UGANDA ADVANCED CERTIFICATE OF EDUCATION

JAM MOCK EXAMINATIONS

SUBSDIARY MATHEMATICS

Paper 1

2hours 40minutes

INSTRUCTIONS

answer **all** the eight questions in **section A** and any **four** from **section B**

all the necessary working must be clearly shown

each question in **section A** is of **5 marks** while each question in **section B** carries **15 marks**

begin each number on a fresh sheet of paper

graph papers are provided

silent non-programmable calculators may be used

mathematical tables and a list of formulae are provided

where necessary, use $g = 9.8ms^{-2}$

SECTION A (40 MARKs)

Answer all the questions from this section

1. Given that $\frac{3^4 \times 3^8}{9 \times 3^7} = 3^{2x}$, find the value of x

(05marks)

2. Find $\mathbf{AB} + 3\mathbf{I}$ when $\mathbf{A} = \begin{pmatrix} -3 & 1 \\ 2 & 3 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 7 & 0 \\ 8 & -6 \end{pmatrix}$ and $\mathbf{I}$ is a 2×2 identity matrix

(05marks)

3. Find the value of y at the minimum point of the curve $y = x^2 - 6x + 8$

(05marks)

4. If $\cos x = a$ find in terms of a,

(i) $\sec x$

(ii) $\sin x$ (05marks)

5. The time in minutess for phone calls made by twelve customers at public telephone booth were recorded as follows:

20, 42, 11, 21, 9, 12, 15, 16, 19, 12, 15, 16

Find the: (**a**) median time (**b**) mean time

(05marks)

6. A random variable X has probability distribution function given in the table below:

x	0	2	3	4
$P(X = x)$	$\frac{1}{10}$	$\frac{3}{10}$	$\frac{1}{5}$	$\frac{2}{5}$

Find the (i) expectation E(X) (ii) variance of X

(05marks)

7. The price in shillings of commodities A, B and C in 2012 and 2013 are given in the table below:

Commodity	2012	2013
A	,500	750
B	1500	2100
C	10,000	12000

Using 2012 as the base year, find the
a. Price relative for each commodity
b. Average price index
(05marks)

8. A car starts moving at a speed of $u\ ms^{-1}$ and moves at constant acceleration of $3ms^{-2}$ for 5seconds until it attains a speed of $v = 126\ kmh^{-1}$. Find the:

a. value of v in ms^{-1}
b. value of u
(05marks)

SECTION B (60 Marks)

*Answer only **four** questions from this section*

9. A continuous random variable X has the pdf $f(x)$ where

$$f(x) = \begin{cases} k(2x+1); & 1 \le x \le 2 \\ 0 & \text{elsewhere} \end{cases}$$

a. Find the
(i) value of k
(04marks)
(ii) expectation of X
(04marks)
(iii) variance of X
(05marks)
b. Sketch the graph of the of $f(x)$
(02marks)

10. **a**. Find the number of terms in the Arithmetic progression (A.P)
$-10 - 2 + 6 + \ldots + 70$ (07marks)

b. An Arithmetic Progression (A.P) has a common difference -3. The sum of the first twenty terms is ten times the second term. Find the sum of the first 15 terms of the A.P.
(08marks)

11. The marks obtained by a student in 10 tests of History (x) and Literature (y) were as given in the table below:

x	45	47	65	80	70	55	60	44	35	80
y	75	84	60	37	50	65	75	96	90	50

(a) Calculate the rank correlation coefficient (05marks)
(b) Comment on your answer in (a) above (01marks)
(c) Draw a scatter diagram for the data
(04marks)
(d) Draw a line of best fit (03marks)
(e) Use the line of best fit to find mark that the student would get in History if he got 54 in Literature
(02marks)

12. **a.** Solve the equation $3x^2 - x - 24 = 0$
(04marks)

b. Form a quadratic equation whose roots are $\frac{3}{5}$ and -3
(04marks)

c. The roots of the quadratic equation $2x^2 - 3x - 6 = 0$ are α and β. Form a quadratic equation with integral coefficients whose roots are $\alpha - 2$ and $\beta - 2$
(07marks)

13. **a.** Two events A and B are such that
$P(A) = 0.4$, $P(B) = 0.7$, $P(A \cap B) = 0.5$
Find the $P(A \cup B)'$
(04marks)

b. Two independent events M and N are such that P(M) = 0.3 and P(N) = 0.4

Find the P(M ∪ N)

(04marks)

c. A box contains 5 red and 8 blue pens. Two pens are picked at random one after the other without replacement. Find the probability that:

(i) both pens are red

(ii) the pens are of different colours

(07marks)

