P4022 WASSCE
November 2010
MATHEMATICS (CORE) 2
2½ hours

2

Name..

Index Number...

THE WEST AFRICAN EXAMINATIONS COUNCIL

West African Senior School Certificate Examination

MATHEMATICS (CORE) 2

November 2010   [100 marks]   2½ hours

*Write your **name** and **index number** in **ink** in the spaces provided above.*

*Answer **ten** questions in all. **All** the questions in Part I and **five** questions from Part II.*

In each question, all necessary details of working, including rough work, must be shown with the answer.

*Give answers as accurately as data and tables allow.*

Graph papers are provided for your use in the examination.

The use of non-programmable, silent and cordless calculator is allowed.

Turn over

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1. (a) Simplify $37\frac{1}{2} \div \frac{5}{9}$ of $(\frac{4}{7} + \frac{1}{5}) - 80\frac{1}{3}$.

   (b) The nth term of a sequence is $5 + \frac{2}{3^{n-2}}$ for $n \geq 1$. What is the sum of the fourth and fifth terms? Leave your answers in the form $\frac{x}{y}$ where x and y are integers.

2. (a) Factorize $x^2 + 4x + 3 + mx + 3m$.
   (b) A T-shirt costs 5 times as much as a singlet. for GH¢800, a trader can buy 32 more singlets than T-shirts. How much does a T-shirt cost?

3. The diagram shows a field $ABCD$ in the form of a trapezium. If $|AD| = |BC| = 600$ m, $\angle ADC = \angle BCD = 120°$ and $|DC| = 450$ m,
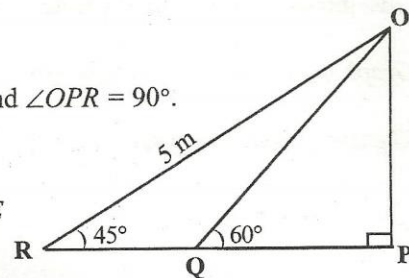
   (a) find the perimeter of the field;

   (b) calculate, correct to **three** significant figures, the area of the field.
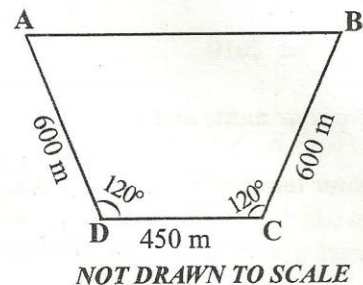
NOT DRAWN TO SCALE

4. (a)

   In the diagram, $|OR| = 5$ m, $\angle ORP = 45°$, $\angle OQP = 60°$ and $\angle OPR = 90°$. Find the distance QP, leaving your answer in surd form.

   NOT DRAWN TO SCALE

   (b) X and Y are two cylindrical tanks with base radii $2r$ cm and r cm respectively. If the water level in Y is 10 cm, what level will the same quantity of water be in X? (Use $\pi = \frac{22}{7}$)

5. (a) In a class, the probability that a student passes a test is $\frac{2}{5}$. What is the probability that if 2 students are chosen at random from the class, one would pass and the other would fail?

   (b)

   In the diagram, O is the centre of the circle. AK is a strailght line and TK is a tangent. If $\angle CTK = 30°$, calculate $\angle TKC$.
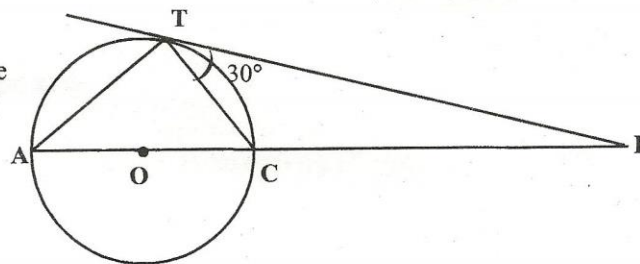
PART II
[60 marks]
*Answer **five** questions **only** from this part. All questions carry equal marks.*

6. (a) In a class of 31 students, 16 play football, 12 play table-tennis and 5 play both games. Find the number of students who play
   (i) **at least** one of the games;
   (ii) **none** of the games.
   (b) Two commodities A and B cost D70 and D80 per kg respectively. If 34.5 kg of A is mixed with 26 kg of B and the mixture is sold at D85 per kg, calculate the percentage profit.

7. (*a*) Copy and complete the following table of values for the relation
$y = (x - 4)(x + 2)$ for $-3 \le x \le 5$.

x	-3	-2	-1	0	1	2	3	4	5
y				-8					

(*b*) Using scales of 2 cm to 1 unit on the x-axis and 2 cm to 2 units on the y-axis, draw the graph of $y = (x - 4)(x + 2)$ for $-3 \le x \le 5$.

