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S475/1 SUBSID. MATHEMATICS Paper 1 July 2017 $2\frac{2}{3}$ hours.



Uganda Advanced Certificate of Education MOCK SET 4 EXAMINATIONS 2017 SUBSIDIARY MATHEMATICS Paper 1 2 hours 40 minutes

INSTRUCTIONS TO CANDIDATES

Answer all the **eight** questions in section **A** and only **four** questions in section **B**.

Any additional question(s) will not be marked.

Each question in section **A** carries **5** marks while each question in section **B** carries **15** marks.

All working **must** be shown clearly.

Graph paper is provided.

Where necessary, take acceleration due to gravity, $g = 9.8 \text{ m s}^{-2}$.

Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

SECTION A (40 MARKS)

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(Answer all questions in this section.)	
Qn 1: The arithmetic progression (A.P) is given below: $\ln(2 - x) + \ln(3 - x) + \ln(5 - x) + \cdots$ Find the value of <i>x</i> .	[5]
Qn 2: Vector $\stackrel{a}{\sim} = 3x \stackrel{i}{i} + 4j$ and $\stackrel{b}{\sim} = x \stackrel{i}{i} - 3j$ are perpendicular. Find the	
possible values of <i>x</i> .	[5]
 Qn 3: Find the number of ways in which the letters of the word "ATTENDENCE" can be arranged if: (i). the three E's must not be together. (ii). Only two E's must be together. 	[5]
Qn 4: Events <i>M</i> and <i>N</i> are such that $P(M' \cap N) = 0.3$, $P(M \cap N) = 0.55$, $P(M' \cap N') = 0.1$. Find:	
(i). $P(M)$, (ii). $P(M \text{ or } N)$.	[5]

Qn 5: Solve the equation $\csc \theta \sec \theta - 2 \cot \theta = 0$, for $0^{\circ} < \theta < 180^{\circ}$. [5]

Qn 6: A traveller finds out that the price index for breakfast (B), lunch (L) and supper (S) in Kampala and Mbarara were as shown in the table,

Town	Price index				
	В	L	S		
Kampala	120	130	125		
Mbarara	115	135	110		

If the actual quantities consumed by the traveller for B, L and S were 300 g, 400 g and 300 g respectively. Calculate the weighted index for each town and comment on your result. [5]

Qn 7: A continuous random variable X has a mean 15. The probability that X is less than 10 is 0.1057. Find the:



- (i). variance to the nearest whole number. (ii). P(14 < X < 18). [5]
- **Qn 8:** A boy pulls a box of mass 20 kg by means of a light inextensible string attached to it across a rough horizontal ground. The coefficient of friction between the box and the ground is 0.25. If the string is inclined at 30° to the horizontal and the box accelerates at 2 m s⁻², find the tension in the string. [5]

SECTION B (60 MARKS)

(Answer any **four** questions from this section.)

Question 9:

The ages in years of teachers in a certain school were recorded as follows:

46	48	40	59	53	23	39	31	34	61	54	54
45	51	33	37	37	27	28	45	48	39	29	23
48	37	39	33	25	31	48	40	53	51	46	45
56	59	40	43	46	38	29	52	54	34	23	41
52	42	50	55	60	45	45	56	59	49	44	36
25	38	56	36	42	47	50	54	59	47	58	57

(a). Construct a grouped frequency table with uniform class width of 5 starting with 20 as the lowest class limit. [3]

(b). Calculate the:

- (i). Mean age.
- (ii). Modal age.
- (iii). Standard deviation.

- [7]
- (c). Draw a cumulative frequency curve and use it to estimate (i). the median.
 - (ii). The number of teachers who should retire if the retirement age is 55 years. [5]

Question 10:

The table below shows the monthly sales of a certain product in (shs "000") for the year 2016.

Month	Sales	Month	Sales
January	220	July	175
February	210	August	186
March	200	September	176
April	207	October	170
Мау	196	November	159
June	189	December	168

(a). Calculate 6-point moving totals and hence the moving averages. [6]

- (b). (i). Plot on the same axes actual sales and moving averages. Comment on the trend of sales during the year.
 - (ii). Determine the sales in January 2017.

Question 11:

Two variables X and Y were recorded as shown below:

Х	10	140	120	100	80	70	40	10
Y	150	30	30	50	70	70	90	120

- (a). Plot a scatter diagram for the data and comment on the relationship between X and Y. Find X when Y = 75. [8]
- (b). Calculate a rank correlation coefficient and comment on the value obtained.[7]

Question 11:

- (a). Given the matrices $A = \begin{pmatrix} 3 & 1 \\ 2 & 4 \end{pmatrix}$, $B = \begin{pmatrix} -1 & 1 \\ 3 & -5 \end{pmatrix}$. Find: (i). λ such that $|A - \lambda I| = 0$; where I is a 2 × 2 identity matrix. (ii). AB and BA and comment on the results.
- (b). Mr. X bought a shirt and a tie at shs. 20,500 and Mr. Y bought two shirts and three ties at shs. 48,000. Form a pair of simultaneous equations for the purchases and use matrix method to determine the cost of a shirt and a tie. [7]

Question 13:

A differential function for a certain curve is given by $\frac{dy}{dx} = x - 1$, given that the curve passes through (0, 0).

[9]

[8]

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(a).	Determine the equation of the curve.	[5]
(b).	Sketch the curve.	[3]
(c).	Find the area enclosed between the x-axis and the curve.	[3]
(d).	Differentiate $(3x^2 - 1)^5$; hence or otherwise evaluate:	
	$\int_0^2 x (3x^2 - 1)^4 dx$	[4]

Question 14:

A car of mass one tonne is travelling down an incline of $\sin^{-1}\left(\frac{1}{20}\right)$ against a constant resistance of 2500 N. At an instant 25 m from the lower end of the incline, it is travelling at a velocity 4 m s⁻¹ with the engine working at 30 kW. Find the:

- (i). acceleration down the incline.
- (ii). Velocity at the end of the incline.
- (iii). Power output of the engine required to take it up the incline at a constant velocity of 10 m s^{-1} against the same resistance. [15]

END