P4022 Nov.
WASSCE 2011
GENERAL
MATHEMATICS/
MATHEMATICS
[CORE] 2

**2**

$2\frac{1}{2}$ hours

Name:.....

Index Number:.....

# THE WEST AFRICAN EXAMINATIONS COUNCIL

## West African Senior School Certificate Examination

GENERAL MATHEMATICS/MATHEMATICS [CORE] 2

November 2011 [100 marks] $2\frac{1}{2}$ hours

*Write your* **name** *and* **index number** *in the spaces provided at the top right-hand corner of this booklet.*

*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.*

*The following are provided for use in the examination:*

*(a) graph paper;*

*(b) drawing paper for construction work.*

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

PART I

[ 40 marks ]

*Answer* **all** *the* **five** *questions in this part.*

**All** *questions carry equal marks.*

**1.** *(a)* Find the value of $x$ in the expression: $\frac{3^{(2x+1)}}{3^{(3x-4)} \times 3^{(6-7x)}} = 27^x$.

*(b)* Without using Tables or Calculator, simplify:

$\frac{1}{3}log\frac{125}{8} - 2log\frac{2}{5} + log\frac{80}{125}$ (All logarithms are in base 10).

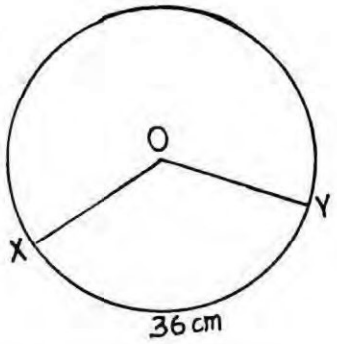
**2.** *(a)* Solve the equations $8 = 2^{(x+y)}$ and $1 = 3^{(x-y)}$ simultaneously.

*(b)* If $\frac{3x + 2y}{5x - 4y} = \frac{9}{4}$, find the ratio $x : y$.

**3.** *(a)* A cube of side 4 *cm* has the same volume as a cone with diameter 7 *cm*. Calculate, correct to the nearest *cm*, the height of the cone.

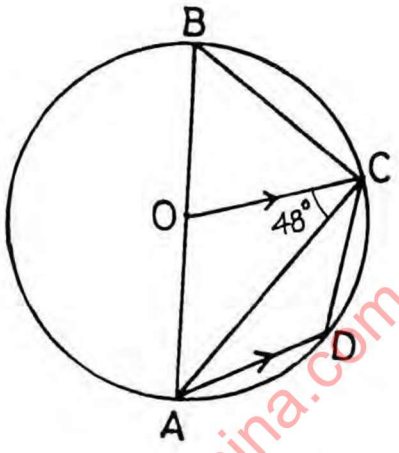
[ Take $\pi = \frac{22}{7}$ ].

*(b)*




In the diagram, $O$ is the centre of the circle, radius 14 *cm*. If the length of the minor arc $XY$ is 36 *cm*, calculate the area of the minor sector $OXY$. [ Take $\pi = \frac{22}{7}$ ].

**4.** *(a)*




In the diagram, $O$ is the centre of the circle, $\overline{OC}$ is parallel to $\overline{AD}$, $\overline{AB}$ is a straight line and $\angle OCA = 48°$. Calculate $\angle ABC$.

*(b)* From a window of a building, the angle of elevation of the top of a tower 50 $m$ away is 31° and the angle of depression of the foot of the tower is 25°. Calculate, correct to 2 decimal places, the height of the tower.

**5.** *(a)* The number of green *(G)*, red *(R)*, white *(W)* and black *(B)* identical balls contained in a bag is as shown in the table.

| *Balls* | *G* | *R* | *W* | *B* |
|---|---|---|---|---|
| *Frequency* | 2 | 4 | 3 | 1 |

If two balls are selected at random **without** replacement, find the probability that both balls are green.

