

HARRISON COLLEGE INTERNAL EXAMINATION MARCH 2016
CARIBBEAN ADVANCED PROFICIENCY EXAMINATION
SCHOOL BASED ASSESSMENT
PURE MATHEMATICS
1 hour 20 minutes

This examination paper consists of 2 printed pages.
This paper consists of 9 questions.
The maximum mark for this examination is 60.

INSTRUCTIONS TO CANDIDATES

- (i) Write your name clearly on each sheet of paper used
- (ii) Answer ALL questions
- (iii) Number your questions identically as they appear on the question paper and do NOT write your solutions to different questions beside each other
- (iv) Unless otherwise stated in the question, any numerical answer that is not exact, MUST be written correct to three (3) significant figures

EXAMINATION MATERIALS ALLOWED

- (a) Mathematical formulae
- (b) Scientific calculator (non-programmable, non-graphical)

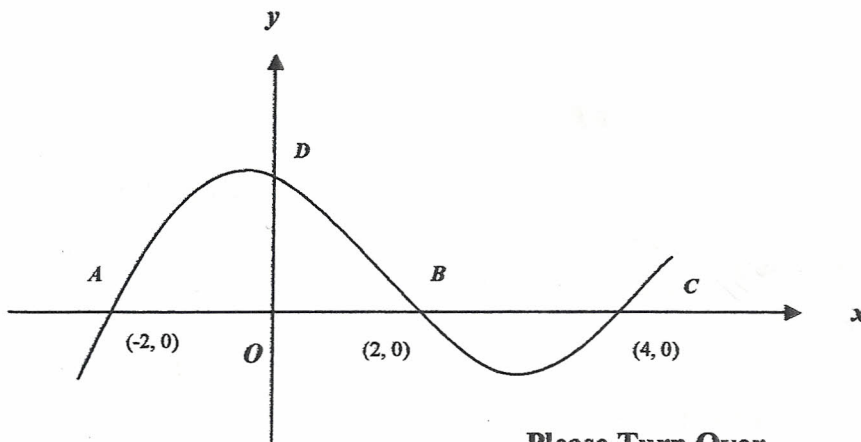
1) Given that p and q are propositions, use the algebra of propositions to simplify fully
 $(p \wedge q) \vee (\sim p \wedge q)$ [3]

Total: 3 marks

2) (i) Express in terms of n , $\sum_{r=1}^{n+1} (2r)$. [3]
(ii) Given that $\sum_{r=1}^{n+1} (2r) = 12$, find the possible value(s) of n . [5]

Total: 8 marks

3) (a) The sketch below shows part of the graph of $y = x^3 + px^2 + qx + r$, where p , q and r are constants.



Please Turn Over

The points A , B and C have coordinates $(-2, 0)$, $(2, 0)$ and $(4, 0)$ respectively.
The curve crosses the y -axis at D .

(i) Evaluate p , q and r . [6]

(ii) Determine the coordinates of D . [1]

(b) Given the polynomial $f(h) = -3h^3 + 2h^2 - h + 2$, solve $f(h) = 0$ for $h \in \mathbb{R}$. [6]

Total: 13 marks

4) Prove by mathematical induction that $\sum_{r=1}^n \frac{1}{(4r-3)(4r+1)} = \frac{n}{4n+1} \forall n \in \mathbb{N}$. [6]

Total: 6 marks

5) (a) Solve for p the equation $3^{2p} - 10(3^p) + 16 = 0$, giving your answer in terms of *logs*. [4]

(b) Solve for x the equation $e^{2x} + 4e^{-2x} = 4$, giving your answer in terms of *logs*. [4]

Total: 8 marks

6) The population, $P(n)$, of a new housing development at 1st January 2000 was 300.
The population growth after n years was found to be directly proportional to $(1.02)^n$.

Calculate estimates of

(i) the population at the beginning of the year 2015 [2]

(ii) the year in which the population is expected to first reached 510. [4]

Total: 6 marks

7) (a) The function f is defined by $f: x \rightarrow \ln(x-3); x \in \mathbb{R}, x > 3$.

(i) Sketch the graph of f , showing clearly any intersection with the axes. [2]

(ii) Determine an expression for the inverse function, $f^{-1}(x)$. [3]

(iii) State for $f^{-1}(x)$

a) the domain

b) the range [2]

(b) The function g is defined by $g: x \rightarrow e^{2x} + 3, x \in \mathbb{R}$.

Determine $fg(x)$. [2]

Total: 9 marks

8) Find the range of values of $x \in \mathbb{R}$ for which $\frac{x+2}{2x-3} \leq 1, x \neq \frac{3}{2}$ [3]

9) Solve for $x \in \mathbb{R}, x > |3x| - 2$ [4]

Total: 7 marks

End of Examination