

THE PUBLIC ACCOUNTANTS EXAMINATIONS BOARD

A Committee of the Council of ICPAU

ATC(U) EXAMINATIONS

LEVEL ONE

BUSINESS MATHEMATICS & STATISTICS - PAPER 3

TUESDAY, 9 DECEMBER 2008

INSTRUCTIONS TO CANDIDATES:

1. Time allowed: **3 hours**
2. Attempt **all** questions in Section A, any **two** questions in Section B and any **two** questions in Section C.
3. Section A has **twenty** compulsory multiple-choice questions, each carrying $1\frac{1}{2}$ marks.
4. Section B has **three** questions and only **two** are to be attempted. Each question carries 20 marks.
5. Section C has **three** questions and only **two** are to be attempted. Each question carries 15 marks.
6. Please read further instructions on the answer booklet.

Question 1

- (i) Which of the following pairs of points lie on the line $y = 13 + 4x$?
- (a) (2, 3) and (1, 4)
 - (b) (1, 17) and (-2, 5)
 - (c) (0, 10) and (4, 13)
 - (d) (5, -2) and (17, 1)
- (ii) Given that $P = \begin{pmatrix} 4 & 5 \\ -1 & 0 \end{pmatrix}$ and $Q = \begin{pmatrix} 6 & 10 \\ 12 & 16 \end{pmatrix}$
Find the matrix, S such that $4P + 5Q + 2S = 0$.
- (a) $\begin{pmatrix} -46 & -70 \\ -58 & -80 \end{pmatrix}$
 - (b) $\begin{pmatrix} 16 & 20 \\ -4 & 0 \end{pmatrix}$
 - (c) $\begin{pmatrix} -23 & -35 \\ -29 & -40 \end{pmatrix}$
 - (d) $\begin{pmatrix} -30 & -50 \\ -6 & -85 \end{pmatrix}$
- (iii) If $Z = 6x^3 - 4x + 1$; find the value of $\frac{dz}{dx}$ - when $x = 2$.
- (a) 18
 - (b) 68
 - (c) 41
 - (d) 64
- (iv) The name given to a chart which shows time series data in the form of three separate line diagrams is a:
- (a) Strata chart
 - (b) Gantt chart
 - (c) Bar chart
 - (d) Z – chart

- (v) A secretary earns Shs 450,000 per month; while a banker earns Shs 1,200,000. They both get pay rises of 10% and 4% respectively. What is the difference between their salaries before and after the increment?

	Before (Shs)	After (Shs)
(a)	48,000	45,000
(b)	495,000	1,248,000
(c)	750,000	753,000
(d)	750,000	530,000

- (vi) Okello invests Shs 40,000,000 in a bank at 15% p.a. compound interest, interest being added half-yearly. How much money will Okello have after two years (to nearest thousand shillings)?

- (a) 53,119,000
- (b) 57,425,000
- (c) 52,900,000
- (d) 53,240,000.

- (vii) 40% of the population of a town are male, 25% of the male population and 30% of the female population are under 21 years. The percentage of people in the town who are under 21 is:

- (a) 27.5
- (b) 55
- (c) 28
- (d) 56

- (viii) A table costs Shs x and a chair Shs y . Given that when the price of each is increased by Shs 20,000 the ratio of their costs becomes 5:2 respectively and when the price is reduced by Shs 5,000 the ratio becomes 5:1; find the ratio of x to y in its lowest terms.

- (a) 4:5
- (b) 8:2
- (c) 5:2
- (d) 4:1

- (ix) A quasi-random method of sampling which involves examining every member of the population is known as:

- (a) stratified.
- (b) cluster.
- (c) systematic.
- (d) quota.