*(b)* In a test, if a student had scored 80 marks in one of the subjects, his average mark in 8 subjects would be 62. If he had scored 64 marks in that same subject with the scores in the remaining 7 subjects unchanged, the average mark would be $m$. Find the value of $m$.



**Turn over**

PART II

[60 marks]

*Answer* **five** *questions* **only** *from this part.*

**All** *questions carry equal marks.*

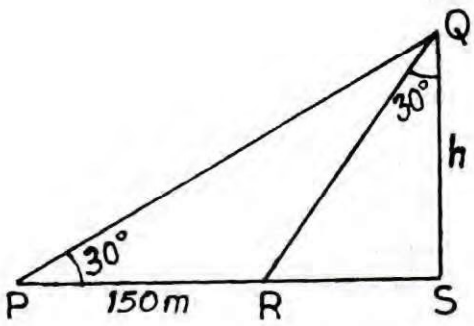
**6.** A man whose annual basic salary is ₦750,000.00 is allowed the following tax reliefs:

| | | |
|---|---|---|
| Personal allowance | : | 20% of annual basic salary |
| Wife allowance | : | ₦70,000.00 |
| Children allowance | : | ₦30,000.00 per child up to 4 children |
| Dependent Relatives | : | ₦100,000.00 |

*(a)* If the man has four children, calculate his taxable income.

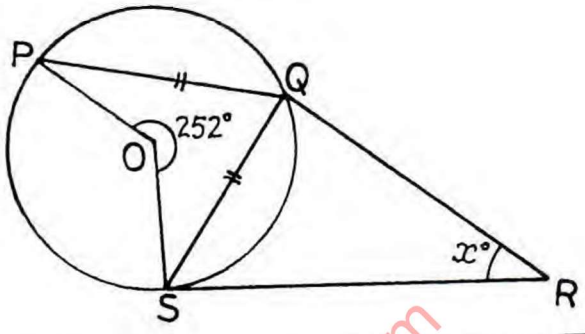
*(b)* If he pays tax at the rate of 35 kobo in the naira on the first ₦180,000.00 taxable income and 15 kobo in the naira on the remaining taxable income, calculate his monthly tax.

**7.** *(a)*




In the diagram $\angle QSR = 90^{o}$, $/PR/ = 150\,m$, $/QS/ = h$ metres and $\angle QPR = \angle RQS = 30^{o}$. Calculate, correct to the nearest whole number, the value of $h$.

(b)




In the diagram, $O$ is the centre of the circle $PQS$. $\overline{SR}$ is a tangent, reflex $P\hat{O}S = 252^o$ and $\angle SQR = 79^o$. Calculate the size of $\angle QRS$.

**8.** *(a)* Copy and complete the table of values for $y = 2x^2 - 3x - 4$ for the interval $-3 \leq x \leq 4$.

| $x$ | –3 | –2 | –1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|
| $y$ | 23 | | | –4 | | | | 16 |

*(b)* Using a scale of 2 *cm* to represent 1 unit on the $x$–axis and 2 *cm* to represent 5 units on the $y$–axis, draw the graph of:

(i) $y = 2x^2 - 3x - 4$;

(ii) $y = 3x - 4$.

*(c)* From your graph, solve the equations

(i) $2x^2 - 3x - 4 = 0$;

(ii) $2x^2 - 6x = 0$.

**9.** *(a)* Using ruler and a pair of compasses only, construct:

(i) a quadrilateral $PQRS$ such that $|PQ| = 5.9cm$, $|QR| = 7.1cm$, $\angle PQR = 135^o$, $|SR| = 11cm$ and $|PS| = 6cm$;

(ii) a perpendicular, $l_1$, from $S$ to $\overline{PR}$;

(iii) the locus, $l_2$, of points equidistant from $\overline{PQ}$ and $\overline{PS}$.

*(b)* Locate a point $T$ such that $T$ is the intersection of $l_1$ and $l_2$.