14. A motorist accelerates uniformly at a rate of $a\ ms^{-2}$ for 10s and then travels at a constant speed for 20s and slows down to rest at a constant retardation of $2a\ ms^{-2}$. If the total distance is 1100m

(i) sketch the velocity – time graph of the motion of the motorist

(ii) find the value of a

(iii) find the maximum speed attained by the motorist

(iv) find the retardation of the motorist

(15marks)

END

SECTION A (40 Marks)

*Answer **all** questions in this section.*

1. If $3log_t(10+3t) = 6$, find the value of t. ***(5 marks)***

2. Given the polynomial $P(x) = 2x^3 + ax^2 + bx - 36$ where $p(3) = 0$ and $P(2) = 26$. Find the values of a and b. ***(5 marks)***

3. The table below shows the number of text books owned by 11 students of a certain class and their total marks in an exam.

	A	B	C	D	E	F	G	H	I	J	K
Number of text books	5	8	2	9	7	5	3	10	1	4	6
Total marks	290	370	184	366	366	277	190	385	200	281	331

Calculate the coefficient of rank correlation between the number of text books and the total marks.

Comment on your result. ***(5 marks)***

4. Solve the equation $sec^2\theta - 2sec\theta + 15 = 0$ ***(5 marks)***

5. Three bags A, B and C, each contain fruits Mangoes, Oranges and Apples as follows;

	Bag A	Bag B	Bag C
Mangoes	3	2	5
Oranges	1	3	6
Apples	3	3	4

A bag is chosen at random and then a fruit is picked from the selected bag at random

Determine the probability that the fruit picked is

(i.) An orange

(ii.) Not an orange. ***(5 marks)***

6. A discrete random variable X is represented by the probability function

$$P(X=x) = \begin{cases} \frac{1+i}{ik} & ; i = 1,2,3,\ldots.6 \\ 0 & ; \ elsewhere \end{cases}$$

Find the ; (i.) value of k
(ii.) expectation of x ***(5 marks)***

7. A game coach has to choose a team of six out of ten of the best athletes, and one of the six has to be made a captain. How many possible teams can the coach obtain? *(5 marks)*

8. A hummer of mass 4.5 kg falls through a vertical height of 1 m and hits a nail of mass 50 grams directly without rebounding. If the nail is then driven into a piece of wood to a depth of 2 cm, find the common velocity of the hammer and nail just after impact. *(5 marks).*

SECTION B (60 MARKS)

Answer any four questions

9. (a.) The vectors $\boldsymbol{m} = \begin{pmatrix} 5 \\ 3 \end{pmatrix}$ and $\boldsymbol{n} - \begin{pmatrix} -6 \\ p \end{pmatrix}$ are perpendicular to each other. Determine;

(i.) The value of p

(ii.) $|2m + n|$ *(8 marks)*

(b.) Use matrix method to solve the simultaneous equations

$3x^2 + 5y = 2$

$2x^2 - 3y = 14$ *(7 marks)*

10. The gradient of curve at point P(x, y) is 4x + 3. If point A(3, 25) lies on the curve

(i.) Find the equation of the curve

(ii.) Determine the coordinates and nature of its turning point

(iii.) Find the area enclose by the curve and the x- axis. *(15 marks)*

11. The sales of soda (in crates) at a certain canteen, open five days a week, were as follows:-

week	Mon.	Tue.	Wed	Thur.	Fri.
1	142	177	213	171	138
2	125	172	191	170	131
3	114	158	192	155	127

(a.) Plot the data, together with the five- point moving averages.

(b.) Comment on the trend of the sales of soda

(c.) Estimate the sales (in crates) on Monday of the 4^{th} week. *(15 marks)*

12. (a.) if x is a normal random variable with mean 4 and variance 1.44. Find;

(i.) $p(x > 5.3)$

(ii.) $P(2.8 < x < 4.6)$ *(7 marks)*

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(b.) The life time of a certain type of component of a computer is normally distributed with an average life of 1120 hours of working and standard deviation of 20 hours. Determine the probability that a component lasts

(i.) for less than 1150 hours

(ii.) Between 1115 hours to 1145 hours *(8 marks)*

13. The table below shows the age (at last birthday) at which expectant mothers in Jinja Hospital married

Age(in years)	16 – 20	20 – 24	25 – 29	30 – 34	35 – 39	40 – 44	45 – 49
Number of expectant mothers	60	120	80	30	3	20	10

(a.) Calculate

(i.) The mean age,

(ii.) The modal age , at which the expectant mothers married. *(7 marks)*

(b.) Draw an Ogive and use it to estimate;

(i.) The number of mothers who were 42 or over when they married.

