301 S. H. S. C. E.
May 2010
MATHEMATICS 1 & 2
Objective and Essay Tests
3 hours

Name .....

Indentification Number .....

THE WEST AFRICAN EXAMINATIONS COUNCIL

Senior High School Certificate Examination

MATHEMATICS

May 2010 — 3 hours

Do **not** *open this booklet until you are told to do so. While you are waiting, read and observe the following instructions carefully. Write your* **name** *and* **identification number** *in the spaces provided above.*

This paper consists of **two** *parts: Paper* 1 *and* 2. *Answer Paper* 1 *on your Objective Test answer sheet and Paper* 2 *in your Answer booklet. Paper* 1 *will last* ***1 ½ hours*** *after which the answer sheet will be collected. Do* **not** *start Paper* 2 *until you are told to do so. Paper* 2 *will last* ***1½ hours****.*

PAPER 1
OBJECTIVE TEST
[40 marks] — 1½ hours

1. Use **2HB** pencil throughout
2. On the objective answer sheet supplied, provide the following details **correctly.**
   (*a*) Supply the information required in the spaces marked *CENTER NAME, CENTER No., SCHOOL NAME* and *SCHOOL No.*
   (*b*) In the space marked *STUDENT'S NAME*, write your **surname** followed by your **other names**. Write your *IDENTIFICATION NUMBER* in the space marked *STUDENT No.*
   (*c*) In the spaces marked *SUBJECT* and *GRADE*, write *MATHEMATICS* and 12TH in that order.
   (*d*) In the box marked *IDENTIFICATION NUMBER*, provide your **identification number** vertically in the spaces on the left-hand side, and shade each numbered space in line with each digit. This identification number must be the same as the one indicated on your Admission Slip. Repeat the process with the correct information for the box marked *YEAR OF FIRST ENTRY.*
   (*e*) In the box marked *Subject Code*, write the digits 301 vertically in the spaces on the left-hand side. **Shade** the corresponding numbered spaces as you did for your identification number.
3. An example is given below. This is for a male candidate whose *name* is Joseph Kerkula TOKPAH. His *identification number* is 101011379, his first entry is in 2010 and he is offering *Mathematics.*

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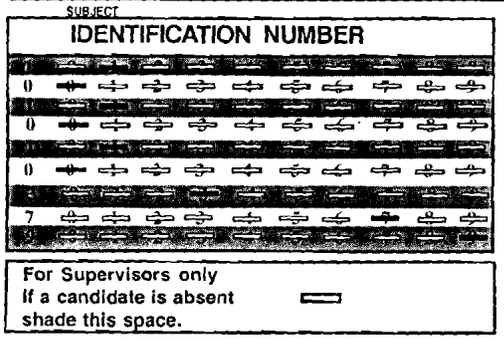
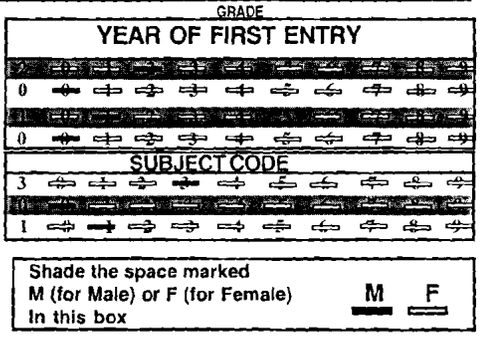
PRINT IN BLOCK LETTERS	
ST.BROWNE HIGH SCHOOL	891001
CENTER NAME	CENTER No.
SWEN S. TOE ACADEMY	101011
SCHOOL NAME	SCHOOL No
TOKPAH JOSEPH KERKULA	003
STUDENT NAME	STUDENT No
MATHEMATICS	12TH
SUBJECT	GRADE





For Supervisors only
If a candidate is absent shade this space.

Shade the space marked
M (for Male) or F (for Female)
In this box — M F

Answer **all** *questions.* **1½ hours**

Paper 1 consists of ***fifty*** *questions. Each question is followed by* ***four*** *options lettered* ***A*** *to* ***D****. Determine the correct option for each question and shade in* ***pencil*** *on your answer sheet the answer space which bears the same letter as the option you have chosen. Give only* ***one*** *answer to a question.*

An example is given below.

