

Caribbean Advanced Proficiency Examinations
Internal Moderation Test 2015
Pure Mathematics Unit 2
Module 3

School: Queen's College 090041
Guyana

Time: 1 hour 30 minutes
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Instruction to Candidates

Answer **ALL** questions. Unless otherwise stated in the question, all numerical answers **MUST** be given exactly **OR** to three significant figures as appropriate.
This paper consists **6** questions. The maximum mark on this paper is **60**.

1. (a) In how many ways can 4 mathematics books, 3 history books, 3 chemistry books and 2 sociology books be arranged on a shelf so that all books of the same subject are together? [3]
- (b) A delegation of 4 students is selected each year from a college to attend the National Student Association annual meeting. In how many ways can the delegation be chosen from 12 eligible students if 2 of them are married and will only attend the meeting together? [4]

Total 7 marks

- 2 (a) Six bulbs are planted on the edge of a circular patch of ground and two of them do not grow. What is the probability that the two that do not grow are next to each other? [4]
- (b) When a person needs a taxi it is hired from one of three providers, A, B and C. Of the hirings 40% are from A, 50% are from B and 10% are from C. For taxis hired from A, 9% are late, the corresponding percentages for taxis hired from B and C being 6% and 20% respectively.
- (i) Draw a carefully labelled tree diagram to illustrate the information. [6]
- (ii) Calculate the probability that the next cab hired
- a) will be from A and will not arrive late, [1]
- b) will arrive late. [3]
- Given that a call is made for a taxi and it arrives late
- c) find, to 3 decimal places, the probability that it came from B. [2]

Total 16 marks

3 (a) Find x, y, z and w if $3\begin{pmatrix} x & y \\ z & w \end{pmatrix} = \begin{pmatrix} x & 6 \\ -1 & 2w \end{pmatrix} + \begin{pmatrix} 4 & x+y \\ z+w & 3 \end{pmatrix}$. [5]

(b) Row reduce $A = \begin{pmatrix} -4 & 1 & -6 \\ 1 & 2 & -5 \\ 6 & 3 & -4 \end{pmatrix}$ to echelon form. [4]

Total 9 marks

4 (a) Determine the value of k for which the system of linear equations

$$x + 2y - 3z = 1$$

$$y - 2z = 2$$

$$2y + kz = 4$$

is consistent. [2]

(b) With the value of k found at (a), show that the system of linear equations has infinitely many solutions. [1]

(c) Hence find the general solution of the system of linear equations. [3]

Total 6 marks

5 (a) Solve $\tan x \frac{dy}{dx} + y = \sec x$, given that $y = 4$ at $x = \frac{\pi}{6}$. [7]

(b) Find the general solution of the differential equation

$$\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} - 3 = \cos x. \quad [9]$$

Total 16 marks

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- 6 A weight attached to a spring moves up and down so that the equation of motion is

$$\frac{d^2s}{dt^2} + 16 = 0$$

where s is the stretch of the spring at time t . If $s = 2$ and $\frac{ds}{dt} = 1$ when $t = 0$, find s in terms of t .

[6]

Total 6 marks

End of Test

Formulae

Probability:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A \cap B) = P(A)P(B|A)$$