(ii.) The number of mothers who were 18 or under when they were married.

(iii.) The range of the age of mothers for the middle 40% age bracket.

(8 marks)

14. A particle starts from rest, moving with a constant acceleration of 1.5 ms^{-1} for 30s.For the next 60s, the acceleration is 0.3 ms^{-1} and for the last 25s^{-1}, it decelerates uniformly to rest.

(a.) Sketch the velocity time graph for the motion of the particle *(5 marks)*

(b.) Find the acceleration of the particle during the last period of motion *(3 marks)*

(c.) Determine the total distance travelled by the particle *(4 marks)*

(d.) Find the average speed for the whole journey. *(3 marks)*

© 2014 Jinja Joint Examinations Board *End*

Attempt **all** *questions in this section.*

1. Three matrices P, Q and I are such that P = $\begin{pmatrix} a & a+1 \\ a-1 & a+2 \end{pmatrix}$ is singular and I is an identity matrix. Find the value of $\boldsymbol{a}$ and hence the matrix **Q** if P + I = Q.
(05marks)

2. Given that A(1,2) B(4,3) and C(5, -1) are vertices of a triangle ABC, find angle ABC.
(05marks)

3. If $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ are the roots of the equation $4x^2 - 8x + 1 = 0$, find the equation whose roots are $\alpha \; and \; \beta$.
(05marks)

4. Two bags contain similar balls. Bag **A** contains 4 red and 3 white balls while bag **B** contains 3 red and 4 white balls. A bag is selected at random and a ball is drawn from it. Find the probability that a red ball is drawn.
(05marks)

5. When a polynomial $g(x)$ is divided by $x^2 + 2x - 3$, the remainder is $2x - 2$. Find the remainder when $g(x)$ is divided by;
   $x - 1$
   $x + 3$ (05marks)

6. The table below shows the price per kg of three food crops.

Item	Price per kg (shs)		Weights
	2000	**2010**	
Beans	4000	5000	3
Millet	3000	4000	3
Maize	2500	3000	4

   i) Calculate the price index of each item for 2010 basing on 2000. (03marks)
   ii) Calculate the weighted price index for 2010. (02marks)

7. The number of computers sold by **JA** Company in a period of 8months is as shown below.

No. of computers	250	200	220	270	220	260	300	240
Month	Jan	Feb	Mar	April	May	Jun	Jul	Aug

Calculate the four point moving averages for the data. (05marks)

8. Three forces of magnitudes 5N, 12N and 10N on bearings of 060^0, 210^0 and 330^0 respectively act on a particle. Find the resultant of the system of forces. (05marks)

SECTION B: (60 MARKS)

Attempt only **four** *questions in this section.*

9. The table below shows the cumulative frequency distribution of marks of 800 candidates who sat a national mathematics contest.

Mark(%)	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
F	30	80	180	330	480	610	700	760	790	800

a) Calculate the mean and standard deviation (08marks)
b) Construct an Ogive for the data and use it to estimate the;
i) Median mark (04marks)
ii) Quartile deviation (02marks)
c) Proportion of candidates that failed if the pass mark was 50% (01mark)

10. A quadratic curve has gradient function *(k - 2x)* and is such that when $x = 1$, $y = 2$ $andwehnx = -1$, y = 0.
(a) Find the value of **k** and state the equation of the curve. (07marks)
(b) Sketch the curve. (05marks)

(c) Find the area bounded by the curve and the x-axis. (03marks)

11. The table below gives marks obtained in mathematics examination (**M)** and physics Examination (**P)** obtained by 10 candidates.

Candidates	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**
Math (M)	35	56	65	78	49	82	20	90	77	35
Physics (P)	57	75	62	75	53	100	38	82	82	20

(i) Draw a scatter diagram and comment. (07 marks)
(ii) Find the score in mathematics by a candidate who scored 82 in physics. (02marks)

(iii) Calculate the rank correlation coefficient and comment on your result. (06marks)

12. a) A and B are events such that P(A) = $1/3$,P(A or B but not both) = $5/12$

and P (B) = $^1/_4$. Calculate:

P (A∪B)
(04marks)
P (A′ ∩B)
(02marks)
P (B′/A) (02marks)

(b) Two men fire at a target. The probability that Allan hits the target is ½ and the probability that Bob does not hit the target is $^1/_3$. Allan fires at the target first followed by Bob. Find the probability that:

Both hit the target (02marks)
Only one hits the target (03marks)
None of them hits the target. (02marks)

13. a) Given that 2sin(A-B) = sin (A + B)
Show that tan A = 3tan B. (03marks)
Hence determine the possible values of A between -180^0 and 180^0 when B=30^0.
(03marks)

(b) Solve the equation $sin2x - cos2x = 1$ for $0^0 \leq x \leq 360^0$.

