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MATHEMATICS

PAPER 3 (CORE/EXTENDED) 3815/3

Tuesday **15 JUNE 2021** 9:00 A.M.–11:30 A.M.

Additional materials:

Answer booklet

Graph paper

MINISTRY OF EDUCATION NATIONAL EXAMINATIONS
--

BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your school number, candidate number, Surname and Initials in the spaces provided on each answer booklet.

Remove the graph paper from the question paper. Write your school number, candidate number, surname and initials, signature and date on the graph paper. Place the graph paper in the answer booklet.

Answer **ALL** questions in the answer booklet.

ALL working must be shown.

ALL working must be done in blue or black ink, except for drawings, lines and constructions which may be done in pencil.

INFORMATION FOR CANDIDATES

Calculators may be used. **[NO GRAPHING CALCULATORS ALLOWED].**

Tracing paper and geometrical instruments may be used.

The mark for each question, or part question, is shown in brackets [].

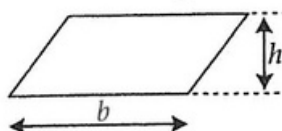
The total number of marks for this paper is 100.

This question paper consists of 10 printed pages and 2 blank pages.

INFORMATION AND FORMULAE

MENSURATION

Parallelogram



$$\text{Area} = bh$$

Circle (radius r , diameter d)

Cylinder (radius r , height h)

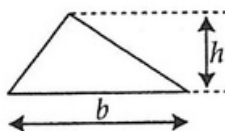
Sphere (radius r)

Prism

Pyramid

Cone (radius r , height h)

Triangle



$$\text{Area} = \frac{1}{2}bh$$

Circumference

Area

Volume

Area of curved surface

Volume

Area of surface

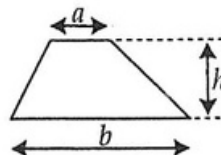
Volume

Volume

Volume

Area of curved surface

Trapezium



$$\text{Area} = \frac{1}{2}(a+b)h$$

$$= 2\pi r \text{ or } \pi d$$

$$= \pi r^2$$

$$= \pi r^2 h$$

$$= 2\pi r h$$

$$= \frac{4}{3}\pi r^3$$

$$= 4\pi r^2$$

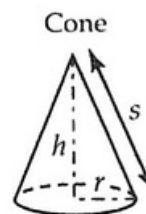
$$= \text{area of cross-section} \times \text{length}$$

$$= \frac{1}{3} \times \text{area of base} \times \text{height}$$

$$= \frac{1}{3}\pi r^2 h$$

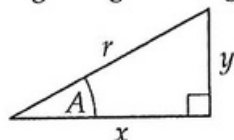
$$= \pi r s$$

where s = slant height $\sqrt{h^2 + r^2}$

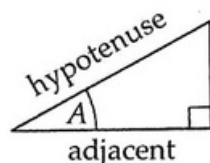


TRIGONOMETRY

Right-angled triangle

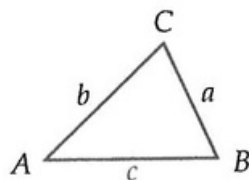


$$r^2 = x^2 + y^2 \text{ (result of Pythagoras)}$$



$$\sin A = \frac{\text{opposite}}{\text{hypotenuse}}, \cos A = \frac{\text{adjacent}}{\text{hypotenuse}}, \tan A = \frac{\text{opposite}}{\text{adjacent}}$$

Any triangle



In any triangle ABC:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\text{Area of triangle ABC} = \frac{1}{2}ab \sin C$$

NUMBER ALGEBRA

Standard form is $a \times 10^n$ where $1 \leq a < 10$ and n is an integer.

The quadratic equation $ax^2 + bx + c = 0$ has solutions

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The determinant of matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ is $ad - bc$.

