FORM TP 2021043

TEST CODE **01254032**

MAY/JUNE 2021

**CARIBBEAN EXAMINATIONS COUNCIL**

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION**

# ADDITIONAL MATHEMATICS

**Paper 032 – General Proficiency**

**ALTERNATIVE TO SCHOOL-BASED ASSESSMENT**

***1 hour 30 minutes***

**READ THE FOLLOWING INSTRUCTIONS CAREFULLY.**

1. This paper consists of ONE compulsory question.
2. Write your answers in the spaces provided in this booklet.
4. Do NOT write in the margins.
5. A list of formulae is provided on page 4 of this booklet.
6. 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**.
7. **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.**

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

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

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

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

Differentiation $\frac{\mathrm{d}}{\mathrm{d}x}(ax+b)^n = an(ax+b)^{n-1} \qquad \frac{\mathrm{d}}{\mathrm{d}x}\sin x = \cos x \qquad \frac{\mathrm{d}}{\mathrm{d}x}\cos x = -\sin x$

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

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

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

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

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

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

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**1.** (a) The area of the floor space of the rectangular room shown below can be expressed as the quadratic equation $A(x) = -x^2 - 4x + 45$.

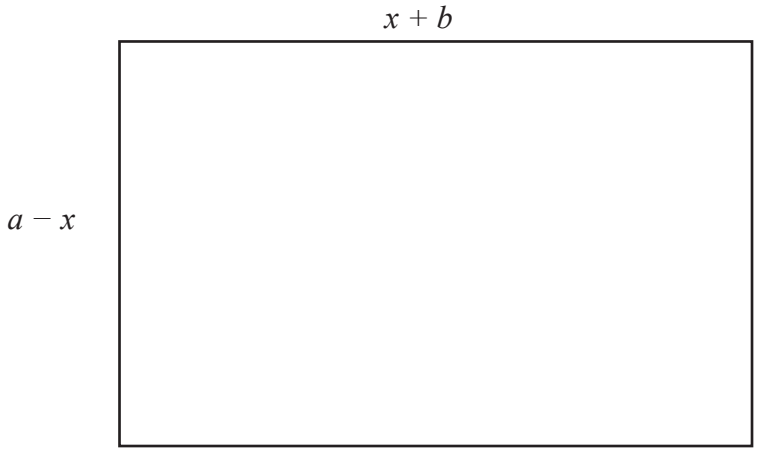



**Figure 1**

(i) Express the given equation in a suitable format and determine the maximum value of $A(x)$.

**(4 marks)**

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(ii) Determine the values of $a$ and $b$ that will provide corresponding solutions to the given equation $A(x) = 0$. Hence, write down the factors of $A(x)$.

**(6 marks)**

(iii) Calculate the dimensions of the room using the maximum area found in (a) (i).

**(2 marks)**

(iv) Given the dimensions of the room with maximum area, state ONE suitable conclusion about the shape of the room.

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**(1 mark)**

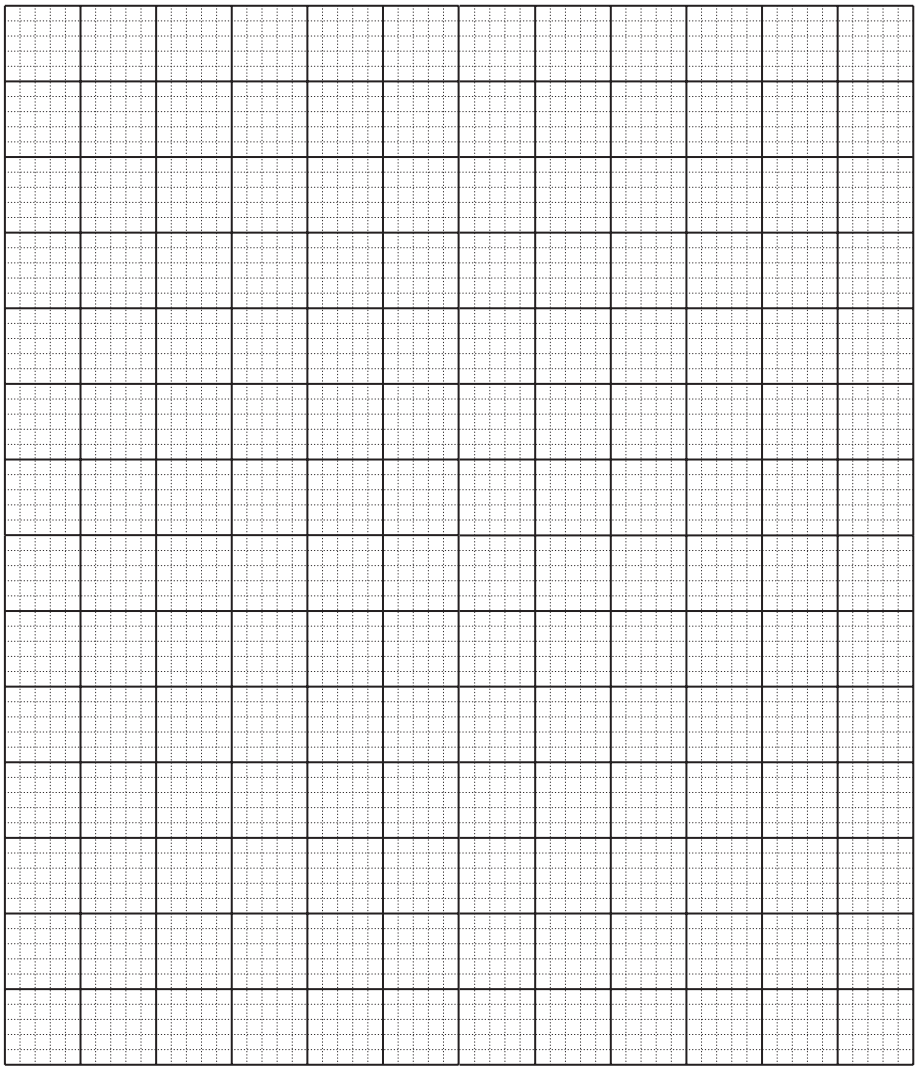
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(v) Using the grid provided below, sketch the graph of A($x$). Hence, determine the values of $x$ for which the area A($x$) is valid.



**(3 marks)**

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(b) A sector of a circle has area $\frac{15\pi}{2}$ cm$^2$ and arc length $\frac{5\pi}{2}$ cm.

Determine the angle subtended by the sector, giving your answer in terms of $\pi$.

**(7 marks)**



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(c) Determine an expression for the radius of a sphere at the point at which its volume is increasing at twice the rate of its radius. Give your answer in the simplest surd form.

Use $V = \frac{4}{3}\pi r^3$ for volume of sphere.

**(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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