- (x) Which of the following is **NOT** a consideration to be made in the construction of index numbers?
- (a) Selection of a base time period.
 - (b) Collection of data.
 - (c) Selection of weights.
 - (d) Location of commodities.
- (xi) 30 vendors in a market sold at least the following vegetables; cabbages, avocado, and beetroot besides pumpkins. When asked about what they sold, the information obtained was as follows:
- cabbages only: 20, beetroot only: 0, cabbages and beetroot only: 1, cabbages and avocado only: 7, avocado and beetroot only: 6
- The number of vendors that sold avocado only was:
- (a) 4
 - (b) 7
 - (c) 11
 - (d) 13
- (xii) A car costing Shs 16.8 million depreciates by 25% in its first year and 20% in its second year. Find the value of the car after 2 years.
- (a) Shs 13,440,000.
 - (b) Shs 12,600,000.
 - (c) Shs 10,080,000.
 - (d) Shs 11,360,000.
- (xiii) An investor wishes to fence off his land to develop a resort beach. The land is adjacent to a lake and has to be fenced on three sides; the side along the lake requiring no fencing. Determine the dimensions, in metres, of the beach of greatest area if the fencing available is 1000 meters.
- (a) 750 x 250.
 - (b) 500 x 250.
 - (c) 500 x 200.
 - (d) 100 x 100.
- (xiv) Which of the following is not a measure of central tendency?
- (a) Arithmetic mean.
 - (b) Variance.
 - (c) Mode.
 - (d) Median.

- (xv) A product is sold in packets marked 500g. The average weight is in fact 510g. Assuming that the weights are normally distributed, find the probability of the underweight if the standard deviation is 4g.
- (a) 0.9938
 - (b) 0.4938
 - (c) 0.0062
 - (d) 0.5062

Use the following information to answer questions (xvi) – (xviii):

At M and B Company Ltd the hourly earnings of 50 workers are given as follows:

Earnings per hour (shillings)	Number of workers
5,100 – 7,500	1
7,600 – 10,000	4
10,100 – 12,500	17
12,600 – 15,000	15
15,100 – 17,500	11
17,600 – 20,000	2

- (xvi) What is the modal class of hourly earnings?
- (a) 12,600 – 15,000
 - (b) 17,600 – 20,000
 - (c) 15,100 – 17,000
 - (d) 10,100 – 12,500
- (xvii) Find the mean hourly earnings.
- a) 12,550
 - b) 13,500
 - c) 11,300
 - d) 8,800
- (xviii) One of the workers is chosen at random. Find the probability that s(he) earns less than Shs 12,600 per hour.
- (a) $\frac{3}{10}$
 - (b) $\frac{11}{25}$
 - (c) $\frac{37}{50}$
 - (d) $\frac{14}{25}$

- (xix) After years of manufacturing a certain brand of fruit juice, a firm knows that if x cartons are demanded in a financial year, the total cost function is $C(x) = 700,000 + 4x$ and the total revenue function is $R(x) = 13x - 0.75x^2$. The total profit function is:
- $-0.75x^2 + 9x - 700,000$
 - $-(0.75x^2 + 9x + 700,000)$
 - $13 - 1.5x^2 + 700,000$
 - $\frac{13x^2}{2} - 0.375x^3 - 700,000x$
- (xx) $M = \{(x, y): 3x - 4y > 12\}$ and
 $N = \{(x, y): x < 2y\}$. The ordered pair, $(-2, -3)$ is a member of the set:
- $M \cap N$
 - $M^1 \cap N^1$
 - $M^1 \cap N$
 - $M \cap N^1$

SECTION B

Question 2

- (a) A certain village has a population of 299. There are 50 more children than men, and 72 more men than women. What is the number of men in the village?
- (4 marks)**
- (b) All the 195 candidates who sat for the ATC December 2007 passed Principles of Law, Accounting or Business Mathematics. 90 candidates passed Principles of Law; 125 passed Accounting and 105 passed Business Mathematics. 55 candidates passed Principles of Law and Accounting; 50 passed Principles of Law and Business Mathematics; 65 passed Accounting and Business Mathematics and 30 passed Principles of Law but not Accounting or Business Mathematics.

