MATHEMATICS

PAPER 3 (CORE/EXTENDED) 3815/3

Monday 23 MAY 2016 9:00 A.M.–11:30 A.M.

Additional materials:
Calculator (not graphing)
Geometrical instruments
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.

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 may be used.

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

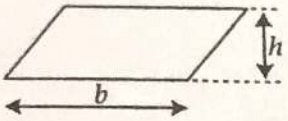
The total number of marks for this paper is 100.

This question paper consists of 9 printed pages and 3 blank pages.

INFORMATION AND FORMULAE

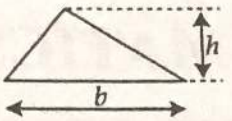
MENSURATION

Parallelogram



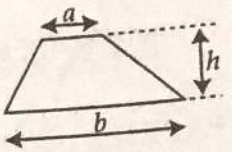
Area = bh

Triangle



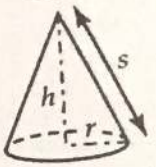
Area = $\frac{1}{2}bh$

Trapezium



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

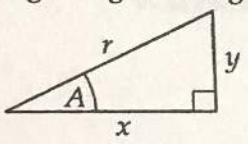
Cone



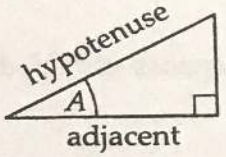
Circle (radius r, diameter d)	Circumference	$= 2\pi r$ or πd
	Area	$= \pi r^2$
Cylinder (radius r, height h)	Volume	$= \pi r^2 h$
	Area of curved surface	$= 2\pi rh$
Sphere (radius r)	Volume	$= \frac{4}{3}\pi r^3$
	Area of surface	$= 4\pi r^2$
Prism	Volume	= area of cross-section × length
Pyramid	Volume	$= \frac{1}{3}$ × area of base × height
Cone (radius r, height h)	Volume	$= \frac{1}{3}\pi r^2 h$
	Area of curved surface	$= \pi rs$ where s = slant height $\sqrt{h^2 + r^2}$

TRIGONOMETRY

Right-angled triangle

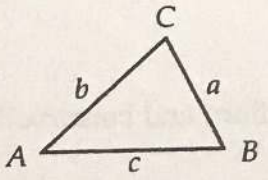


$r^2 = x^2 + y^2$ (result of Pythagoras)



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

Any triangle



In any triangle ABC: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

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

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

NUMBER

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

ALGEBRA

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

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

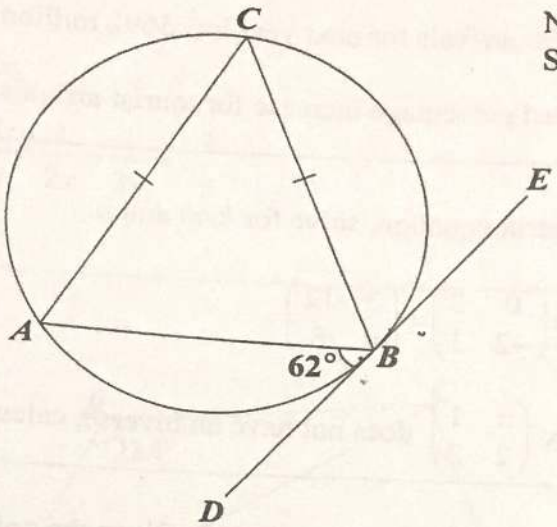
The determinant of matrix $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ is $ad - bc$.

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

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

1. In the diagram, the line DE is tangent to the circle ABC at the point B.

$AC = BC$ and $\angle ABD = 62°$.



NOT TO SCALE

Calculate the value of

(a) $\angle ACB$, [1]

(b) $\angle BAC$, [1]

(c) $\angle CBE$. [1]

2. In the formula $\frac{k}{x^3}$, k is a constant. If $y = 4$ when $x = 6$, calculate

(a) the value of k, [2]

(b) the value of y when $x = 4$. [2]

3. (a) Simplify $\left(16b^8\right)^{\frac{3}{4}}$ [2]

(b) Solve for x $9^{2x} = 27$ [3]

4. The estimated number of tourist arrivals for this year is 5.355 million. This is an increase of 5% from last year.

(a) Calculate the number of tourist arrivals for last year. [2]

The projected number of tourist arrivals for next year is 5.5692 million.

