

**HARRISON COLLEGE INTERNAL EXAMINATION MARCH 2020**  
**CARIBBEAN ADVANCED PROFICIENCY EXAMINATION**  
**SCHOOL BASED ASSESSMENT**  
**PURE MATHEMATICS**  
**UNIT I – TEST 1**  
**1 hour and 20 minutes**

**NAME OF STUDENT:** \_\_\_\_\_  
**SCHOOL CODE:** 030014  
**DATE:** \_\_\_\_\_

This examination paper consists of **9** printed pages.  
The paper consists of **6** questions.  
The maximum mark for this examination is 60.

**INSTRUCTIONS TO CANDIDATES**

1. Write your name clearly in the space above.
2. Answer **ALL** questions in the **SPACES PROVIDED**.
3. Number your questions carefully and **DO NOT** write your solutions to different questions beside each other.
4. 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**

1. Mathematical formulae
2. Scientific calculator (non-programmable, non-graphical)

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1) Given that ***a*** and ***b*** are propositions, use the algebra of propositions to fully simplify  
 $\sim (a \vee \sim b) \vee (\sim a \wedge \sim b)$

[4]

**Total: 4 marks**

2) Prove that for all real numbers  $a$  and  $b$ ,  $a^2 + b^2 \geq 2ab$

[3]

**Total: 3 marks**

3) Without the use of a calculator, express  $\frac{2\sqrt{2} + \sqrt{3}}{2\sqrt{2} - \sqrt{3}}$  in the form  $\frac{a + b\sqrt{6}}{c}$ , where  $a$ ,  $b$  and  $c$  are constants to be found.

[4]

**Total: 4 marks**

4) Prove by mathematical induction that  $8^n + 6$  is a multiple of 14.

[6]

**Total: 6 marks**

5) The expression  $2x^3 + px^2 + qx + 6$  is exactly divisible by  $(x - 2)$ , and gives a remainder of  $-12$  when divided by  $(x + 1)$ .

(i) Calculate the values of  $p$  and of  $q$ . [4]

(ii) Factorize the expression completely. [4]

**Total: 8 marks**

6) Solve for  $x$

(a)  $6\log_3 x - 4 = 2\log_x 3.$

[6]

(b)  $4^x - 7(2^x) = 8.$

[5]

**Total: 11 marks**

7) The population,  $P(t)$ , of larvae found in a swamp after  $t$  days is modelled by  $P(t) = 600e^{0.04t}$

(a) Determine for the swamp

(i) the initial population of larvae [1]

(ii) the population of larvae after 14 days [2]

(b) The length of time, in days, for which the population is first expected to exceed 2500. [4]

**Total: 7 marks**

8) Find the range of values of  $x$  for which  $\left| \frac{2x+1}{4-x} \right| < 1, x \neq 4$ .

[5]

**Total: 5 marks**

9) If  $\alpha, \beta$  and  $\gamma$  are the roots of the equation  $2x^3 - 11x^2 + 4x + 5 = 0$

(a) find the values of

(i)  $\alpha + \beta + \gamma$

(ii)  $\alpha\beta + \alpha\gamma + \beta\gamma$

(iii)  $\alpha\beta\gamma$

[3]

(b) hence, or otherwise, find the equation with roots  $\alpha - 1, \beta - 1$  and  $\gamma - 1$ .

[9]

**Total: 12 marks**

**End of Test**



**EXTRA SPACE**

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Question No.

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Question No.