FORM TP 2016143

TEST CODE **02205032**

MAY/JUNE 2016

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN ADVANCED PROFICIENCY EXAMINATION®

APPLIED MATHEMATICS

MATHEMATICAL APPLICATIONS

UNIT 2 – Paper 032

1 hour 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE sections. Answer ALL questions from the THREE sections.
2. Write your answers in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. Unless otherwise stated in the question, all numerical answers MUST be given exactly OR to three significant figures as appropriate.
5. 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 page(s) provided at the back of this booklet. **Remember to draw a line through your original answer**.
6. **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:

Mathematical formulae and tables (Revised 2010)
Electronic calculator
Ruler and graph paper

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

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SECTION A

MODULE 1: DISCRETE MATHEMATICS

1. A manufacturer makes two types of items, *A* and *B*, using four different types of ingredients, *P*, *C*, *M* and *T*. The following table gives the requirements for each type of item and the total number of each type of ingredient that is available.

Type of Ingredient	Number of Ingredients for A	Number of Ingredients for B	Available Ingredients
P	6	4	36
C	1	0	4
M	3	5	30
T	0	1	5

The manufacturer makes a profit of \$10 on Item *A* and \$5 on Item *B* and wants to maximize profit.

(a) Formulate a linear programming problem for the information given.

[9 marks]

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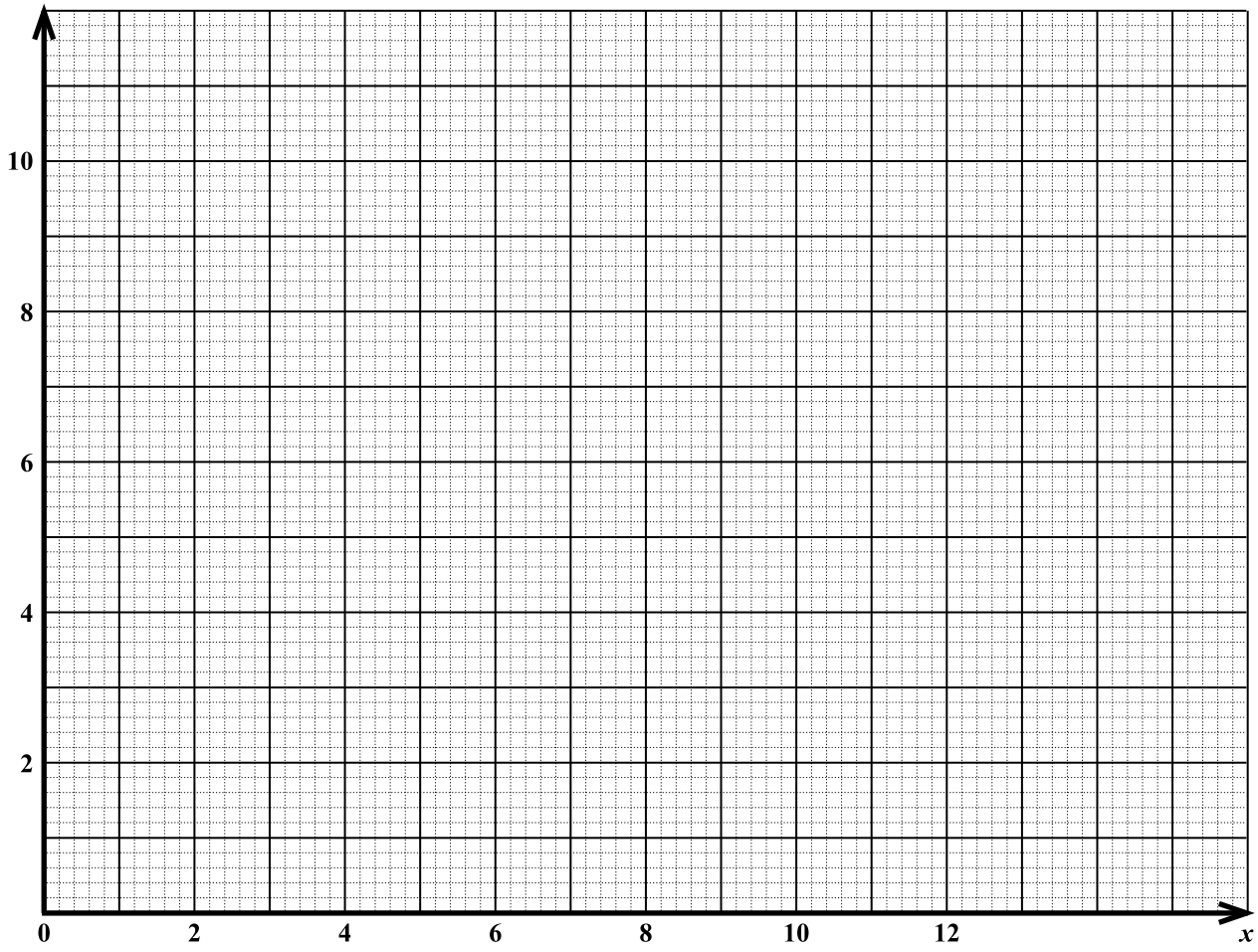
(b) On the grid below, graph the feasible region for the linear programming problem.



[7 marks]

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(c) Determine the number of EACH item that should be manufactured to maximize profit.

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[4 marks]

Total 20 marks

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SECTION B

MODULE 2: PROBABILITY AND DISTRIBUTIONS

2. (a) The independent random variables, R and S, are normally distributed with means and standard deviations as shown in the following table.

	Mean	**Standard Deviation**
R	3.2	1.2
S	2.8	0.35

The sum of 15 independent observations of R is denoted by T.

(i) Determine the mean and variance of T.

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[3 marks]

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(ii) Calculate $P(T > 54)$.

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[3 marks]

(iii) The random variable $W = 5R + 3S$. Determine the mean and variance of W.

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(iv) Calculate $P(W < 28)$.

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[3 marks]

(b) A sample size of 250 is taken from a population with 0.5% of the items being defective. Justifying a suitable approximation, calculate the probability that at MOST three of the items in the sample will be defective.

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[6 marks]

Total 20 marks

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SECTION C

MODULE 3: PARTICLE MECHANICS

Take $g = 10\ \text{ms}^{-2}$

3. (a) A car starts from rest and accelerates uniformly to its maximum speed, v, covering a distance of 1.5 km. It maintains this speed for 10 minutes and then slows down uniformly to rest after another 5 minutes. The total distance travelled is 12 km.

(i) Sketch a clearly labelled velocity–time graph to show this information.

[2 marks]

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(ii) Calculate the maximum speed of the car in m s^{-1}.

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(iii) Calculate the time to accelerate from rest.

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(b) An arrow is shot horizontally from a height of 2 m above the ground. The arrow hits the ground at a distance of 3.5 m from its release point. Calculate the speed at which the arrow was released.

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(c) An object is thrown vertically upwards with an initial velocity, u, of 25 m s^{-1}. The motion of the object follows the differential equation $\frac{ds}{dt} = u - gt$, where s is the height of the object in metres at time t seconds.

(i) Derive an equation for the height, s, if $s = 0$ when $t = 0$.

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[4 marks]

(ii) Determine the height of the object after 4 seconds.

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[2 marks]

Total 20 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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