4x^{-1}$ is

$$-\frac{1}{2}x^{-3} + 4.$$

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[8 marks]

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- (ii) Hence, determine the equation of a tangent at the stationary point of the curve in (a) (i).

[5 marks]

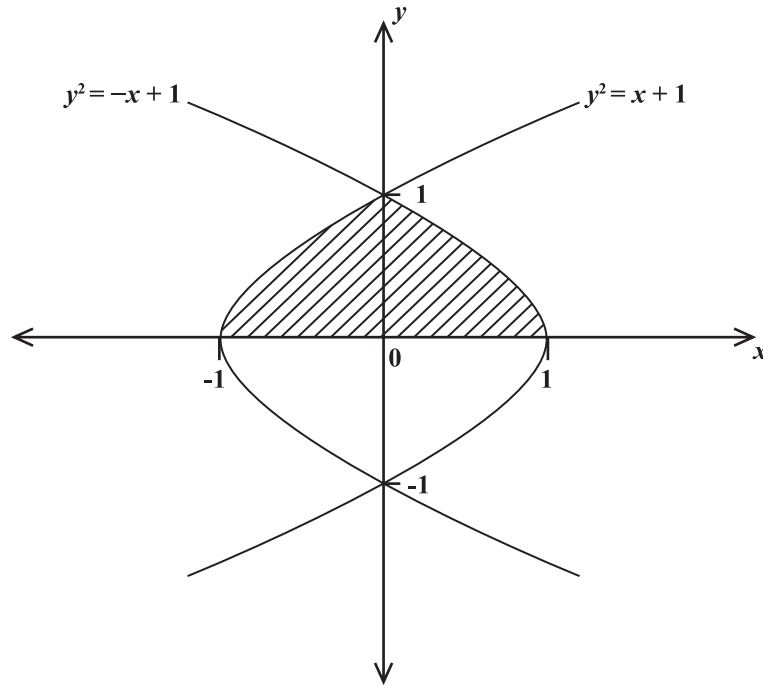
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- (b) The diagram below, **not drawn to scale**, shows the curves $y^2 = x + 1$ and $y^2 = -x + 1$. Using integration, determine the area of the shaded region.



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[7 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

If you use this extra page, you **MUST** write the question number clearly in the box provided.

Question No.

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CANDIDATE'S RECEIPT

INSTRUCTIONS TO CANDIDATE:

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

TEST CODE:

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SUBJECT: PURE MATHEMATICS – UNIT 1 – 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.**
-

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: _____