

HARRISON COLLEGE INTERNAL EXAMINATION 2013
CARIBBEAN ADVANCED PROFICIENCY EXAMINATION
SCHOOL BASED ASSESSMENT
PURE MATHEMATICS
UNIT 2 – TEST 3
1 hour 30 minutes

This examination paper consists of 2 pages.

This paper consists of 4 questions.

The maximum marks for this examination is 60.

INSTRUCTIONS TO CANDIDATES

1. Write your name clearly on each sheet of paper used.
2. Answer **ALL** questions.
3. Do **NOT** do questions beside one another.
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 sheet
2. Scientific Non-programmable calculator (non-graphical)

1. A builder is planning to build 12 houses along one side of a road. He will build 2 houses in style A, 2 houses in style B, 3 houses in style C, 4 houses in style D and 1 house in style E.

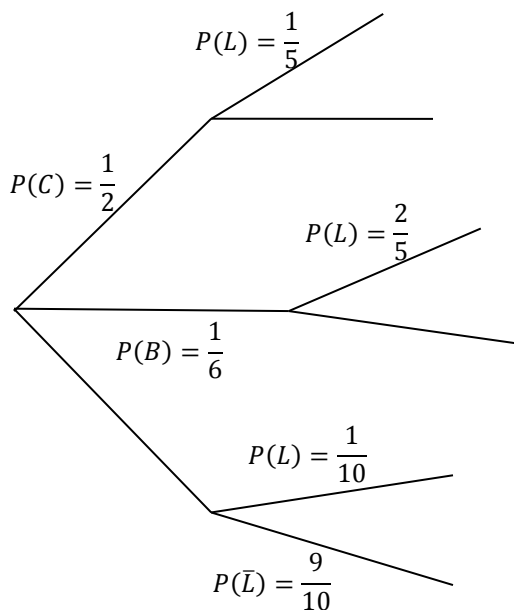
- i. Find the number of possible arrangements of these 12 houses. [2]



- ii. The 12 houses will be in two groups of 6 (see diagram). Find the number of possible arrangements if all the houses in styles A and D are in the first group and all the houses in styles B, C and E are in the second group. [2]
 - iii. Four of the 12 houses will be selected for a survey. Exactly one house must be in style B and exactly one house in style C. Find the number of ways in which these four houses can be selected. [2]

Total: 6 marks

2. On a randomly chosen day Bill travels to school by car, or by bicycle or on foot. The probability that he is late when using these methods of travel is $\frac{1}{5}$, $\frac{2}{5}$ and $\frac{1}{10}$ respectively as shown in the tree diagram below.



PLEASE TURN OVER

- (a) Copy and complete the tree diagram. [3]
- (b) Find the probability that on a randomly chosen day
- (i) Bill travels by foot and is late [2]
- (ii) Bill is not late. [2]
- (c) Given that Bill is late, find the probability that he did not travel on foot. [3]

Total: 10 marks

3. (a) Show that the substitution $y = xz$ reduces the differential equation

$$\frac{1}{x} \frac{d^2 y}{dx^2} + \left(\frac{6}{x} - \frac{2}{x^2} \right) \frac{dy}{dx} + \left(\frac{9}{x} - \frac{6}{x^2} + \frac{2}{x^3} \right) y = 169 \sin 2x$$

to the differential equation

$$\frac{d^2 z}{dx^2} + 6 \frac{dz}{dx} + 9z = 169 \sin 2x \quad [6]$$

- (b) Hence, find the complementary function. [3]

- (c) Given that $z = p \sin 2x + q \cos 2x$ is a particular integral of the differential equation

- i. Find the values of p and q . [8]
- ii. Write down the general solution of z as a function of x . [1]
- iii. Find the particular solution for z in terms of x , given that when $x = 0$, $z = -10$ and $\frac{dz}{dx} = 5$. [6]
- iv. Hence, state the particular solution of y in terms of x . [2]

Total: 26 marks

4. a) Find x such that $\begin{vmatrix} x & 2 & 3 \\ 2 & x & 3 \\ 2 & 3 & x \end{vmatrix} = 0$ [7]

- b) Pelican wishes to produce daily, three types of ceramics: type A, B and C. Each ceramic must pass through three machines during production and the time taken on each machine, as well as, the total time available on each machine is outlined in the table below:

	Type A	Type B	Type C	Time Available (mins)
Machine 1	2	1	1	180
Machine 2	1	3	2	300
Machine 3	2	1	2	240

- i. Write three equations in terms of A, B and C to represent the given information. [3]
- ii. Write the augmented matrix for the system of equations in part i. [1]
- iii. Reduce the augmented matrix obtained to echelon form. [2]
- iv. Hence, determine the number of type A, type B and type C ceramics that are produced a day. [5]

Total: 18 marks