(06marks)

(c) Without using tables or calculators, show that $\cos 75^0 = \frac{\sqrt{2}(\sqrt{3}-1).}{4}$
(03marks)

14. a) Bodies of mass 6kg and 2kg are connected by a light inextensible string passing over a smooth fixed pulley with the masses hanging vertically. Find the acceleration of the system when released from rest. (05marks)

(b) A body of mass 2kg moves along a smooth horizontal surface with speed of $2ms^{-1}$. It then meets a rough horizontal surface whose co-efficient of friction is 0.2. Find the horizontal distance it travels on the rough surface before it comes to rest.
(05marks)

(c) A particle of mass 5kg rests on a smooth surface of a plane inclined at angle 30^0 to the horizontal. When a force X acting up the plane is applied to the particle, it rests in equilibrium. Find the normal reaction and force X.
(05marks)

Uganda Advanced Certificate of Education
INTERNAL MOCK 2016
Subsidiary mathematics

INSTRUCTIONS:

- *Attempt **all** questions in section **A** and **any four** questions in section **B**.*
- *Time: 2 Hours 40 minutes*.

SECTION A:

1. A box contains 4 red and 7 black pens . Two pens are picked at random one ater the other without replacement. Find the probability that:

i) both pens are red.

ii) the pens are of a different colours.

2. i) Two mutually exclusive events A and B are such that

$P(A) = 2/3$ *and* $P(B) = 3/7$.

Find $P(A\,U\,3)^{1}$.

ii) Two independent events Q and P are such that P(Q) = 0.5 and P(P) = 0.7
Find P(Q u P).

3. The following table gives the marks obtained by 10 students in maths and Economics.

Students	A	B	C	D	E	F	G	H	I	J
Maths(x)	74	48	71	66	60	47	72	80	40	48
Economics(Y)	50	44	38	41	48	45	57	50	47	36

Compute the rank correlation coefficient for the data and your results.

4. Given that a = 3i – 4j, b = -5i + 12j. Find

i) (3a + b).6

ii) angle between a and b.

5. Find the sum of the A.P series 11 + 13 + 15 + ……. + 89.

6. Differentiate the following with respect to x.

a) $(x + 5)^2 (x – 1)$

b) $\frac{1}{x^2} + x^2$

7. Given that $A = \begin{pmatrix} 3 & 1 \\ 0 & 2 \end{pmatrix}, B = \begin{pmatrix} 1 & 2 \\ -1 & 5 \end{pmatrix}$ *and* $C = AB$; *Find* C^{-1}

8. A body of mass 4kg decreases it's kinetic energy by 32J. If initially it had a speed of $5ms^{-1}$, find it's final speed.

SECTION B:

9. The quarter number of accidents in a certain town over a period of four years is given in the table below:

Year	Q U A R T E R S			
	1st	2nd	3rd	4th
2004	13	22	58	26
2005	16	28	61	25
2006	17	29	61	26
2007	18	30	65	29

i) Draw a graph to illustrate the data.
ii) Calculate the 4- quarterly moving averages and plot them on the same graph . Comment on your results.
iii) Estimate the accidents in the 1st quarter of 2008.

10. A discrete random variable X has a probability density function.

$$P(X = x) = \begin{cases} \frac{a}{2x}, & x = 1,2,....,4 \\ 0 & elsewhere \end{cases}$$

Determine the:

i) Expectation X.
ii) Variance and standard deviation of X.
iii) Probability of $P(X \leq 3)$.

11. The table below shows the prices and quantities of some four commodities A,B,C and D for the years 2011 and 2012.

Item	Price per unit(shs)		Quantities	
	2011	2012	2011	2012
A	100	120	36	42
B	110	100	69	88
C	50	65	10	12
D	80	85	11	10

Using 2011 as base year.

i) Calculate the prices index number for each item for 2012.
ii) Calculate the simple aggregate price index number for 2012.
iii) Calculate the weighted aggregate price index number fr 2012.
iv) Calculate value index number.

