

# THE PUBLIC ACCOUNTANTS EXAMINATIONS BOARD

*A Committee of the Council of ICPAU*

## ATC(U) EXAMINATIONS

### LEVEL ONE

#### BUSINESS MATHEMATICS & STATISTICS - PAPER 3

**TUESDAY, 17 JUNE 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.

**SECTION A****Question 1**

- (i) Calculate the following expression leaving your answer in index form:  
 $a^5 \times a^{-1}$
- (a)  $a^6$   
 (b)  $a^{-6}$   
 (c)  $a^4$   
 (d)  $a^{-4}$
- (ii) Which of the following best describes the matrix form of the following simultaneous equations?  
 $x - 3y - 5 = 0$  Equation i  
 $2y - 5x + 13 = 0$  Equation ii
- (a)  $\begin{pmatrix} 1 & -3 \\ 2 & -5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5 \\ 13 \end{pmatrix}$   
 (b)  $\begin{pmatrix} 1 & -3 \\ -5 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 5 \\ -13 \end{pmatrix}$   
 (c)  $\begin{pmatrix} 1 & -3 \\ 2 & 5 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -5 \\ 13 \end{pmatrix}$   
 (d)  $\begin{pmatrix} 1 & -3 \\ 5 & -2 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -5 \\ 13 \end{pmatrix}$

**Use the following information to answer questions (iii) and (iv)**

The following is information of the number of calls received by James on six different days: 9, 7, 11, 10, 13, and 7.

- (iii) Compute the mean number of calls (approximate to one decimal place).
- (a) 9.5  
 (b) 9.3  
 (c) 9.7  
 (d) 9.45
- (iv) Find the standard deviation of the number of calls.
- (a) 2.14  
 (b) 2.32  
 (c) 2.07  
 (d) 2.19

- (v) Considering independence of events:  
 a :- A coin is tossed once and lands head up.  
 b :- A coin is tossed a second time and lands tail up.  
 Compute  $A \cap B$ .
- (a)  $\frac{1}{2}$   
 (b)  $\frac{1}{4}$   
 (c) 1  
 (d) 0
- (vi) If y varies directly as x and given  $x = 8$  when  $y = 12$ ; find y when  $x = 12$ .
- (a) 12  
 (b) 8  
 (c) 4  
 (d) 18
- (vii) Which of the following statements best describes cumulative frequency?
- (a) The number of times a certain event occurs.  
 (b) A bar chart in which the area of the rectangles are proportional to the frequencies.  
 (c) A running total of consecutive frequencies.  
 (d) A quantity with the highest frequency.
- (viii) Simplify;  $0.25 \times 3.75 + 0.25^2$  (2 decimal places).
- (a) -6.25  
 (b) -0.02  
 (c) 1.00  
 (d) 2.35
- (ix) For a skewed distribution, the mean is 22, the median is 20 and standard deviation is 4. Calculate the Pearson's Coefficient of Skewness.  
 Given  $SK = 3 \frac{(\text{mean} - \text{median})}{\text{standard deviation}}$
- (a) 3.0  
 (b) 10.5  
 (c) 1.5  
 (d) 0.75
- (x) Given  $A = \begin{pmatrix} 3 & -2 \\ 4 & 0 \end{pmatrix}$   $B = \begin{pmatrix} -4 & -6 \\ 4 & 5 \end{pmatrix}$   
 Find  $2A - B$ .

(a)  $\begin{pmatrix} 10 & 2 \\ 4 & -5 \end{pmatrix}$

(b)  $\begin{pmatrix} 2 & 10 \\ 4 & -5 \end{pmatrix}$

(c)  $\begin{pmatrix} 2 & 10 \\ 4 & 5 \end{pmatrix}$

(d)  $\begin{pmatrix} -10 & 10 \\ 4 & -5 \end{pmatrix}$

- (xii) Solve for x, given the following quadratic expression.  
 $(3x-4)(x+5) = 0$ .

- (a) 5, -4/3  
 (b) -5, 4/3  
 (c) -5, -4/3  
 (d) 5, 4/3

**Use the following information to answer questions (xii) and (xiii):**

Chemos sells ICT equipment at Shs 2,000 per unit. He gives a discount of 20% to the customers for the first 1,000 units and 30% on the extra purchases beyond 1,000 units.

If Zaina, a prominent business woman in town, bought 1,250 units:

- (xii) Calculate the trade discount given to her.

- (a) Shs 2,500,000.  
 (b) Shs 400,000.  
 (c) Shs 550,000.  
 (d) Shs 150,000.