The inverse of $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ is $\frac{1}{ad - bc} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$

If $y = ax^n$, then $\frac{dy}{dx} = anx^{n-1}$



1. Find **TWO** possible values, correct to the nearest degree, of θ such that $0^\circ \leq \theta \leq 360^\circ$ and $\sin \theta = 1 - \cos 58^\circ$. [3]

2. In a public school, the ratio of girls to boys is 3:2. There are 950 students in the school.
- (a) 80% of the boys in the school take the bus to school. How many boys take the bus to school? [2]
- (b) If 58% of all students take the bus to school, how many girls take the bus to school? [2]

3. Calculate the compound interest on \$8400 at 4% per annum for three years. [3]

4. Find the value of x . [3]

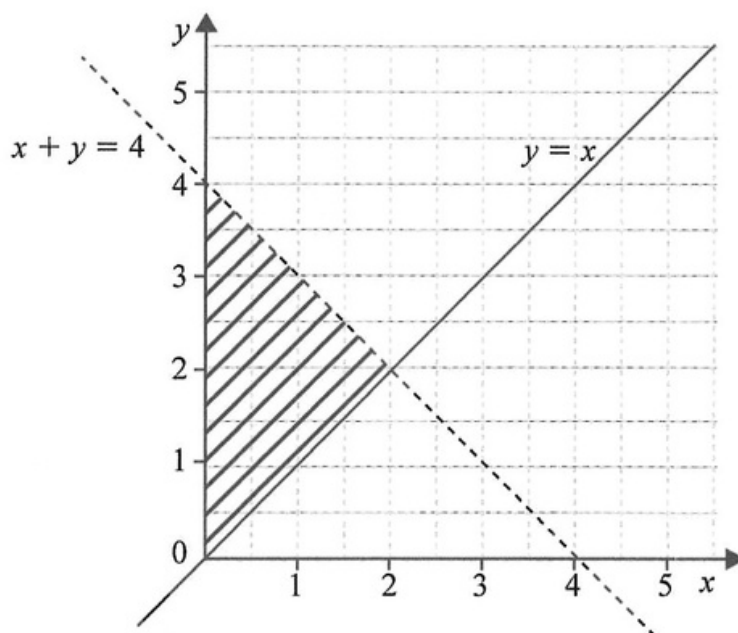
$$2^{3x+1} = 4^x$$

5. x is inversely proportion to y^2 . If $x = 4$ when $y = 3$, calculate the value of

- (a) x when $y = 12$ [3]

- (b) y when $x = 2\frac{1}{4}$ [3]

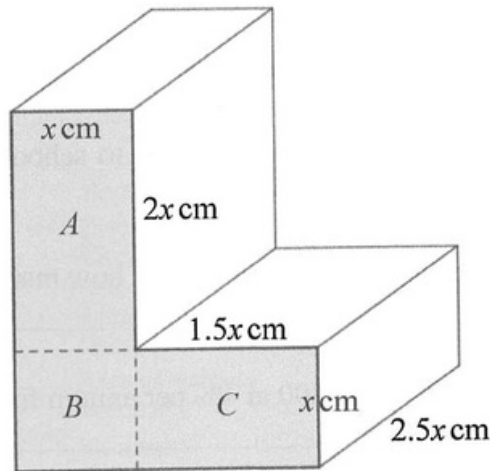
6. (a) Describe fully using inequalities the region that is shaded. [3]



- (b) Given that x is an integer, solve the inequality $10 \leq 2x < x + 9$ and state the values of x . [3]

[Turn over]

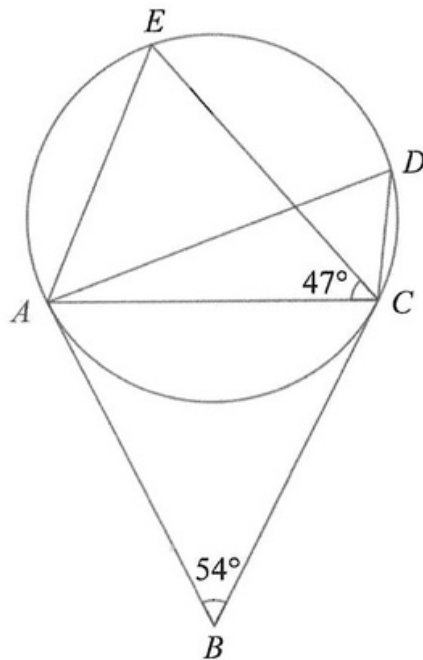
7. The diagram below is that of a compound prism with an L-shaped cross section with a length of $2.5x$ cm.