(*c*) Using the graph, find the:
(i) values of x for which y is decreasing;
(ii) gradient of the curve at $x = 0$.

8. (*a*) Using a ruler and a pair of compasses only, construct:
(i) triangle PQR such that $|PQ| = 8.5$ cm, $\angle QPR = 60°$ and $|PR| = 7.5$ cm;
(ii) the locus l_1 of points equidistant from P and R;
(iii) the locus l_2 of points equidistant from Q and R;
(iv) locate the point of intersetion I, of the loci l_1 and l_2.

(*b*) (i) Construct a circle passing through the three vertices of the triangle PQR.
(ii) Find the radius of the circle.
(iii) Measure $|QR|$.

9. (*a*) Simplify $\sqrt{\left(\dfrac{x^3 y^5}{xy^7}\right)}$, where $x > 0$ and $y > 0$.

(*b*) A man 1.7 m tall observes the angle of elevation of the tip of a tower to be 35°. He moves 50 m away from the tower and now observes the angle of elevation to be 28°. How far above the ground is the tip of the tower to **three** significant figures?

10. The table shows the distribution of marks scored by 50 students in a test.

Marks (%)	$1-10$	$11-20$	$21-30$	$31-40$	$41-50$	$51-60$	$61-70$	$71-80$	$81-90$
Frequency	1	3	5	8	12	10	5	4	2

(*a*) Construct a cumulative frequency table for the distribution.

(*b*) Draw a cumulative frequency curve for the distribution.

(*c*) Use the curve to estimate the :
(i) interquartile range;
(ii) percentage of students who scored more than 66%.

11. The base of a right pyramid with vertex O is a square $ABCD$ of side 13 cm. Each slant edge is 12 cm long. Calculate, correct to **two** significant figures, the:
(*a*) vertical height $|OE|$ of the pyramid;
(*b*) volume of the pyramid.

12. (*a*) The operation ($\bullet$) is defined on the set $\{2, 4, 6\}$ by $m \bullet n = $ the unit digit in the product mn.
(i) Copy and complete the table.

$\bullet$	2	4	6
2	4	8	2
4		6	
6			

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      (ii)   Use the table to solve the following equations:
- (α) $x \bullet 4 = 8$;
- (β) $e \bullet e = e$;
- (γ) $(4 \bullet f) \bullet 4 = f$.

(*b*)   The functions *f* and *g* are defined as
$f : x \rightarrow 2 - x^2$ and
$g : x \rightarrow \dfrac{1}{x-1}$.

Evaluate
- (i) $g(-\tfrac{1}{4})$:
- (ii) $\dfrac{f(2)}{g(3)}$.

13.   (*a*)   A triangle has vertices $A(1, 1)$, $B(2, 4)$ and $C(5, 8)$.

      (i)   If the triangle is translated by the vector $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$ to $A'B'C'$, where $A \rightarrow A'$, $B \rightarrow B'$ and $C \rightarrow C'$, calculate the coordinates of A', B' and C'.

      (ii)   The triangle ABC undergoes a transformation involving rotation in an anticlockwise direction through 90° about the origin followed by a translation. If the final position is $A''(2, -1)$, $B''(-1, 0)$ and $C''(-5, 3)$, determine the translation vector.

(*b*)   In triangle PQR, $\overrightarrow{PQ} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\overrightarrow{RQ} = \begin{pmatrix} -6 \\ -4 \end{pmatrix}$, find $\overrightarrow{PR}$.

(*c*)   Find the equation of the line which is perpendicular to the line $y = 2x - 1$ and passes through the point (2, 5).

QUESTIONS 14 AND 15 ARE FOR CANDIDATES IN NIGERIA, SIERRA LEONE AND THE GAMBIA ONLY.

14. P(lat 40° N, long 18° W) and Q(lat 40° N, long 78° W) are two cities on the surface of the earth. Calculate the:
- (*a*)   radius of the parallel of latitude on which P and Q lie, correct to the **nearest** 10 km;
- (*b*)   length of the minor arc PQ, correct to the **nearest** 100 km;
- (*c*)   vertical distance between the centre of the earth and the centre of the small circle on which P and Q lie, correct to the **nearest** km.

[*Take* $\pi = \dfrac{22}{7}$ *and radius of the earth* $= 6400$ km]

15.   (*a*)   The second, fourth and sixth terms of an Arithmetic Progression (*AP*) are $x - 1$, $x + 1$ and 7 respectively. Find the
- (i)   common difference;
- (ii)   first term;
- (iii)   value of x.

(*b*)   A spherical bowl of radius r cm is one-quarter full when 6 litres of water is poured into it. Calculate, correct to **three** significant figures, its diameter. [*Take* $\pi = \dfrac{22}{7}$].

END OF PAPER

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