- (xiii) Calculate the net amount she would pay.

- (a) Shs 1,950,000.  
 (b) Shs 750,000.  
 (c) Shs 1,250,000.  
 (d) Shs 1,000,000.

- (xiv) If  $y = 7x^3 - 2x^2 - x + 3$ ; find  $\frac{d^2y}{dx^2}$  if  $x = 1/6$ .

- (a) 25/256  
 (b) 3  
 (c) 105/36  
 (d) 5

- (xv) Compute the harmonic mean of 2 and 4.
- (a) 3.05
  - (b) 12
  - (c) 2.67
  - (d) 1.5
- (xvi) What is the interpretation of the following net present value (NPV) condition:  $NPV < 0$ ?
- (a) Project is in profit.
  - (b) Project breaks even.
  - (c) Project makes a loss.
  - (d) Project is neither in profit/loss situation.
- (xvii) Which of the following best describes the term 'ordinary annuity'?
- (a) Equal payments made at the beginning of the period.
  - (b) Equal payments made at the end of the period.
  - (c) Equal payments made in the middle of the period.
  - (d) Equal payments made neither at the beginning nor at the end of the period.
- (xviii) A process has a total cost function given by  $C = 20 + 4x$  and a revenue function given by  $R = 22x - 4x^2$  where  $x$  is the level of activity (in hundreds of units of output) and  $C$  and  $R$  are both in \$ 1,000s.
- Find the expression for the profit function.
- (a)  $26x - 4x^2 - 20$ .
  - (b)  $26x + 4x - 20$ .
  - (c)  $18x - 4x^2 - 20$ .
  - (d)  $18x - 4x^2 - 20$ .
- (xix) Cluster sampling is employed:
- (a) on non-homogenous data.
  - (b) on homogenous data.
  - (c) in market research.
  - (d) where no sampling frame exists.
- (xx) J.B Dada, a Ugandan national, travelled to the United States of America. On his way back he had \$ 4,000 with him; so he decided to purchase an LG washing machine valued at \$ 2,350. He was also required to pay for his ticket and clearance tax of the equipment in UK pounds all valued at £ 600. Exchange rates are \$1 = Shs 1,625 and £1 = Shs 3,020.

How much money did he return home with in shillings (Shs)?

- (a) 863,000.
- (b) 828,000.
- (c) 825,000.
- (d) 838,900.

## SECTION B

### Question 2

- (a) Distinguish between the following terms: 'identity matrix' and 'zero matrix'.  
(2 marks)
- (b) Given that  $I_2$  is an identity matrix of order  $2 \times 2$  and  $A^{-1}$  denotes the inverse matrix of A.

**Required:**

Simplify the following:

- (i)  $I_2 \cdot A$  (2 marks)
- (ii)  $A^{-1} \cdot A$  (2 marks)

- (c) Given  $A = \begin{pmatrix} 3 & -4 & 3 \\ 2 & 6 & 5 \\ 0 & 7 & 1 \end{pmatrix}$

**Required:**

- (i) In terms of rows and columns identify the position of 0 in matrix A.  
(2 marks)
- (ii) Identify the element or value in position described as 2, 3.  
(2 marks)

- (iii) If  $I_3 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

**Required:**

Find  $A I_3$ .

- (d) Given  $B = \begin{pmatrix} 3 & 2 \\ 4 & 1 \end{pmatrix}$

**Required:**

Compute the inverse of B

(6 marks)  
(Total 20 marks)

**Question 3**

- (a) Define the following terms:
- (i) Function. (1 mark)
  - (ii) Equation. (1 mark)

- (b) Y is a function such that  $Y = 12 - 10x + 6x^2 - 2x^3$ .

**Required:**

Calculate:

i)  $\frac{dy}{dx}$  (2 marks)

ii)  $\frac{d^2y}{dx^2}$  (2 marks)

- (c) The variable cost of a process is Shs 1.3 per item. The fixed costs per day have been calculated as Shs 500 with special costs estimated as  $0.04x^2$ , where x is the size of the production run (i.e number of items produced).

**Required:**

- (i) Derive a function of cost per item. (5 marks)
- (ii) Calculate the size of the daily run that will minimize the cost per item. (5 marks)
- (iii) Find the cost of a day's production for a run that minimizes the cost per item.