Required:

- (i) Find the number of candidates who passed:
- all the three subjects.
- (8 marks)**
- Principles of Law and Business Mathematics but not Accounting.
- (1 mark)**
- (ii) Find the percentage of candidates who passed only two of the three subjects (correct to 2 significant figures).
- (3 marks)**

(c) Given $A = \begin{pmatrix} 4 & 3 \\ 1 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}$

Find:

- (i) $3A + B$
- (ii) $\det AB$

(4 marks)

(Total 20 marks)

Question 3

- (a) Define the following terms:

- (i) Annuity.
- (ii) Amortised debt.
- (iii) Sinking fund.
- (iv) Depreciation fund.

(10 marks)

- (b) Mrs. Oweka earns Shs 7,680,000 and at the end of each year invests 20% of this sum at $12\frac{1}{2}\%$ simple interest p.a. After 3 years how much interest will her investment have earned?

(4 marks)

- (c) A publishing company purchased a machine for its production department at a cost of Shs 175 million on 30 June 2005. The machine was purchased from a five year loan. The debt is compounded annually at 11% and will be discharged on 30 June 2010. Using a sinking fund method, five equal annual deposits were made from 30 June 2005 into the fund paying 9.5% annually.

Required:

- (i) Calculate the size of the equal annual deposits in the sinking fund.
- (ii) Draw a table which demonstrates the growth of the loan and the sinking fund.

(6 marks)

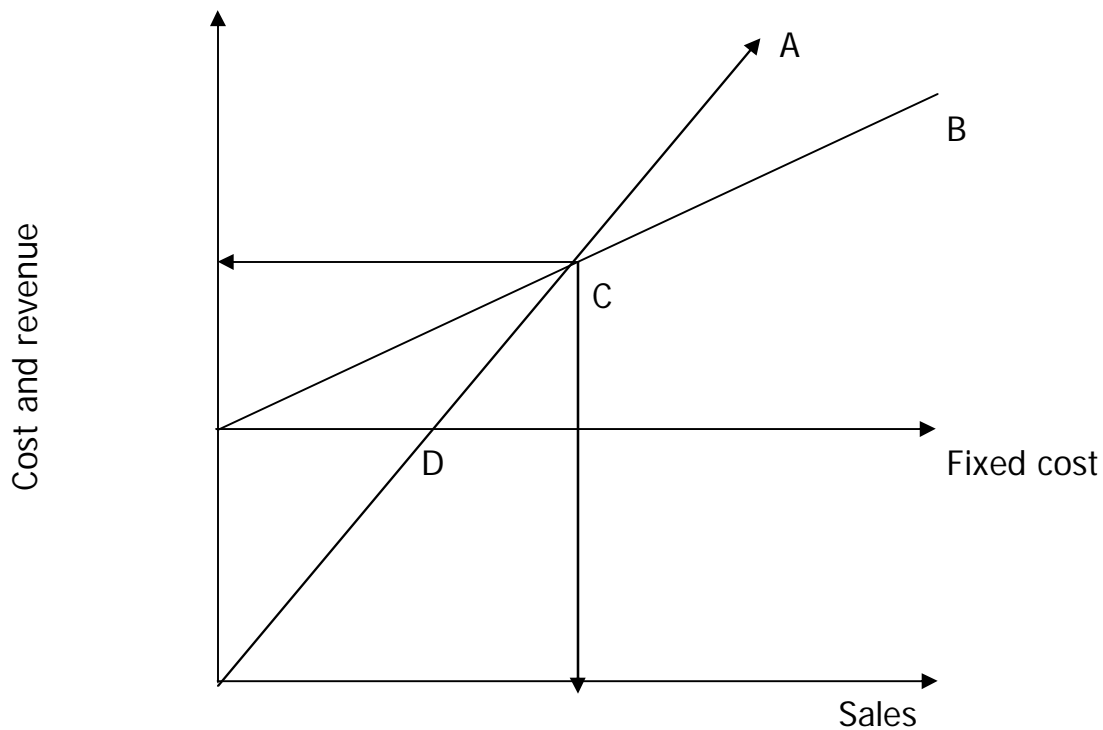
(Total 20 marks)

Question 4

- (a) Define the following terms:
 (i) Marginal cost function.
 (ii) Marginal revenue function

(2 marks)

- (b) The following graph shows sales against costs and revenue of a firm:



Required

- (i) Identify the graphs A and B. **(2 marks)**
- (ii) Name the point C and describe its application **(2 marks)**
- (iii) Find out what is happening to the firm at point D. **(2 marks)**
- (c) A firm wants to launch a new product. After careful research, it discovers that the fixed cost of the new product is Shs 35,000 and the variable cost per thousand units is Shs 8,000. The revenue function is $20,000x - 1,000x^2$, where x is the number of units sold in thousands.

