

Name \_\_\_\_\_

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2305/301      2308/301

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2307/301

MATHEMATICS

Oct/Nov 2014

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  $A = \begin{bmatrix} -5 & 4 & 2 \\ 0 & 3 & 6 \\ 8 & 2 & 5 \end{bmatrix}$  and  $B = \begin{bmatrix} a & 3 \\ b & 4 \\ c & c \end{bmatrix}$  and that  $AB = \begin{bmatrix} 24 & 3 \\ 30 & 18 \\ 37 & 37 \end{bmatrix}$ .

Find:

(i)  $a, b$  and  $c$ ;

(ii)  $\text{adj } A$  hence  $A^{-1}$ . (11 marks)

(b) Use Cramer's rule to solve the following simultaneous equations.

$$3x - 4y + 2z = -3$$

$$3z + 4x - 2y = 10$$

$$3y - 2z - 2x = 2$$

(9 marks)

2. (a) Solve the differential equations  $x^2 \frac{dy}{dx} - xy = 6x^6 e^{x^3}$  given that  $y = -8$  when  $x = 2$ . (10 marks)

(b) If metal heated to a temperature of  $245^\circ\text{C}$  cools to  $140^\circ\text{C}$  in 10 minutes when placed in a fluid having a temperature of  $25^\circ\text{C}$ , determine the temperature of the metal after 45 minutes. (10 marks)

3. (a) Find the stationary points of the function  $z = 2x^3 - 3xy + \frac{3}{4}y^2$  and hence determine their nature. (10 marks)

(b) The sides forming the right-angle of a triangle are denoted by  $a, b$  and the hypotenuse by  $h$ . If these are possible errors of  $\pm 0.6\%$  in measuring  $a$  and  $b$ , use partial differentiation to determine the maximum possible errors in calculating the length of  $h$ . (10 marks)

4. (a) Determine the first fourth root of  $z = (3 - 9j)$  expressing the answer in Cartesian form. (7 marks)

(b) Given the vectors  $v = 4\hat{i} + 4\hat{j}$  and  $u = 2\hat{i} + 4\hat{j}$ , find the angle between the two vectors. (6 marks)

(c) Find the area of the triangle whose two sides are the vectors  $A = 4\hat{i} + 6\hat{j} + 7\hat{k}$  and  $B = 9\hat{i} - 2\hat{j} + 5\hat{k}$ . (7 marks)

5. (a) Obtain the first four terms in the binomial expansion of  $(1 - 16x)^{\frac{1}{4}}$  by substituting  $x = \frac{1}{10000}$ . Use the first two terms to find the value of  $\sqrt[4]{39}$ , correct to 6 significant figures. (9 marks)
- (b) A triangle has vertices  $P(2, 4, -3)$ ,  $Q(3, 2, -2)$  and  $R(-2, 3, 4)$ . Find the:
- vectors  $\overline{PQ}$  and  $\overline{PR}$ ;
  - area of the triangle using the two sides  $\overline{PQ}$  and  $\overline{PR}$  correct to 3 decimal places. (11 marks)
6. (a) Evaluate  $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \cos^5 x dx$  (7 marks)
- (b) The curve  $y = 2x^2 + 3$  is rotated about the x-axis between the limits  $x = 1$  and  $x = 2$  through a complete revolution. Determine the volume of the solid generated. (13 marks)
7. (a) On average 2.5% of items produced by a machine are found to be defective. If the items are packed 100 per box, determine the probability that a box selected at random will contain:
- exactly 3 defectives;
  - at most 2 defectives;
  - at least 4 defectives. (7 marks)
- (b) A sample of 10 plots showing their sizes and selling price is shown in Table 1.

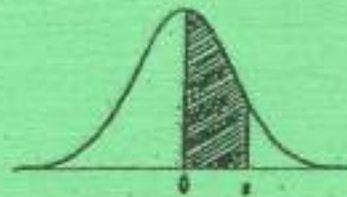
Table 1

| Size ('00' of sq. m) | Price (millions of Ksh) |
|----------------------|-------------------------|
| 19                   | 1.2                     |
| 15                   | 1.5                     |
| 35                   | 1.5                     |
| 52                   | 3.3                     |
| 35                   | 2.5                     |

Determine the Karl Pearson's correlation coefficient and comment on the relationship between size and price. (13 marks)

8. (a) The number of accidents on a certain construction site occurs at an average rate of two every five months. Determine the probability that there are:
- (i) 25 or more accidents in 5 years;
  - (ii) 15 accidents in 4 years. (10 marks)
- (b) A population consists of numbers 1, 3, 6, 8 and 10. Considering all possible samples of size 2, that can be drawn with replacement from this population. Determine:
- (i) the mean of the population;
  - (ii) standard deviation of the population;
  - (iii) mean of the sampling distribution of means;
  - (iv) standard error of the sampling distribution of means. (10 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 |