Convert 2π radians to degree.

A. 45°
B. 90°
C. 180°
D. 360°

The correct answer is 360°, *which is lettered* D, *and therefore answer space* D *would be shaded.*

⊏A⊐ ⊏B⊐ ⊏C⊐ ■D■

Think carefully before you shade the answer spaces; erase completely any answers you wish to change.

Do all rough work on this question paper. Now answer the following questions:

1. Find the number base y, such that $35_{(7)} + 43_{(y)} = 61_{(10)}$

A. 2
B. 5
C. 8
D. 9

2. Which of the following expressions is **not** a factor of $3x^3 - 3x$?

A. x
B. x + 1
C. x – 1
D. $x^3 - 1$

3. Find the quadratic equation whose roots are $\frac{1}{2}$ and –2.

A. $2x^2 + 3x - 2 = 0$
B. $2x^2 - 3x + 2 = 0$
C. $2x^2 - 3x - 2 = 0$
D. $2x^2 + 3x + 2 = 0$

4. Given that μ = {prime numbers between 1 and 8}, P = {2,4,7} and Q ={2,5}, find the *complement* of $\{ P \cap Q \}$.

A. $\{3,5,7\}$
B. $\{2,5,7\}$
C. $\{3,7\}$
D. $\{5,7\}$

5. The original price of an article was reduced by 20%. The new price of the article was $1,500.00. What was the original price?

A. $1,875.00
B. $1,825.00
C. $1,800.00
D. $1,200.00

6. Solve the system of equations: *x + y = 4 and 3x – 2y = 12.*

A. (3, −1)
B. (3, 1)
C. (4, 0)
D. (−4, 0)

7. Find the midpoint of the line segment that joins the points $(-11, 3)$ and $(8, -7)$.

A. $(-\frac{7}{3}, -2)$
B. $(\frac{7}{3}, -2)$
C. $(-\frac{7}{2}, -2)$
D. $(\frac{7}{2}, -2)$

8. The sum of the digits of a two-digit number is 13. The number formed by reversing the digits is 27 more than the original number. Find the original number.

A. 76
B. 67
C. 58
D. 49

9. Find the fifth term in the expansion of $(t^2 + s)^{12}$.

A. $495t^{16}s^4$
B. $485t^{10}s^4$
C. $475t^{10}s^4$
D. $465t^{16}s^4$

10. Find the GCF of $x^2 - 4$ and $x^2 - x - 2$.

A. $x + 4$
B. $x - 2$
C. $x + 2$
D. $x - 4$

11. Factor completely $x^4 + 3x^3 - 16x^2 - 48x$.

A. $(x^2 + 3x)(x + 4)(x - 4)$
B. $x(x + 3)(x + 4)(x - 4)$
C. $(x^2 + 3x)(x + 16)(x - 16)$
D. $x(x + 3)(x^2 - 16)$

12. Solve for x in the equation $x + 2\sqrt{x-3} = 6$.

A. 4
B. 6
C. 8
D. 12

13. Given that $\sin\theta = \frac{\sqrt{3}}{2}$, what is the degree measure of θ?

A. 30°
B. 45°
C. 60°
D. 90°

14. Find the distance between the points P and Q given that the coordinates of $P = (2, 9)$ and $Q = (7, -3)$.

A. 8 units
B. 10 units
C. 12 units
D. 13 units

15. It is 15 miles from Monrovia to Kun Town. A car plies from Monrovia to Kun Town at 30 mph and returns at 45mph. What is the average speed of the whole journey?

A. 65 mph
B. 50 mph
C. 36 mph
D. 30 mph

16. What is the cost of painting the walls of a room 5m long, 4m wide and 3m high at $4.50 per square meter?

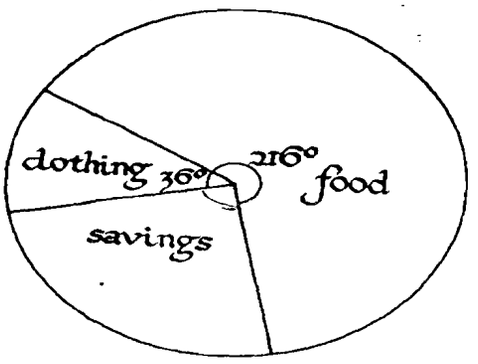
A. $243.00
B. $258.00
C. $420.00
D. $540.00