12. a) Given that matrices;

$$A = \begin{pmatrix} 5 & 1 \\ 0 & 2 \end{pmatrix}, \quad B = \begin{pmatrix} -2 & 3 \\ 1 & 0 \end{pmatrix} \quad and \quad C = \begin{pmatrix} 2 & 1 & -1 \\ 1 & 5 & 2 \end{pmatrix}$$

Find :

i) ABC
ii) $(A + B)C$

b) By use of matrix method; Solve the simultaneous equations below; solve the simultaneous equations below:

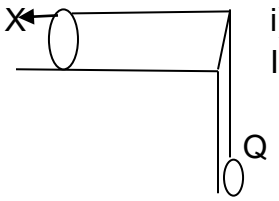
3x + 4y = 8
X + 2y = 3

13. a) Evaluate : $\int_0^6 2x\left(x^2 + 3\right)dx$

b) Determine the nature of turning points of the curve $y = 5 + 4x - x^2$; Hence sketch the curve.

c) Calculate the area bounded by the curve and the x – axis.

14. Take 9 =10ms^{-2}in this question. The diagram shows particle P of mass 0.5kg on a smooth horizontal table. P is connected to another particle Q, of mass 1.5kg by a taut light inextensible string which passes over a small fixed smooth pulley at the edge of the table , Q hanging vertically below the pulley. A horizontal force of magnitude X_N acts on P as shown.



i) Given that the system is in equilibrium find X.

II) Given that x = 12, find the distance travelled by Q in The first two seconds of its motion following the release of the system from rest. You may assume

That P dies not react the pulley in this time.

END

Section A (40 Marks)

(Answer **all** questions in this section)

Qn 1: Given that $\frac{1}{\sqrt{2}} - \frac{\sqrt{2}+1}{1+3\sqrt{2}} = a\sqrt{2} + b$ where a and b are constants, find the values of a and b. [5]

Qn 2: The data below shows the marks obtained by 8 students in a certain test marked out of 30.

$$25, 20, 21, 23, 27, 23, 30, 23.$$

Find the:

(i). Mean mark,

(ii). Modal mark,

(iii). Median mark. [5]

Qn 3: If $3\log_t(10 + 3t) = 6$, find the value of t. [5]

Qn 4: A committee of 5 people is to be formed from a group of 6 men and 7 women.

(a). Find the number of possible committees. [2]

(b). What is the probability that there are only 2 women on the committee? [3]

Qn 5: Given the vectors $\underset{\sim}{\boldsymbol{a}} = \underset{\sim}{\boldsymbol{i}} - 2\underset{\sim}{\boldsymbol{j}}$, $\underset{\sim}{\boldsymbol{b}} = 3\underset{\sim}{\boldsymbol{i}} - \underset{\sim}{\boldsymbol{j}}$ and $\underset{\sim}{\boldsymbol{c}} = \underset{\sim}{\boldsymbol{i}} + 2\underset{\sim}{\boldsymbol{j}}$, find the length of the vector $5\underset{\sim}{\boldsymbol{a}} - \underset{\sim}{\boldsymbol{b}} + 3\underset{\sim}{\boldsymbol{c}}$. [5]

Qn 6: Given that $X \sim N(72, 225)$, find $\mathrm{P}(45 \leq X < 90)$. [5]

Qn 7: A and B are acute angles such that $\sin A = \frac{12}{13}$ and $\sin B = \frac{4}{5}$. Without the use of tables or a calculator, find the value of $\sin(A - B)$. [5]

Qn 8: Find the constant force necessary to accelerate a car of mass 1000 kg from 15 m s^{-1} to 20 m s^{-1} in 10 seconds against a resistance of 270 N. [5]

Section B (60 Marks)

(Answer only **four** questions from this section)

Question 9:

The table below shows the marks obtained by 10 students in a subsidiary mathematics and history exams.

History	80	75	65	90	95	98	78	65	54	60
Sub-Math	70	85	70	90	92	88	76	70	73	76

(a). (i). Represent the above data on a scatter diagram.
(ii). Draw the line of best fit.
(iii). If the student scored 75% in history, predict his score in subsidiary mathematics using your line of best fit.

(b). Calculate the spearman's rank correlation coefficient and comment on your result. [15]

Question 10:

A company that manufactures three types of radios requires diodes (D), valves (V), transistors (T) and capacitors (C). Sony requires 4 D, 3 V, 5 T and 2 C. Panasonic requires 4 V, 6 T and 1 C while Philips requires 2 D, 8 T and 5 C. The cost of each diode, valve, transistor and capacitor in thousands of shillings is 15, 5, 9 and 12 respectively.

(a). Write down:
(i). 3×4 matrix for the requirements of the radios.
(ii). 4×1 matrix for the cost of the accessories.
(iii). Use matrix multiplication to find the cost of manufacturing each radio.