Required:

- (i) Find the profit function. (4 marks)
 - (ii) Work out the break-even values. (4 marks)
 - (iii) Find the value of x that results in maximum profits. (4 marks)
- (Total 20 marks)**

SECTION C

Question 5

The table below shows the ages of people who attended a Local Council I (LC 1) meeting at Lubaga village:

Age	Under 20	20-29	30-39	40-49	50-59	60 and above
Frequency	2	3	5	10	2	6

Required:

- (a) Find the:
 - (i) mean. (3 marks)
 - (ii) median age. (2 marks)
 - (b) Which of the two measures in (a) above do you consider to be a better measure of average? Give a reason. (2 marks)
 - (c) Find the percentage number of people within one standard deviation from the median using the cumulative frequency curve. (7 marks)
 - (d) Using the curve find the D_3 to D_7 range. (1 mark)
- (Total 15 marks)**

Question 6

- (a) Define an index number. (1 mark)
- (b) Distinguish between *Laspayre's* index and *Paasche's* index number. (3 marks)
- (c) A small construction company discovered that each year it uses 80 tonnes of river sand; 150 tonnes of lake sand and 250 tonnes of aggregates. In 2005 the prices of these items were Shs 60,000, Shs 65,000 and Shs 80,000 per tonne respectively. In 2006 the prices had gone up to Shs 70,000, Shs 72,000, and Shs 90,000 per tonne respectively.

Calculate Laspayre's price index for the company's total cost in 2006 compared with 2005. (2005 = 100).

(4 marks)

- (d) The time taken by a delivery van to a supermarket is normally distributed with mean 12 minutes and standard deviation 2 minutes. The van delivers groceries everyday. Estimate the number of days during the year when the van takes:
- (i) Longer than 17 minutes.
 - (ii) Less than 10 minutes.

(7 marks)

(Total 15 marks)

Question 7

- (a) What is meant by the term "statistical experiment"? Give **two** examples.
(3 marks)
- (b) Distinguish between a mutually exclusive event and an independent event.
(2 marks)
- (c) Briefly explain the term 'cluster sample' and identify a suitable measure of location and dispersion that would be appropriate to use in the analysis of cluster findings.
(2 marks)
- (d) Thomas is to travel from Lira to Kampala for an ATC examination. The probabilities that he will be in time for the examination when he travels by bus and by taxi are 0.1 and 0.2 respectively. He cannot be on time if he uses other means. The probabilities that he will travel by bus and by taxi are 0.5 and 0.4 respectively.
- (i) Find the provability that he will use other means.
(4 marks)
 - (ii) Find the probability that he will be on time.
(2 marks)
 - (iii) Given that he is on time, what is the probability that he travelled by taxi?
(2 marks)

(Total 15 marks)

