S475/1
SUBSID. MATHEMATICS

## Paper 1

July $2017{ }^{2 \frac{2}{3}}$
hours.


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

## INSTRUCTIONS TO CANDIDATES

Answer all the eight questions in section $\mathbf{A}$ and only four questions in section B.

Any additional question(s) will not be marked.
Each question in section A carries $\mathbf{5}$ 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, $g=9.8 \mathrm{~m} \mathrm{~s}^{-2}$.
Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used.
(Answer all questions in this section.)
Qn 1: The arithmetic progression (A.P) is given below:

$$
\begin{equation*}
\ln (2-x)+\ln (3-x)+\ln (5-x)+\cdots \tag{5}
\end{equation*}
$$

Find the value of $x$.
Qn 2: Vector $\underset{\sim}{\boldsymbol{a}}=3 x \underset{\sim}{\boldsymbol{i}}+4 \boldsymbol{j}$ and $\underset{\sim}{\boldsymbol{b}}=x \underset{\sim}{\boldsymbol{i}}-3 \boldsymbol{j}$ are perpendicular. Find the possible values of $x$.

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.

Qn 4: Events $M$ and $N$ are such that $P\left(M^{\prime} \cap N\right)=0.3, P(M \cap N)=0.55$, $P\left(M^{\prime} \cap N^{\prime}\right)=0.1$. Find:
(i). $P(M)$,
(ii). $P(M$ or $N)$.

Qn 5: Solve the equation $\operatorname{cosec} \theta \sec \theta-2 \cot \theta=0$, 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 |  |  |
| :--- | :--- | :--- | :--- |
|  | B | L | S |
| Kampala | 120 | 130 | 125 |
| Mbarara | 115 | 135 | 110 |

If the actual quantities consumed by the traveller for $\mathrm{B}, \mathrm{L}$ and S were 300 $\mathrm{g}, 400 \mathrm{~g}$ and 300 g respectively. Calculate the weighted index for each town and comment on your result.

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.

$$
\text { (ii). } P(14<X<18) \text {. }
$$

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 $30^{\circ}$ to the horizontal and the box accelerates at $2 \mathrm{~m} \mathrm{~s}^{-2}$, find the tension in the string.

## 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.
(b). Calculate the:
(i). Mean age.
(ii). Modal age.
(iii). Standard deviation.
(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.

## 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 |
| May | 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:

| X | 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 $Y=75$.
(b). Calculate a rank correlation coefficient and comment on the value obtained.

## Question 11:

(a). Given the matrices $\boldsymbol{A}=\left(\begin{array}{ll}3 & 1 \\ 2 & 4\end{array}\right), \boldsymbol{B}=\left(\begin{array}{cc}-1 & 1 \\ 3 & -5\end{array}\right)$. Find:
(i). $\lambda$ such that $|\boldsymbol{A}-\lambda \boldsymbol{I}|=0$; where $\boldsymbol{I}$ is a $2 \times 2$ identity matrix.
(ii). $\boldsymbol{A B}$ and $\boldsymbol{B A}$ 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.

## Question 13:

A differential function for a certain curve is given by $\frac{d y}{d x}=x-1$, given that the curve passes through $(0,0)$.
(a). Determine the equation of the curve.
(b). Sketch the curve.
(c). Find the area enclosed between the $x$-axis and the curve.
(d). Differentiate $\left(3 x^{2}-1\right)^{5}$; hence or otherwise evaluate:

$$
\begin{equation*}
\int_{0}^{2} x\left(3 x^{2}-1\right)^{4} d x \tag{4}
\end{equation*}
$$

## 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 $4 \mathrm{~m} \mathrm{~s}^{-1}$ 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 $10 \mathrm{~m} \mathrm{~s}^{-1}$ against the same resistance.