(b). If Sony radio, Panasonic and Philips are sold at shs. 200,000; 150,000 and 160,000 each respectively. Use matrix method to find the percentage profit made by the company from sales of 20 Sony, 25 Panasonic and 15 Philips. [15]

Question 11:

(a). The table below shows the probability distribution function of a discrete random variable X.

X	-1	0	1	2
$P(X = x)$	0.4	0.1	0.3	0.2

(i). Calculate $P(X < 2/X > 0)$. [4]
(ii). Obtain the variance of X [4]

(b). The pdf of a continuous random variable X is given by

$$f(x) = \begin{cases} 3kx^2 & ; \quad 1 \leq x \leq 3, \\ 0 & ; \quad elsewhere. \end{cases}$$

Find:

(i). the value of k [3]

(ii). the expectation of X. [4]

Question 12:

A curve is such that $\frac{dy}{dx} = 3 - 2x$ and a point $P(1, 0)$ lies on the curve.

(a). Find the:

(i). equation of the curve. [3]

(ii). co-ordinates of the points where the curve meets the x-axis. [3]

(iii). co-ordinates and the nature of the stationary points. [4]

(b). Sketch the curve in (a) above and find the area enclosed by the curve and the x-axis. [5]

Question 13:

The table below shows the 3-point termly moving total scores of a student from S.1 over a period of three years.

Year	**Term one**	**Term two**	**Term three**
2014		1380	1215
2015	1020	915	870
2016	840	795	

(a). Calculate the 3-point moving averages for data.

(b). Represent the moving averages on a graph and comment on the trend of performance.

(c). Determine the moving totals in third term of 2016.

Question 14:

A train starts from station P and accelerates uniformly for 2 minutes reaching a speed of 72 km h^{-1}. It continues at this speed for 5 minutes and then is retarded uniformly for a further 3 minutes coming to rest at station Q. Draw a velocity-time graph and use it to find the:

(i). Time taken to cover the distance between P and Q in seconds.

(ii). Distance PQ in metres.

(iii). Average speed of the train.

(iv). Acceleration in m s^{-2}. [15]

*****END*****

Section A (40 Marks)

Answer **all** *the questions in this section.*

Qn 1: If $5\log_x(10+3x) = 10$, find the value of x. [5]

Qn 2: For a set of 10 numbers, $\sum x = 290$ and $\sum x^2 = 8469$. Find:

(a). the mean,

(b). the standard deviation. [5]

Qn 3: Given the polynomial $P(x) = 3x^3 + ax^2 + bx - 20$ where $P(1) = -14$ and $P(2) = 14$. Find the values of a and b. [5]

Qn 4: The table below shows the number of text books owned by 10 students of a certain class and their total marks in an exam.

Student	Number of text books	Total marks in an exam
A	5	290
B	8	370
C	2	184
D	9	366
E	7	277
F	5	190
G	3	385
H	10	200
I	1	281
J	4	331

Calculate the rank correlation coefficient between the number of text books and the total marks. Comment on your result at 5% level of significance. [5]

Qn 5: Given the vectors $\underset{\sim}{\boldsymbol{p}} = 3\underset{\sim}{\boldsymbol{i}} - 2\underset{\sim}{\boldsymbol{j}}$, $\underset{\sim}{\boldsymbol{q}} = 4\underset{\sim}{\boldsymbol{i}} + 2\underset{\sim}{\boldsymbol{j}}$ and $\underset{\sim}{\boldsymbol{r}} = \underset{\sim}{\boldsymbol{i}} + 2\underset{\sim}{\boldsymbol{j}}$, find the length of the vector $\underset{\sim}{\boldsymbol{p}} - 4\underset{\sim}{\boldsymbol{q}} + 3\underset{\sim}{\boldsymbol{r}}$. [5]

Qn 6: Three bags X, Y and Z, each contain black, red and blue pens as follows:

