FORM TP 2019041

TEST CODE **01254032**

MAY/JUNE 2019

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
Mathematical tables (provided)
Graph paper (provided)

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

Copyright © 2017 Caribbean Examinations Council
All rights reserved.

"*"Barcode Area"*"
Sequential Bar Code

LIST OF FORMULAE

Arithmetic Series $T_n = a + (n-1)d \qquad S_n = \frac{n}{2}[2a + (n-1)d]$

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

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

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

$\frac{\mathrm{d}}{\mathrm{d}x}\sin x = \cos x$

$\frac{\mathrm{d}}{\mathrm{d}x}\cos x = -\sin x$

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 $v = u + at \qquad v^2 = u^2 + 2as \qquad s = ut + \frac{1}{2}at^2$

GO ON TO THE NEXT PAGE

"*"Barcode Area"*"
Sequential Bar Code

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

NOTHING HAS BEEN OMITTED.

1. A programmer designs a game in which a ship must travel in a circular motion, relative to a centre at origin, *O*. The ship intersects a square as shown in Figure 1, in order to be awarded points.

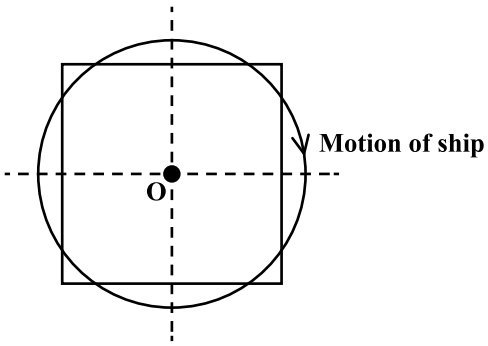


Figure 1.

(a) Determine the coordinates, relative to the origin, *O*, of **all** intersections if the ship must maintain a distance of 5 cm from the origin at all times, the sides of the square are parallel to the coordinate axes and EACH side of the square is of length 8 cm.

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

"*"Barcode Area"*"
Sequential Bar Code

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(7 marks)

GO ON TO THE NEXT PAGE

"*"Barcode Area"*"
Sequential Bar Code

(b) The points awarded for reaching each intersection increases according to a geometric progression such that the points awarded for the third intersection are 100, and the **sum** of the points awarded for the fourth and fifth intersections is 600.

Determine the TOTAL number of points to the nearest thousand that can be gained, if the ship in (a) travels in a circle **twice**.

(9 marks)

GO ON TO THE NEXT PAGE

"*"Barcode Area"*"
Sequential Bar Code

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

(c) The ship in the game has a rectangular-shaped stern, shown in Figure 2, that takes in water at a rate of 2500 $m^3 s^{-1}$ whenever a wrong turn is made.

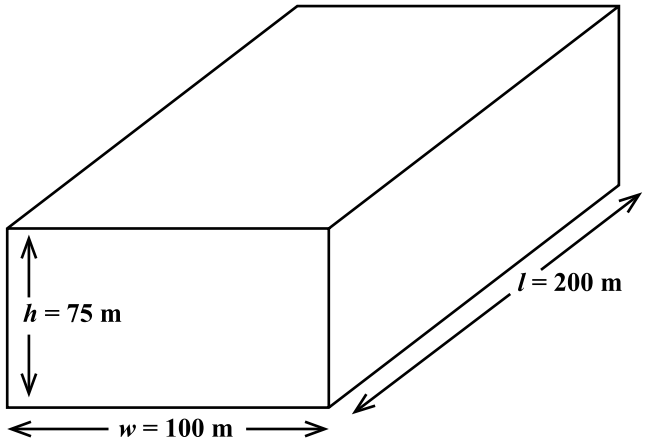


Figure 2. Stern of ship

Show that when a wrong turn is made the stern is filled after 6 seconds, if the rate of change of volume of water to height of the stern is given by $\frac{dv}{dh} = 200\ m^2$.

(4 marks)

Total 20 marks

END OF TEST

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

"*"Barcode Area"*"
Sequential Bar Code