CUMULATIVE NORMAL DISTRIBUTION $P(z)$											ADD								
Z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
0.0	0.0000	0040	0080	0120	0160	0199	0239	0279	0319	0359	4	8	12	16	20	24	28	32	36
0.1	0.0398	0438	0478	0517	0557	0596	0636	0675	0714	0753	4	8	12	16	20	24	28	32	36
0.2	0.0793	0832	0871	0910	0948	0987	1026	1064	1103	1141	4	8	12	15	19	22	27	31	35
0.3	0.1179	1217	1255	1293	1331	1368	1406	1443	1480	1517	4	8	11	15	19	22	26	30	34
0.4	0.1554	1591	1628	1664	1700	1736	1772	1808	1844	1879	4	7	11	14	18	22	25	29	32
0.5	0.1915	1950	1985	2019	2054	2088	2123	2157	2190	2224	3	7	10	14	17	21	24	27	31
0.6	0.2257	2291	2324	2357	2389	2422	2454	2486	2517	2549	3	6	10	13	16	19	23	26	29
0.7	0.2580	2611	2642	2673							3	6	9	12	15	19	22	25	28
					2704	2734	2764	2794	2823	2852	3	6	9	12	15	18	21	24	27
0.8	0.2881	2910	2939	2967	2995	3023					3	6	8	11	14	17	20	22	25
							3051	3078	3106	3133	3	5	8	11	13	16	19	22	24
0.9	0.3159	3186	3212	3238	3264	3289					3	5	8	10	13	16	18	21	23
							3315	3340	3365	3389	2	5	7	10	12	15	17	20	22
1.0	0.3413	3438	3461	3485	3508						2	5	7	10	12	14	17	19	22
						3531	3554	3577	3599	3621	2	4	7	9	11	13	15	18	20
1.1	0.3643	3665	3686	3708							2	4	6	8	11	13	15	17	19
					3729	3749	3770	3790	3810	3830	2	4	6	8	10	12	14	16	18
1.2	0.3849	3869	3888	3907	3925						2	4	6	8	10	11	13	15	17
						3944	3962	3980	3997	4015	2	4	5	7	9	11	13	14	16
1.3	0.4032	4049	4066	4082	4099	4115	4131	4147	4162	4177	2	3	5	6	8	10	11	13	14
1.4	0.4192	4207	4222	4236	4251	4265	4279	4292	4306	4319	1	3	4	6	7	8	10	11	13
1.5	0.4332	4345	4357	4370	4382	4394	4406	4418	4429	4441	1	2	4	5	6	7	8	10	11
1.6	0.4452	4463	4474	4484	4495	4505	4515	4525	4535	4545	1	2	3	4	5	6	7	8	9
1.7	0.4554	4564	4573	4582	4591	4599	4608	4616	4625	4633	1	2	3	3	4	5	6	7	8
1.8	0.4641	4649	4656	4664	4671	4678	4686	4693	4699	4706	1	1	2	3	4	4	5	6	6
1.9	0.4713	4719	4726	4732	4738	4744	4750	4756	4761	4767	1	1	2	2	3	4	4	5	5
2.0	0.4772	4778	4783	4788	4793	4798	4803	4808	4812	4817	0	1	1	2	2	3	3	4	4
2.1	0.4821	4826	4830	4834	4838	4842	4846	4850	4854	4857	0	1	1	2	2	2	3	3	4
2.2	0.4861	4864	4868	4871	4875	4878	4881	4884	4887	4890	0	1	1	1	2	2	2	3	3
2.3	0.4893	4896	4898	4901	4904	4906	4909	4911	4913	4916	0	0	1	1	1	2	2	2	2
2.4	0.4918	4920	4922	4925	4927	4929	4931	4932	4934	4936	0	0	1	1	1	1	1	2	2
2.5	0.4938	4940	4941	4943	4945	4946	4948	4949	4951	4952									
2.6	0.4953	4955	4956	4957	4959	4960	4961	4962	4963	4964									
2.7	0.4965	4966	4967	4968	4969	4970	4971	4972	4973	4974									
2.8	0.4974	4975	4976	4977	4977	4978	4979	4979	4980	4981									
2.9	0.4981	4982	4982	4983	4984	4984	4985	4985	4986	4986									
3.0	0.4987	4990	4993	4995	4997	4998	4998	4999	4999	5000									

The table gives $P(z) = \int_0^z \phi(z) dz$

If the random variable Z is distributed as the standard normal distribution $N(0,1)$ then:

1. $P(0 < Z < z_p) = P(\text{Shaded Area})$
2. $P(Z > Z_p) = Q = \frac{1}{2} - P$
3. $P(Z > |Z_p|) = 1 - 2P = 2Q$