- (a) Write expressions in terms of x for the areas of the labelled parts of the cross section:
- (i) Region A [1]
 - (ii) Region B [1]
 - (iii) Region C [1]
- (b) Write a simplified expression in terms of x for the total area of the cross section. [1]
- (c) The volume of the prism is $2,430 \text{ cm}^3$, find the value of x . [3]
-



8. In the diagram below, AB and BC are tangents to the circle at points A and C respectively.



NOT TO SCALE

Determine the size of the following angles:

- | | | |
|-----|--------------|-----|
| (a) | $\angle BAC$ | [1] |
| (b) | $\angle AEC$ | [1] |
| (c) | $\angle EAC$ | [1] |
| (d) | $\angle ADC$ | [1] |

9.
$$\begin{pmatrix} 2x-3 & 4 \\ -18 & y \end{pmatrix} \begin{pmatrix} 2 \\ 6 \end{pmatrix} = \begin{pmatrix} 15 \\ 0 \end{pmatrix}$$

- | | | |
|------|---|-----|
| (a) | Calculate the value of | |
| (i) | x , | [3] |
| (ii) | y . | [2] |
| (b) | Given that the matrix $\begin{pmatrix} z & -3 \\ 8 & 6 \end{pmatrix}$ has no inverse, find the value of z . | [2] |

10. (a) Simplify

$$\frac{xy - 3x + 4y - 12}{5x + 20}$$

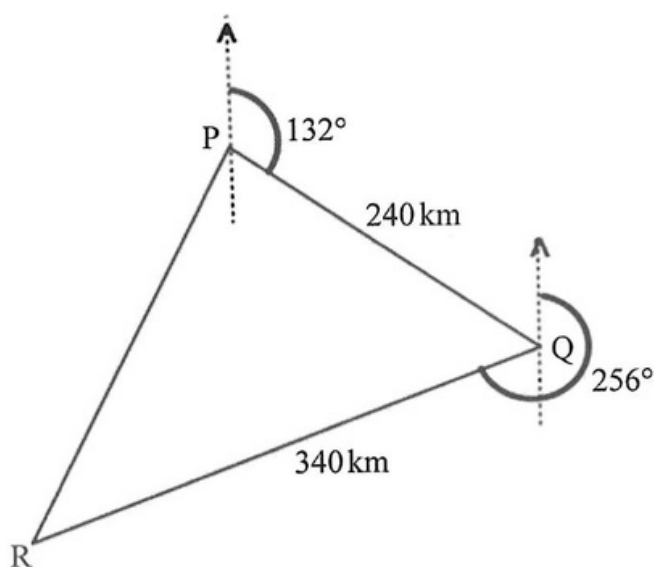
[4]

Using your answer from (a), simplify

(b) $\frac{xy - 3x + 4y - 12}{5x + 20} \div \frac{y^2 - 9}{xy + 6x}$

[4]

11. The diagram shows the route of a mail boat sailing from Port P to Port Q and then to Port R. The bearing of Port Q from Port P is 132° and the bearing of Port R from Port Q is 256° .



NOT TO SCALE

- (a) Calculate the size of angle PQR. [2]

The distance from Port P to Port Q is 240 km.

The distance from Port Q to Port R is 340 km.

- (b) Calculate the distance RP, giving your answer correct to the nearest whole number. [4]

- (c) Calculate the bearing of Port R from Port P. [4]



12. The functions f and g are defined as follows:

$$f(x) = 3x + 2 \quad g(x) = \left(\frac{2x-1}{3} \right)$$

- (a) Calculate the value of $f(-4)$. [1]
- (b) Determine, in simplified form, expressions for
- (i) $g^{-1}(x)$, [3]
- (ii) $gf(x)$. [4]
- (c) Calculate the value of x for which $f(x) = g(x)$. [4]
-

13. The cumulative frequency table below shows the results of a placement test given to 200 students upon their entry into a college.