(b) Calculate the projected percentage increase for tourist arrivals. [3]

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5. (a) For the following matrix equation, solve for k, m and n.

$$\begin{pmatrix} m & 0 \\ 1 & 4 \end{pmatrix} + k\begin{pmatrix} 0 & 3 \\ -2 & 1 \end{pmatrix} = \begin{pmatrix} 3 & 12 \\ n & 8 \end{pmatrix}$$ [3]

(b) Given that the matrix $\begin{pmatrix} x & 1 \\ 2 & 3 \end{pmatrix}$ does not have an inverse, calculate the value of x. [3]

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6. $\overline{OA}$ and $\overline{OB}$ are position vectors relative to the origin O. Given the points $A(7,-15)$ and $B(-2,3)$,

(a) write down the column vectors $\overline{OA}$ and $\overline{OB}$, [2]

(b) express $\overline{AB}$ as a column vector, [2]

(c) calculate $|\overline{AB}|$, the magnitude of $\overline{AB}$. [2]

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7. Given that $h(t) = 7 - 5t$ and $k(t) = \frac{4+t}{3}$, calculate

(a) the value of $h(3)$, [1]

(b) t where $k(t) = 9$, [2]

(c) a simplified expression for $kh(t)$, [2]

(d) $k^{-1}(t)$. [2]

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8. (a) Express as a fraction in simplest form.

$$\frac{3}{x-1}-\frac{2}{3-x}$$

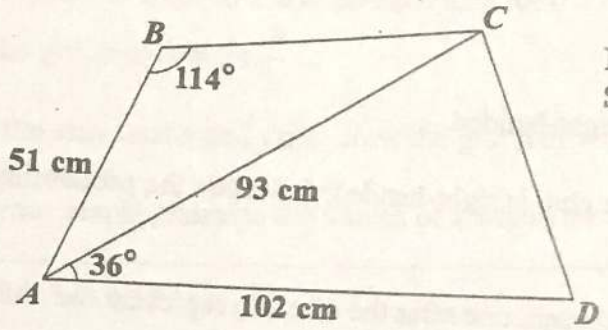
[4]

(b) Solve for x.

$$\frac{1}{x}-\frac{1}{2x}+\frac{1}{3x}=1\frac{2}{3}$$

[4]

9.



NOT TO SCALE

For the quadrilateral $ABCD$, $AB = 51$ cm, $AD = 102$ cm and $AC = 93$ cm. $\angle ABC = 114°$ and $\angle CAD = 36°$.

Calculate, giving your answer to the nearest whole number,

(a) the length of CD,

[4]

(b) the angle $\angle ACB$.

[4]

10. In a club with 30 members, 18 are girls, 6 are left-handed and 3 are left-handed boys. The table is to show the number of members in each category.

	Left-handed	Right-handed
Girls		15
Boys	3	

(a) Copy and complete the table. [2]

(b) A member is chosen at random. Use your table to calculate the probability that the member is

(i) left-handed, [1]

(ii) a boy, [1]

(iii) a girl and right-handed. [1]

(c) The president of the club is right-handed. Calculate the probability that the president is a boy. [2]

(d) Two members are chosen, one after the other, to represent the club. Calculate the probability that they are

(i) both right-handed, [2]

(ii) a boy and a girl, in any order. [3]

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

The following is an incomplete table of values for the graph of $y = 3 + \frac{2}{x}$.

x	0.4	0.5	1		2	3	4	5	6
y	8	7	5	4.5	4	3.7		3.4	3.3

(a) Calculate

(i) the missing y value, [1]

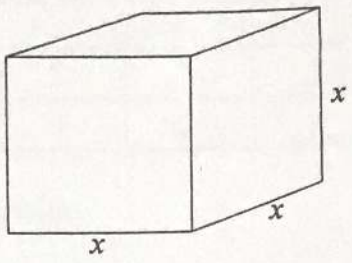
(ii) the missing x value. [3]

(b) Using a scale of 2 cm to 1 unit on each axis for $0 \leq x \leq 7$ and $0 \leq y \leq 9$, draw the graph of $y = 3 + \frac{2}{x}$. [4]

(c) Using the same scale and axes, draw the graph of $y = 7 - x$. [2]

(d) From your graph, estimate the values of x where the curve and line intersect. [2]

12. A manufacturing company ships material in quantities of 8000 cm^3 by volume. The material is shipped in cubic packaging as shown.

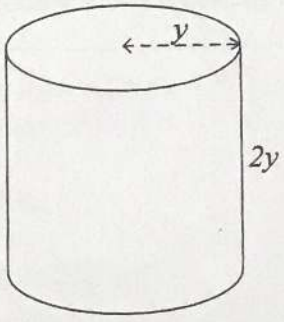


(a) For this cube, calculate

(i) the length of a side, [2]

(ii) the surface area. [2]

In the interests of economy, it was found that it would be cheaper to use cylindrical packaging as shown.



(b) For this cylinder, calculate, using $\pi = 3.14$ where necessary,

(i) the radius (to 1 decimal place), [3]

(ii) the surface area. [4]

(c) Calculate the amount of packaging saved by using the cylindrical form. [1]

13. The general expression for a trinomial is $ax^2 + bx + c$.

(a) Substitute each set of values into the expression, and factorise.

(i) $a = 1,\ b = -5,\ c = 0$ [2]

(ii) $a = 1,\ b = 7,\ c = 10$ [2]

(iii) $a = 2,\ b = 5,\ c = -3$ [2]

(b) When $a = 1$ and $c = -9$, determine the value of b so that the product of the factors of the expression is the difference of squares.
Show your working. [3]

(c) When $a = 1$ and $b = 8$, determine the value of c so that the expression factorises into a perfect square.
Show your working. [3]

End]