17. A shopkeeper marks his goods to gain 35%. Find the cash profit on a set of items which cost him $80.00

A. $18.00
B. $28.00
C. $108.00
D. $118.00

Turn over

The diagram below is a pie chart that shows how a man spends his monthly income. Use it to answer questions **18** *and* **19.**



18. What fraction of his income is used on food?

A. $\frac{3}{4}$
B. $\frac{3}{5}$
C. $\frac{1}{3}$
D. $\frac{1}{10}$

19. What is the angle of the sector representing his savings?

A. 160°
B. 152°
C. 120°
D. 108°

20. Find the distance between the points (– 4, 2) and (2, –1).

A. $8\sqrt{5}$
B. $6\sqrt{5}$
C. $5\sqrt{5}$
D. $3\sqrt{5}$

21. Change $1423_{(five)}$ to base eight numeral.

A. $365_{(eight)}$
B. $356_{(eight)}$
C. $563_{(eight)}$
D. $653_{(eight)}$

22. What is the fifth term of the expansion $(3d^2 - 2)^5$?

A. $112d^2$
B. $192\ d^2$
C. $240\ d^2$
D. $220\ d^2$

23. A circle has an equation of $2x^2 + 2y^2 - 6x - 2y + 3 = 0$. What are the coordinates of its center and the radius?

A. $C(\frac{3}{2}, \frac{1}{2}); r = 1$
B. $C(\frac{1}{2}, \frac{1}{2}); r = 2$
C. $C(-\frac{3}{2}, \frac{1}{2}); r = 1$
D. $C(-\frac{3}{2}, -\frac{1}{2}); r = 2$

24. Given P = {Even numbers between 5 and 10 exclusively}, Q = {x/x is a natural number} and R = {1, 2, 3, 4}, which of the following is **not** true?

A. P is a finite set.
B. 0 is a member of Q.
C. R is a subset of Q.
D. $P \cap R = \emptyset$.

25. Multiply $245_{(seven)}$ by $63_{(seven)}$

A. $21241_{(seven)}$
B. $34025_{(seven)}$
C. $33412_{(seven)}$
D. $23121_{(seven)}$

26. A fruit grower uses $\frac{1}{3}$ of his land for oranges, $\frac{3}{8}$ for plums, $\frac{1}{6}$ for paw-paw and the remaining 23 acres for grape fruits. Find the total area of land.

A. 163 acres
B. 184 acres
C. 207 acres
D. 230 acres

27. Factorize $z^3 - 8$.

A. $(z - 2)(z^2 - 4z + 2)$
B. $(z + 2)(z^2 - 2z + 4)$
C. $(z - 2)(z^2 + 2z + 4)$
D. $(z + 2)(z^2 + 4z + 2)$

28. Simplify $\frac{3}{1-\sqrt{2}}$

A. $3(1+\sqrt{2})$
B. $3(1-\sqrt{2})$
C. $-3(1+\sqrt{2})$
D. $-3(1-\sqrt{2})$

29. Simplify $(15\frac{5}{8})^{\frac{1}{3}}$

A. $5\frac{5}{6}$
B. $4\frac{5}{8}$
C. $3\frac{1}{3}$
D. $2\frac{1}{2}$

30. If $\tan x = \frac{3}{4}$, what is $\sin x$?

A. $\frac{1}{5}$
B. $\frac{2}{5}$
C. $\frac{3}{5}$
D. $\frac{4}{5}$

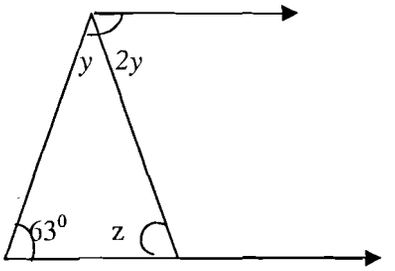
31. What is the equation of the line passing through (1, 3) whose slope is 2?