The maximum score for the test is 100 marks. The scores are organised in groups of 10-mark increments.

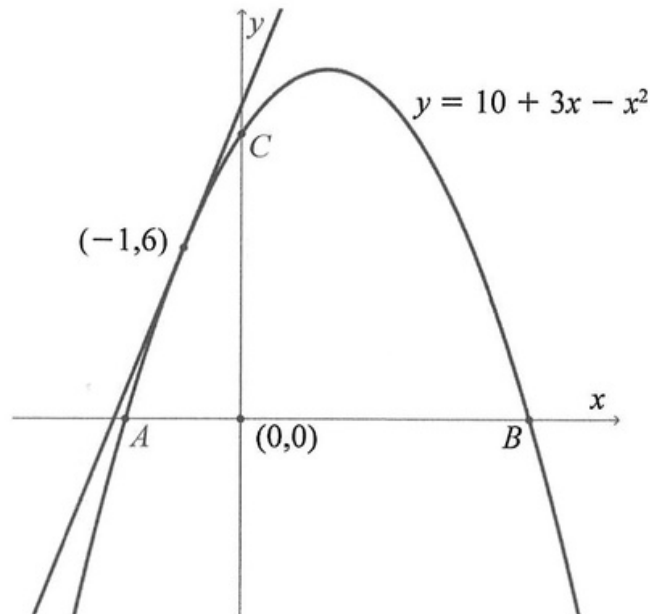
Marks Earned	Frequency	Cumulative Frequency
1–10	4	4
11–20	4	8
21–30	11	19
31–40	21	40
41–50	37	
51–60	44	
61–70	38	
71–80	24	
81–90	12	
91–100	5	

- (a) Copy and complete the cumulative frequency table. [2]
- (b) Using a scale of 1 cm to 10 marks on the x -axis and 1 cm to 10 students on the y -axis, draw a cumulative frequency curve of the completed table of data. [4]
- (c) Use the cumulative frequency curve to estimate the:
- (i) median mark, [1]
 - (ii) upper quartile mark, [1]
 - (iii) interquartile range. [2]



14. The diagram below shows the graph of the equation $y = 10 + 3x - x^2$. The scales of the x and y axes are different.

The graph of $y = 10 + 3x - x^2$ passes through the y -axis at point C and passes through the x -axis at points A and B .



- (a) Determine the y -coordinate of point C . [1]
- (b) Determine the x -coordinates of points A and B . [4]

There is also a tangent line to the curve $y = 10 + 3x - x^2$ at the point $(-1, 6)$.

- (c) Determine the gradient of this tangent line. [2]



15. **ANSWER THIS ENTIRE QUESTION ON THE GRAPH PAPER PROVIDED.**

$\overrightarrow{OP}$ and $\overrightarrow{OQ}$ are position vectors such that O is the origin and

$$\overrightarrow{OP} = \begin{pmatrix} 10 \\ 5 \end{pmatrix} \text{ and } \overrightarrow{OQ} = \begin{pmatrix} 2 \\ 11 \end{pmatrix}$$

- (a) Using a scale of 1 cm to 1 unit on both axes and values $0 \leq x \leq 14$ and $0 \leq y \leq 16$, draw and label the vectors $\overrightarrow{OP}$ and $\overrightarrow{OQ}$ [3]
- (b) (i) Draw the vector $\overrightarrow{PQ}$ [1]
(ii) Give $\overrightarrow{PQ}$ in column vector form. [2]
- (c) Calculate the magnitude of $\overrightarrow{PQ}$ [2]
- (d) (i) X is the midpoint of $\overrightarrow{PQ}$. Mark the position of X on your graph. [1]
(ii) Express $\overrightarrow{OX}$ as a column vector. [1]
-



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