FORM TP 2024047

TEST CODE 01254032

MAY/JUNE 2024

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

ADDITIONAL MATHEMATICS

Paper 032 – General Proficiency

ALTERNATIVE TO SCHOOL-BASED ASSESSMENT

1 hour 30 minutes

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READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of ONE compulsory question.
2. Write your answers in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. A list of formulae is provided on page 4 of this booklet.
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.**

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Required Examination Materials

Electronic calculator (non-programmable)
Geometry set

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

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LIST OF FORMULAE

Arithmetic series $T_n = a + (n-1)d \qquad S_2 = \frac{n}{2}\left[2a + (n-1)d\right]$

Geometric series $T_n = ar^{n-1} \qquad S_n = \frac{a(r^n - 1)}{r-1} \qquad S_\infty = \frac{a}{1-r}, -1 < r < 1 \text{ or } |r| < 1$

Circle $x^2 + y^2 + 2fx + 2gy + c = 0 \qquad (x+f)^2 + (y+g)^2 = r^2$

Vectors $\mathbf{v} = \frac{\hat{\mathbf{v}}}{|\mathbf{v}|} \qquad \cos\theta = \frac{\mathbf{a}\bullet\mathbf{b}}{|\mathbf{a}| \bullet |\mathbf{b}|} \qquad |\mathbf{v}| = \sqrt{(x^2 + y^2)}$ where $\mathbf{v} = x\mathbf{i} + y\mathbf{j}$

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Trigonometry $\sin(A \pm B) \equiv \sin A \cos B \pm \cos A \sin B$

$\cos(A \pm B) \equiv \cos A \cos B \mp \sin A \sin B$

$\tan(A \pm B) \equiv \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

Kinematics $v = u + at \qquad v^2 = u^2 + 2as \qquad s = ut + \frac{1}{2}at^2 \qquad v = \frac{dx}{dt} = \dot{x}$

$a = \frac{d^2x}{dt^2} = \frac{dv}{dt} = \ddot{x}$

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Calculus $\frac{d}{dx}(ax+b)^n = an(ax+b)^{n-1} \qquad \frac{d}{dx}\sin ax = a\cos ax$

$\frac{d}{dx}\cos ax = -a\sin ax \qquad s = \int v\,dt \qquad v = \int a\,dt$

Statistics $\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{\sum_{i=1}^{n} f_i x_i}{\sum_{i=1}^{n} f_i}, \qquad s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1} = \frac{\sum_{i=1}^{n} f_i x_i^2}{\sum_{i=1}^{n} f_i} - (\bar{x})^2$

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

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1. A farmer sowed a total of 220 green bean and kidney bean seeds. Once the first seed germinated and a shoot appeared, he recorded the number of new seeds that germinated each day. Table 1 below shows his records for the first 4 days.

TABLE 1: TOTAL NUMBER OF BEAN SEEDS GERMINATED OVER 4 DAYS

Day	Total Number of Seeds Germinated at the End of Each Day
1	3
2	10
3	17
4	24

(a) He recognized that these numbers formed a sequence.

(i) State the type of sequence observed. Justify your response.

(2 marks)

(ii) By forming a suitable quadratic equation, determine the day on which all 220 of the bean seeds would have germinated. Assume that all of the bean seeds germinated.

(6 marks)

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(b) The farmer is planning to use a drone irrigation system to water the bean crops. The drone, when positioned over the piece of land, waters the crops in a circular motion with a radius of 12 metres.

(i) Find the total area of land that will be watered by the drone. (Give your answer correct to 2 decimal places.)

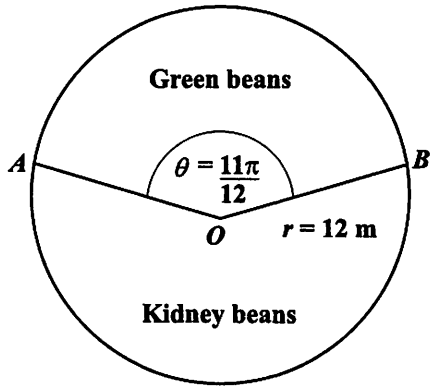
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(ii) The diagram below shows that layout of the bean crops watered by the drone.



If the green beans are planted in the sector inscribed by the angle $\theta = \frac{11\pi}{12}$ radians and the kidney beans in the remaining portion of the circular area, find the area of land that contains kidney beans that will be watered by the drone. (Give your answer correct to 2 decimal places.)

(5 marks)

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(iii) If the farmer wishes to fence the area within the range of the drone that contains green beans in order to treat those crops only, what length of fencing should be used?

(3 marks)

(c) The harvested beans will be packed for shipping in cartons. The length of each carton is 3 times the width and each carton has a volume of 0.135 m^3.

(i) Show that the surface area, A, of EACH carton is given by

$A = 6x^2 + \frac{9}{25x}$, where x represents the width of the carton.

(5 marks)

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(ii) Hence, determine the minimum surface area, A, of the carton and prove that this area is a minimum.

(7 marks)

Total 30 marks

END OF TEST

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

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