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MATHEMATICS**Oct/Nov 2013****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.**Your should have mathematical tables/ calculator for this examination.**This paper consists of EIGHT question.**Answer any FIVE questions in the spaces provided in this question paper.**All questions carry equal marks.**Maximum marks to each part of a question are as shown.**Standard Normal Distribution table is attached.**Do NOT remove any pages from this booklet.**Candidates should answer the questions in English.***For Examiner's Use Only**

Question	1	2	3	4	5	6	7	8	TOTAL SCORE
Candidate's Score									

This paper consists of 20 printed pages.

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

1. (a) Given that $z = x + jy$
- (i) Express $\frac{z-1}{z+1}$ in the form $a + jb$.
- (ii) Show that the expression is purely real for $\frac{z-1}{z+1} = \frac{x-1}{x+1}$. (5 marks)
- (b) Using the substitution $z = x^2$ solve for x in the equation $x^4 + x^2 + 1 = 0$. (15 marks)

2. (a) Given the matrices

$$A = \begin{pmatrix} 2 & 1 & 1 \\ 5 & -1 & 3 \\ 2 & -1 & 1 \end{pmatrix} \quad B = \begin{pmatrix} 1 & -2 & -1 \\ 3 & -1 & 1 \\ 1 & 4 & 0 \end{pmatrix}$$

determine:

- (i) AB^T
- (ii) $5B - 2A$
- (iii) B^{-1} (15 marks)
- (b) Use a result in 2 (a) above to solve the following simultaneous equations:

$$\begin{aligned} x - 2y - z &= 2 \\ 3x - y + z &= 0 \\ x + 4y &= -9 \end{aligned} \quad (5 \text{ marks})$$

3. (a) Solve the equation and show that $\sin 4\theta \cos 2\theta = 2 \sin \theta (1 - \sin 2\theta)(1 + \sin 2\theta)$. Hence solve the equation $\sin 4\theta \cos 2\theta = 0$. (7 marks)
- (b) Express $3 \sin \theta + \cos \theta$ in the form $R \sin(\theta + \alpha)$. Hence solve the equation $3 \sin \theta + \cos \theta = 1$ for $0^\circ \leq \theta \leq 360^\circ$. (13 marks)

4. (a) Given the function: $f(xy) = 5x^3y^4 - 2xy^2 + xy$ find an expression for:

$$\frac{\delta^2 f}{\delta x^2} + \frac{\delta^2 f}{\delta y^2} + \frac{\delta^2 f}{\delta x \delta y} - \frac{\delta^2 f}{\delta x \delta y} \quad (8 \text{ marks})$$

- (b) Given that $V = \cos(x^2 + y^2)$, $x = 5t$ and $y = \frac{1}{1-t^2}$ find $\frac{dv}{dt}$. (6 marks)

- (c) If $U = z^3 \cos(x^3 + y^3)$ find the change in U if x is measured 0.2 too large, y is measured 0.1 too small and z is measured 0.4 too large, at the point of $x = 0.3$, $y = 0.2$ and $z = 0.2$. (6 marks)

5. (a) Find $\int \frac{(2x+3)dx}{\sqrt{x^2+3x+2}}$ (4 marks)
- (b) Evaluate the following
- (i) $\int_0^1 x^2 e^{3x} dx$
- (ii) $\int_0^1 \frac{(x^2+5)dx}{(x+2)(x^2+3)}$ (16 marks)
6. Given the functions $y_1 = 10x$ and $y_2 = \frac{x^2}{10}$:
- (a) Sketch the area enclosed between the two curves; (2 marks)
- (b) Determine the area in 6 (a); (8 marks)
- (c) Find the coordinates of the centroid of the area. (10 marks)
7. (a) Show that the differential equation $\frac{d^2y}{dt^2} + \frac{dy}{dt} - 2y = e^t$ is satisfied by the equation $y = Ae^t + Be^{-2t} + te^t$. (4 marks)
- (b) Solve the differential equation $\frac{d^2x}{dt^2} - 3\frac{dx}{dt} + 2x = \sin t$ given that at $t = 0$, $x = 0$ and $\frac{dx}{dt} = 0$. (16 marks)
8. (a) Seven hundred and fifty candidates sat a college entrance examination and the mean score was 52%. If the pass mark was 58%, then 240 candidates passed the examination. Assuming the marks to be normally distributed, estimate the:
- (i) standard deviation of the scored marks;
- (ii) number of students who scored more than 50%. (8 marks)
- (b) Table 1 shows the distribution of the number of defective electric bulbs found in 400 lots from a certain firm.

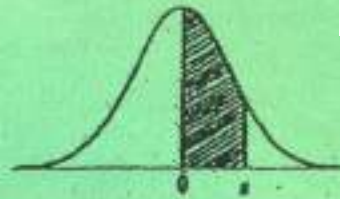
Table 1

No. of defective bulbs	0	1	2	3	4	5	6	7	8	9	10	11	12
No of lots	55	108	80	56	34	21	19	11	8	4	1	2	1

The manufacturer of the bulbs claims that the mean number of defective bulbs in a lot is 3. Test this claim at 5% level of significance. (12 marks)



AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0754
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2147	0.2190	0.2224
0.6	0.2258	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2518	0.2549
0.7	0.2580	0.2612	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2996	0.3023	0.3051	0.3078	0.3206	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000