A. $2x - y + 5 = 0$
B. $2x - y - 5 = 0$
C. $2x - y - 1 = 0$
D. $2x - y + 1 = 0$

32. What is the value of the angle subtended by the diameter of a circle at any point on its circumference?

A. 60°
B. 90°
C. 120°
D. 150°

33. In the figure below, what is the value of $y + 2z$?



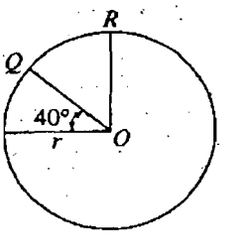
A. 109°
B. 138°
C. 175°
D. 195°

34. The sides of ΔPQR are in the ratio of 4:7:8 and its perimeter is 3 ft 2 inches. Find the measure of the longest side of this triangle.

A. 12 in
B. 14 in
C. 16 in
D. 19 in

35. The circle in the figure below has radius r. If $\overline{OP} \perp \overline{OR}$ and the measure of $\angle POQ$ is 40°, what is the length of arc QR in terms of r?

P



A. $\frac{7}{18}\pi$ r
B. $\frac{5}{18}\pi$ r
C. $\frac{4}{15}\pi$ r
D. $\frac{2}{15}\pi$ r

Turn over

6

36. Factorize $(x^2 - 2xy - 1 + y^2)$.

A. $(x - y - 1)(x + y + 1)$
B. $(x - y + 1)(x - y - 1)$
C. $(x - y - 1)(x + y - 1)$
D. $(x - y + 1)(x + y - 1)$

37. Simplify $\sqrt[3]{56} + \sqrt[3]{189} + \sqrt[3]{(-7)}$.

A. $-5\sqrt[3]{7}$
B. $4\sqrt[3]{7}$
C. $5\sqrt[3]{7}$
D. $6\sqrt[3]{7}$

38. After spending 1/2 of my monthly salary on food and 1/3 of the balance on clothes, I still had $60.00 left. How much is my monthly salary?

A. $72.00
B. $120.00
C. $180.00
D. $360.00

39. In a class of 36 students, 30 students like rice, 12 students like cassava, and 7 students like both cassava and rice. How many students like neither cassava nor rice?

A. 12
B. 13
C. 1
D. 7

40. Simplify $\dfrac{1\frac{1}{2}}{1+\dfrac{1}{1+\frac{1}{4}}}$

A 6/5
B. 5/6
C. 1/6
D. 3/5

41. In a right triangle ABC $\angle C = 90°$ and $\tan B = \frac{3}{4}$, evaluate $\frac{\sin B + \sin A}{2\cos A}$.

A. 7/8
B. 8/7
C. 7/6
D. 6/7

42. Find the base x such that $32_x = 17_{10}$.

A. 5
B. 4
C. 3
D. 2

43. Find the value of k if $x + 2$ is a factor of $x^3 + kx^2 - 2x + 4$.

A. -4
B. 0
C. 2
D. 4

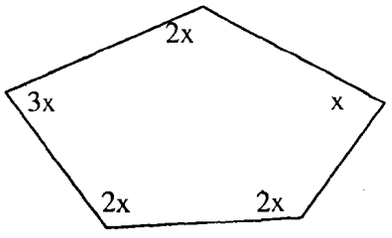
44. Find the positive value of x in the logarithmic equation $log_{10}(x^2 + 36) = 2$.

A. 8
B. 36
C. 64
D. 100

45. Two similar pyramids with square bases have sides equal to 2 cm and 1 cm respectively. If the volume of the smaller pyramid is $25cm^3$, what is the volume of the larger one?

A. $50\ cm^3$
B. $200cm^3$
C. $2000\ cm^3$
D. $2500\ cm^3$

46.



Find the value of $3x$ in the diagram above.

A. 54°
B. 108°
C. 152°
D. 162°

47. Two numbers are to be added to the list of seven numbers below so that the **median** and **mode** of the new list of nine numbers will be equal. Which of the following could be the two numbers that are added?

1, 1, 2, 5, 8, 10, 10

A. *1 and 8*
B. *5 and 5*
C. *6 and 8*
D. *8 and 10*

48. A number is chosen at random between 1 and 20 inclusive. What is the probability that it is a prime number?

A. 11/20
B. 1/2
C. 2/3
D. 3/5

49. If $3^{\left(x-\frac{1}{2}\right)} = 1$, what is the value of x?

A. 3/2
B. 3/4
C. 1/4
D. 1

50. How many different subsets can be made using either three or four people from a set of five people?

A. 5
B. 6
C. 15
D. 18

STOP!