(4 marks)

**(Total 20 marks)****Question 4**

- (a) Define the following terms:
- (i) Intersection of sets. (1 mark)
  - (ii) Disjoint sets. (1 mark)
- (b) Represent the following statements diagrammatically:
- (i)  $A \subset B$  (A is a subset of B) (2 marks)
  - (ii)  $A^1$  (The complement of A) (2 marks)
- (c) 53 members of the Kampala Golf Club decided to register their membership on three different committees namely; Welfare (W), Projects (P) and Programming (M). The condition was that 20 members register for each committee, 9 members register for both W and P, 4 for both W and M and 6 for both P and M. If the number of members who did not

register for any of the three committees was twice the number that registered for all the three committees;

**Required:**

- (i) Represent the information on a venn diagram. **(8 marks)**
  - (ii) Find the number of members that registered for all the three committees. **(2 marks)**
  - (iii) Find the number of members that registered for only one committee. **(2 marks)**
  - (iii) Find the probability of those who did not register for any committee. **(2 marks)**
- (Total 20 marks)**

**SECTION C**

**Question 5**

- (a) Define the following terms as used in statistics.
    - (i) Probability **(1 mark)**
    - (ii) Outcome **(1 mark)**
  - (b) List any **three** rules governing the probability of an event occurring. **(3 marks)**
  - (c) Calculate and tabulate the probabilities of 0, 1, 2, 3, and 4 successes in a binomial situation with  $n = 4$  and  $p = 0.25$ , given that  

$$P(x) = {}^nC_x \cdot p^x \cdot (1-p)^{n-x}$$
**(10 marks)**
- (Total 15 marks)**



**Question 6**

(a) Give **two** advantages of using a:

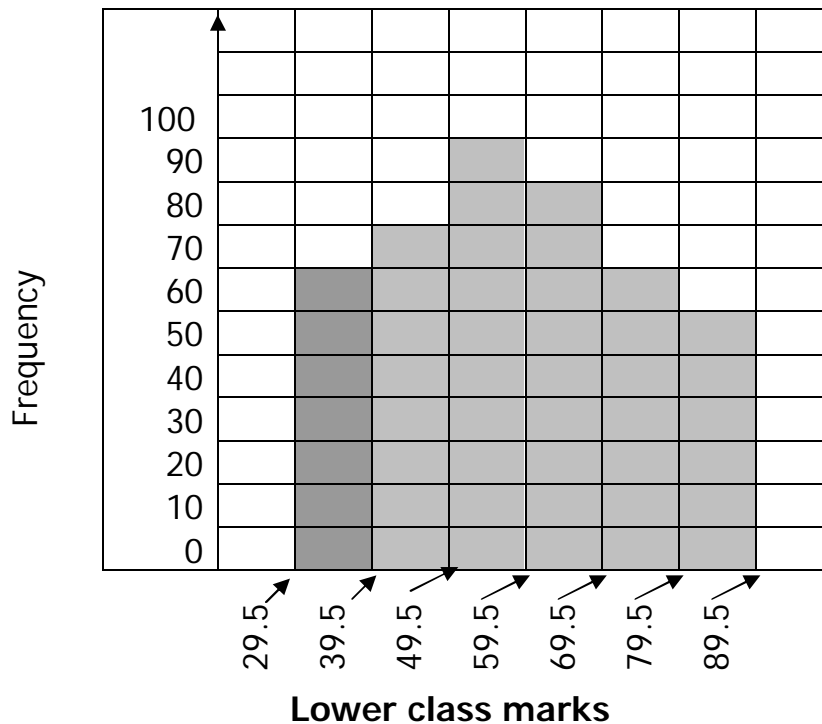
(i) pie-chart.

**(2 marks)**

(ii) line graph.

**(2 marks)**

(b) Use the figure below, which shows students who sat for the June 2005 ATC examinations, to answer questions (i) – (iii):



**Lower class marks**

Vertical Scale: 1 rectangle represents 10 units

Horizontal axis represents lower class marks.

**Required:**

(i) Identify the statistical diagram.

**(1 mark)**

(ii) Determine the median class.

**(1 mark)**

(iii) How many ATC students sat for the June 2005 examinations?

**(3 marks)**

(iii) State the modal class and use it to estimate the modal mark.

**(6 marks)**

**(Total 15 marks)**

**Question 7**

(a) Define the following terms:

(i) Normal rate.

**(1 mark)**

(ii) Effective rate.

**(1 mark)**

(b) Use the table below to answer questions that follow:

Components of Mix	Year 1	Year 2	Standard Quantity
X	3.0	6.0	16
Y	6.8	8.5	6
Z	20.8	17.68	2

**Required:**

Calculate:

(i) the index relative for each component.

**(7 marks)**

(ii) a weighted average of the relatives.

**(6 marks)**

**(Total 15 marks)**