*(c)* Measure

(i) $|TQ|$;

(ii) $\angle PSR$.

**Turn over**

**10.** *(a)* Given the Arithmetic Sequence $-6, -2\frac{1}{2}, 1, ..., 71$, find the:

(i) common difference;

(ii) number of terms of the sequence.

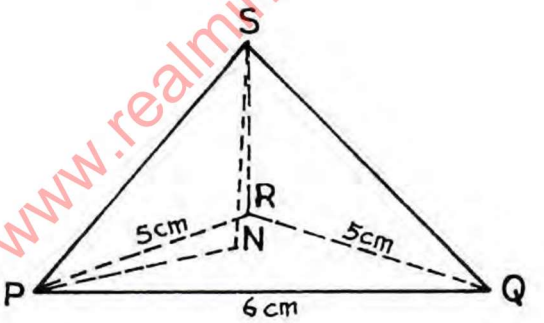
*(b)* The difference between the third and first terms of a Geometric Progression (G. P.) is 42. If the fourth term is greater than the second term by 168, find the:

(i) first term;

(ii) fourth term

of the progression.

**11.**




The diagram is a right pyramid with a triangular base $PQR$ and height $|SN|$. If $|PQ| = 6\,cm$, $|PR| = |RQ| = 5cm$, $|PN| = 3.3\,cm$ and $\angle SPN = 52^{o}$, calculate, correct to 2 significant figures, the

(i) vertical height $|SN|$ ;

(ii) area of the base $PRQ$;

(iii) volume;

(iv) angle between the slant face $SPQ$ and the base $PRQ$ of the pyramid.

**12.** The table shows the distribution of the masses of some bags of beans in a grains stores.

| Mass *(kg)* | 51 – 55 | 56 – 60 | 61 – 65 | 66 – 70 | 71 – 75 | 76 – 80 |
|---|---|---|---|---|---|---|
| No of bags | 7 | 10 | 24 | 6 | 2 | 1 |

Calculate, correct to one decimal place, the:

*(a)* range;

*(b)* mean deviation

of the distribution.

**13.** From a point $X$, a boat sails 6 *km* on a bearing of 037° to a point $Y$. It then sails 7 *km* from $Y$ on a bearing of 068° to a point $Z$. Calculate the:

*(a)* distance $XZ$, correct to two decimal places;

*(b)* bearing of $Z$ from $X$, correct to the nearest degree.

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

**14.** *(a)* Draw the tables for:

(i) addition $\oplus$

(ii) multiplication $\otimes$

on the set {0, 1, 2, 3, 4 } modulo 7.

*(b)* From your table, evaluate:

(i) $m \otimes m = 2$

(ii) $m \oplus (m \otimes 4) = 5$

(iii) $m \otimes (m + 3) = 0$

**15.** *(a)* Using a scale of 2 *cm* to 2 units on both axes, draw on a sheet of graph paper two perpendicular axes $0x$ and $0y$ for $-10 \leq x \leq 10$ and $-10 \leq y \leq 10$.

*(b)* Draw on this graph, indicating clearly the coordinates of all the vertices;

(i) quadrilateral $PQRS$ with $P(4, 8)$, $Q(2, 2)$, $R(6, 2)$ and $S(8, 8)$;

(ii) the image $P_1\ Q_1\ R_1\ S_1$ of quadrilateral $PQRS$ under a reflection in the line $x = 0$ where $P \rightarrow P_1$, $Q \rightarrow Q_1$, $R \rightarrow R_1$ and $S \rightarrow S_1$;

(iii) the image $P_2\ Q_2\ R_2\ S_2$ of quadrilateral $PQRS$ under a rotation through 180° about the origin where $P \rightarrow P_2$, $Q \rightarrow Q_2$, $R \rightarrow R_2$ and $S \rightarrow S_2$.

*(c)* Draw the line $PP_1$ and calculate its gradient.