Name: ______________________________ Index No: ______________/____

2305/301, 2307/301
2306/301, 2308/301
2309/301
MATHEMATICS
Oct./Nov. 2012
Time: 3 hours

Candidate's Signature: ____________

Date: ______________________

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN BUILDING
DIPLOMA IN QUANTITY SURVEYING
DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN HIGHWAY ENGINEERING
DIPLOMA IN ARCHITECTURE

MATHEMATICS

3 hours

INSTRUCTIONS TO CANDIDATES

Write your name and index number in the spaces provided above.
Sign and write the date of the examination in the spaces provided above.
You should have the following for this examination:
Mathematical tables/calculator
*Answer any **FIVE** of the following **EIGHT** questions.*
All questions carry equal marks.
Maximum marks for each part of a question are as shown.
*Answer **ALL** the questions in the spaces provided on this question paper.*

For Examiner's Use Only

Question	1	2	3	4	5	6	7	8	TOTAL
Marks									

This paper consists of 16 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

Turn over

1. (a) By letting $\tan\frac{x}{2} = t$ solve the equation $\sqrt{3}\cos x - \sin x = 1$ for $0° \leq x \leq 360°$. (8 marks)

(b) Solve for x where

$$2\log_5 x + \log_x 5 = 3$$

(7 marks)

(c) Use the binomial theorem to evaluate $\frac{1}{\sqrt{26}}$ correct to 3 decimal places. (5 marks)

2. (a) Find the values of x and y that satisfy the following simultaneous equations

$$2x + 3y = 7$$
$$3x + 2y = 8$$

(5 marks)

(b) Sketch the curve $y = 8x^3 - 24x + 11$ given that at $y = 0$; $x = \frac{1}{2}$ (8 marks)

(c) Given that $y = e^{2x} \ln x$, show that

$$\frac{d^2y}{dt^2} - 4\frac{dy}{dx} + 4y + \frac{e^{2x}}{x^2} = 0$$

(7 marks)

3. (a) Given that

$$A = \begin{pmatrix} 2 & 0 & 1 \\ 3 & 1 & 2 \\ 1 & 2 & 1 \end{pmatrix} \quad B = \begin{pmatrix} 0 & 2 & 1 \\ 2 & 2 & 1 \\ 3 & 1 & 2 \end{pmatrix} \quad and \quad C = \begin{pmatrix} 2 & 4 & 2 \\ 6 & 9 & 7 \\ 5 & 7 & 4 \end{pmatrix}$$

Determine:

(i) $M = AB - C$;

(ii) M^{-1}

Use the results above to solve the simultaneous equations:

$$x + y + 2z = 9$$
$$2x + y + z = 7$$
$$2x + 2 = 5$$

(15 marks)

(b) Show that:

$$\int_0^{\frac{\pi}{4}} \frac{dx}{1 + \sin x} = 1.$$

(5 marks)

4. (a) Figure 1 shows a cross-section of a building structure. AC = 4.8m, BC = 2.8m angle $B\widehat{A}C = 33^\circ$ and T divides AC in the ratio 1:3.

Calculate the following:

(i) Greatest area of ΔABC correct to three decimal places.
(ii) Ratio of the areas ABT and ABC
(iii) Length of BT

(15 marks)

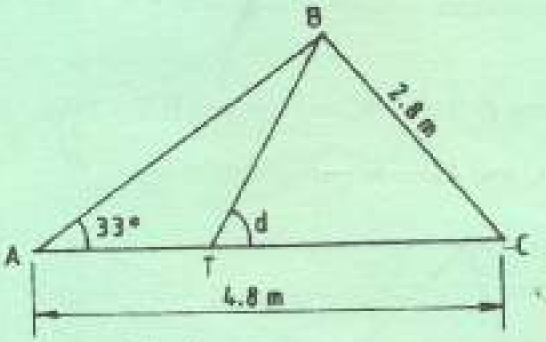

Fig. 1

(b) Find the sum of the complex numbers $Z_1 = 1.3 + 0.7j$, $Z_2 = -4j$ and $Z_3 = 2.1 + 1.4j$ in the form of $r(\cos\theta + j\sin\theta)$.

(5 marks)

5. (a) Construct a frequency distribution table for the following marks of students in a class starting from class 5 -15.

(7 marks)

10	45	31	83	67	59	95	60	62	70
63	71	86	87	48	61	52	34	77	54
80	40	56	36	09	63	37	13	79	28
64	46	97	47	84	07	32	57	41	24
32	67	15	35	82	14	27	05	67	60
57	72	57	92	88	66	55	64	33	40

(b) Using the above classified data

(i) Draw the histogram
(ii) Draw a cumulative frequency curve and use it to estimate the 1st quartile
(iii) Calculate the mean and median

(13 marks)

6. (a) The product and sum of the 3rd and 5th terms of a geometric progression are 81 and -18 respectively. Find the first term and the common ratio. (8 marks)

(b) How many two letter words can be formed from the letters B E E T? (2 marks)

(c) A committee of six people is to be chosen from six men and four women. Find the number of ways in which the committee will have the following cases.

(i) More men than women

(ii) At least one woman.

(10 marks)

7. (a) In figure 2 below $\cos\beta = \frac{1}{3}$, BC = 1 cm and BA = 2 cm

AD is parallel to BC and AD = K cm

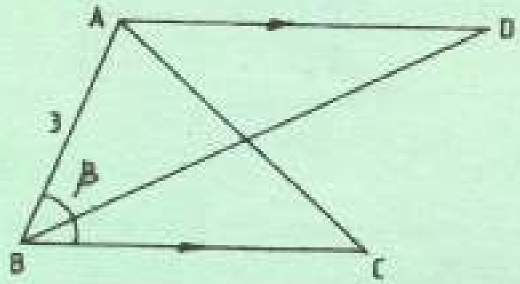

Fig. 2

If $\underset{\sim}{p}$ *and* $\underset{\sim}{q}$ are unit vectors in the directions $\overrightarrow{BC}$ *and* $\overrightarrow{BA}$ respectively, express in terms of $\underset{\sim}{p}$, $\underset{\sim}{q}$ and k the vectors

(i) $\overrightarrow{BD}$

(ii) $\overrightarrow{AC}$

(5 marks)

(b) Given that vectors $\underset{\sim}{a} = \begin{pmatrix} 8 \\ 15 \end{pmatrix}$ *and* $\underset{\sim}{b} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$

Find:

(i) $|\underset{\sim}{a}|$

(ii) $|\underset{\sim}{b}|$

(iii) $|\underset{\sim}{a} + \underset{\sim}{b}|$

(7 marks)

(c) Given that vectors PQ = i - 4j - k and PR = -2i - j + K, find:

(i) the are of the parallelogram whose sides are formed by $\overrightarrow{PQ}$ *and* $\overrightarrow{PR}$

(ii) the angle between $\overrightarrow{PQ}$ *and* $\overrightarrow{PR}$

(8 marks)

8. (a) Given that $8 \cos \theta + 25 \text{ Sin } \theta = R \cos (\theta - \alpha)$
Where $R > 0$ and $0° \leq x \leq 90°$

(i) Find the values of R and α and hence

(ii) Solve the equation

$8 \cos \theta + 25 \sin \theta = 17$ for $0° \leq x \leq 360°$

(10 marks)

(b) Using the expansion of tan (a + B) show that:

(i) $\tan 3\theta = \dfrac{3 \tan\theta - \tan^3\theta}{1 - 3 \tan^2\theta}$

(ii) Hence solve the equation $\tan 3\theta + 2 \tan \theta = 0$ for values of θ between $0°$ and $180°$ (inclusive)

(10 marks)