	Black pens	Red pens	Blue pens
Bag X	3	1	3
Bag Y	2	3	3
Bag Z	5	6	4

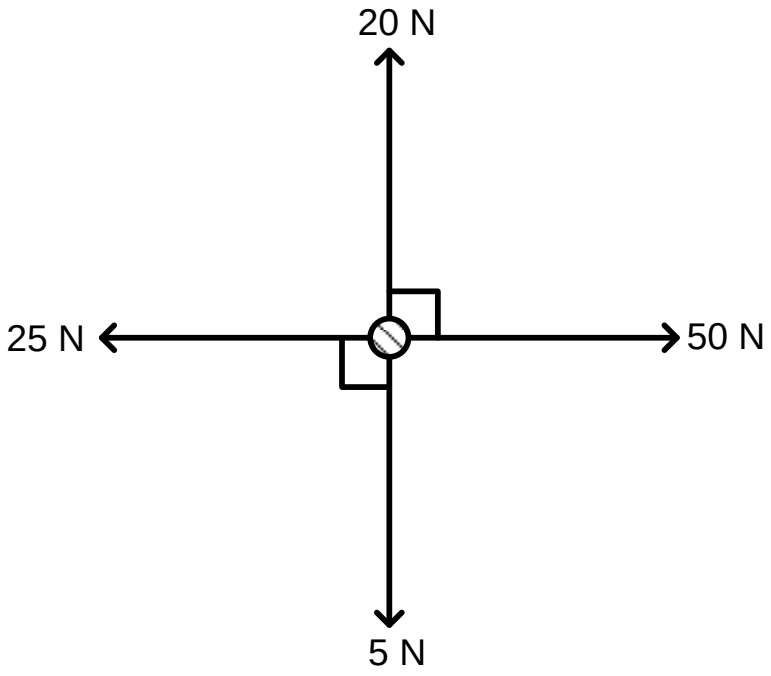
A bag is chosen at random and then a pen is randomly picked from the selected bag. Determine the probability that the pen picked is:

(i). a blue pen,

(ii). Not a blue pen. [5]

Qn 7: Given that $\sin\theta = \frac{-15}{17}$ and $180° \leq \theta \leq 360°$, find the value of $6\tan\theta + 8\,\text{cosec}\,\theta$. [5]

Qn 8: Find the magnitude and direction of the resultant force of the system of forces acting on a particle as shown below:



[5]

Section B (60 Marks)

Answer only **four** *questions from this section. All questions carry equal marks.*

Question 9:

The table below represents the length of leaves in millimetres (mm).

Length (mm)	Number of leaves
18.0 – 18.9	5
19.0 – 19.9	15
20.0 – 20.9	20
21.0 – 21.9	19
22.0 – 22.9	16
23.0 – 23.9	15
24.0 – 24.9	7
25.0 – 25.9	3

(a). Calculate the:
  (i). mean length.
  (ii). standard deviation. [6]

(b). Draw a cumulative frequency curve (ogive) and use it to estimate the:
  (i). median length.
  (ii). 80^{th} percentile length.
  (iii). number of leaves whose length is below 22.45 mm. [9]

Question 10:

(a). Given that $P = \frac{1-\sin\theta}{1+\sin\theta}$,show that $P = (\sec\theta - \tan\theta)^2$. Hence deduce that if $\theta = 60°$, then $P = 7 - 4\sqrt{3}$. [8]

(b). Solve the equation $3\cos^2 x - 2\sin^2 x - \sin x + 1 = 0$ for $0° \leq x \leq 360°$. [7]

Question 11:
The cost of building a house is calculated from the price of cement, sand, bricks, roofing materials and labour. The table below gives the prices and price relatives of the items in the months of March and April respectively of 2019; and weights.

Item	March Unit Price (Ushs)	April Price Relatives (March = 100)	Weight
Cement	25,000	1.4	3
Sand	120,000	1.2	3
Bricks	230,000	0.65	2
Roofing materials	100,000	0.25	1
Labour	400,000	0.55	1

(a). Taking "Cement" as the base, calculate the price relatives for April.
(b). Determine the price of each item in April.
(c). Calculate the weighted aggregate price index for April using March as the base. Comment on your result. [15]

Question 12:
T is the tangent to the curve $y = x^2 + 6x - 4$ at $(1, 3)$ and N is the normal to the curve $y = x^2 - 6x + 18$ at $(4, 10)$. Find:
(a). the equation of the tangent T.
(b). the equation of the normal N.
(c). the coordinates of the point of intersection of T and N. [15]

Question 13:
The table below shows the monthly sales of a certain product in (shs "000") for the year 2018.

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 2019. [9]

Question 14:

(a). A boy pulls a box of mass 25 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 0.4. If the string is inclined at 30° to the horizontal and the box accelerates at 5 m s^{-2}, find the tension in the string. [7]

(b). A cyclist travels 100 m as he accelerates uniformly at a rate of Qm s^{-2} ; from a speed of 18 km h^{-1} to a speed of 36 km h^{-1}. Find:

(i). the value of Q.