The End of Paper 1

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

YOU WILL BE PENALIZED SEVERELY IF YOU ARE FOUND LOOKING AT THE NEXT PAGE BEFORE YOU ARE TOLD TO DO SO.

PAPER 2 **1½ hours**

ESSAY

[60 marks]

Paper 2 consists of **seven** *questions divided into* ***two*** *sections* ***A*** *and* ***B****. Section* ***A*** *has* ***four*** *compulsory questions and section* ***B*** *has* ***three*** *questions for which you are required to answer any* ***two****.*

Write your answers in ***ink*** *(blue or black)* ***only****.*

For each question, all necessary details of working including diagrams must be shown with the answer.

The use of silent, cordless, non-programmable calculators ***(not cell phones)*** *is allowed:*

Credit will be given for clarity of expression and orderly presentation of material.

SECTION A

COMPULSORY

[36 marks]

Answer **all** *the questions in this section.*

1. *(a)* Express as a single term : $\ln\left(\frac{e^3}{x}\right) + \ln\left(\frac{x}{e}\right)$

(b) Solve:

(i) $3^{2(1+x)} - 28 \times 3^x + 3 = 0$.

(ii) $\begin{vmatrix} x-2 & 1 \\ 2 & x-3 \end{vmatrix} = 0.$

2.

(a) Simplify the following:

(i) $\dfrac{\log 8 - \log 4}{\log 6 - \log 3}$

(ii) $\dfrac{2}{x+2} - \dfrac{5}{3x-1}$

(b) A bag contains 24 tennis balls, some white and some green. If a ball is chosen at random, the probability of getting a green ball is $\frac{3}{8}$.

(i) What is the probability of choosing a ball that is not green?

(ii) How many white balls are in the bag?

3. *(a)* Two of the exterior angles of a polygon are 63° each. The remaining exterior angles are each 26°. How many sides has the polygon?

(b) A woman is 35 years old and her son is 12 years old. How many years ago was the product of their ages 174?

4. *(a)* If k is a constant not equal to zero find the value(s) of x for which the expression $\dfrac{k}{x} + \dfrac{b}{x-3} + \dfrac{c}{x(x-3)}$ is not defined.

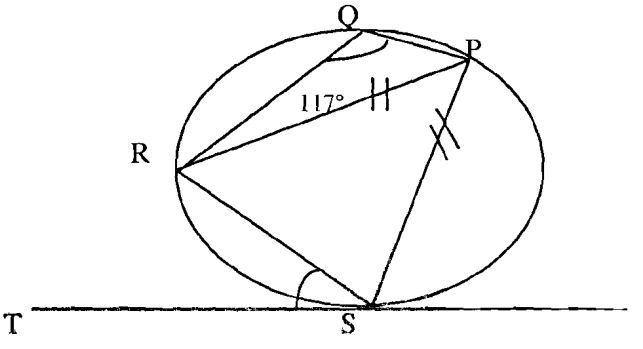
(b) If x is not equal to any of the values obtained in *(a) above*, find the value of k such that $\frac{k}{x}+\frac{2}{x-3}+\frac{6}{x(x-3)}=0$

SECTION **B**

[24 marks]

Answer any **two** *questions in this section.*

5. *(a)* In the diagram TS is tangent to circle PQRS. If $|PR|=|PS|$ and $\angle PQR = 117°$,



(i) calculate $\angle RST$.

(ii) XYZ is an isosceles triangle with $|XY|=|XZ|=6cm$ and $\angle YXZ = 120°$.
Calculate the length of $\overline{YZ}$.

6. x,y, and z are related quantities such that x varies directly as y and inversely as the square root of z. When x = 300 and y = 65, z = 25.

(i) Find the formula relating x, y, and z.

(ii) Calculate the value of x when y = 468 and z = 144.

7. In a right-angled triangle, $\tan\theta = \frac{4}{3}$. What is the value of $\sin\theta - \cos\theta$?

END OF TEST