(ii). the time taken to cover this distance. [8]

*****END*****

SECTION A: (40 MARKS)

Answer all questions from this section

1. A curve passing through point A (0, 8) has a gradient function $2x + 5$. Find the equation of the curve. *(05 marks)*

2. Solve the equation;
   $3^{2x} - 3^{x} - 6 = 0$. *(05 mark)*

3. The mass (kg) of 10 candidates in Naalya S.S was recorded as follows, 60, 83, 72, 51, 64, 80, 75, 56, 90 and 85. Find the standard deviation. *(05 marks)*

4. A discrete random variable x has the following probability distribution:
   P(X = 1) = 0.1, P(X = 2) = 2P (X = 4) and P(X = 3) = 0.3. Find;
   (i) P(X = 2)
   (ii) Expected value of x *(05 marks)*

5. Find the reflex angle θ such that;
   $2Sin^{2}\theta + Cos\theta + 1 = 0$ *(05 mark)*

6. Given that $\overrightarrow{OA} = 2\mathbf{i} + 2\mathbf{j}$ *and* $\overrightarrow{BA} = 7\mathbf{i} - \mathbf{j}$. Find;
   (i) $\overrightarrow{OB}$
   (ii) $\overrightarrow{OM}$, such that $\overrightarrow{AM} = ½ \overrightarrow{AB}$ *(05 marks)*

7. In 2014, the unit price of salt, price and cooking oil was 1600, 4200 and 3600 respectively. Given that the unit price in 2015 was P, 6800 and 3200 respectively and the simple aggregate price index was 125, find the value of P. *(05 marks)*

8. A car of mass 1.5 tonnes moves along a level road at a constant velocity of $80ms^{-1}$. If its engine exerts a driving force of 5kN, find the resistance that the car is experiencing. *(05 marks)*

SECTION B

9. The table below shows the termly expenditure in thousands of shillings by a school on National water;

Year	Term I	Term II	Term III
2013	303	324	318
2014	336	345	330
2015	321	300	312
2016	339	342	x

(a) Calculate the 3 – termly moving averages for the data. *(06 marks)*

(b) On the same axes, plot the graphs of the 3 termly moving averages and the termly expenditure. *(07 marks)*

(c) Use your graph to estimate the value of x. *(02 marks)*

10. (a) Sketch the curve;
$y = x^2 - 2x - 3$ *(10 marks)*

(b) Find the area bound by the curve and the x - axis. *(05 marks)*

11. A certain aptitude test has 10 statements that require a candidate to respond by writing true or false. A candidate passes if he or she scores at least eight questions correct;

(a) Find the probability that;
(i) A candidate gets exactly 5 questions correct
(ii) A candidate passes the test *(09 marks)*

(b) Calculate the expected number and standard deviation of the correctly answered questions. *(06 marks)*

12. The marks scored by candidates in a submaths exam were as follows;

64	74	78	59	67	55	61	54
80	58	76	58	74	65	63	83
72	60	71	52	61	57	68	69
62	73	64	59	62	53	81	68
50	75	67	53	80	77	60	71

(a) Construct a grouped frequency table for the data using equal classes of width 4 marks starting with 50 – 53 as the first class. *(02 marks)*

(b) State the;

(i) Median class

(ii) Modal class and its frequency. *(03 marks)*

(c) Calculate the;

(i) Mean mark

(ii) Standard deviation *(10 marks)*

13. (a) Given that $A = \begin{pmatrix} 2 & 4 \\ -6 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} x & 2 \\ y & 5 \end{pmatrix}$. Find the value of x and y such that AB = BA. Hence determine matrix p where P = AB = BA. *(08 marks)*

(b) Given the matrix $M = \begin{pmatrix} 1 & 3 \\ 2 & 2 \end{pmatrix}$. Find the value of λ for which matrix N = M - λ I is singular, where I is a 2 x 2 identity matrix. *(07 marks)*

14. Forces of 7N, 8N, 6N, 4N, 6N and 7N and 7N act along the sides of a regular hexagon ABCDEF in the directions AB, CB, CD, DE, EF and FA respectively. Find the magnitude and direction of the resultant force taking AB as the horizontal axis. *(15 marks)*

END

SMATA

2ND ANNUAL POST MOCK SEMINAR

S.6 Subsidiary Mathematics 2019

AT

ST. JOSEPH OF NAZARETH HIGH SCHOOL

5th October 2019

SEMINAR QUESTIONS

APPLIED MATH TOPICAL AREAS

Random variables

1. A random variable $\boldsymbol{x}$ has a probability density function given by

$$\boldsymbol{f(x)} = \begin{cases} \boldsymbol{kx} & \boldsymbol{0 < \times < 3} \\ \boldsymbol{3k \quad (4-x)} & \boldsymbol{3 \leq \times \leq 4} \\ \boldsymbol{0 \ \ elsewhere} & \end{cases}$$

$\boldsymbol{k}$ is constant.

(i) Find the value of $\boldsymbol{k}$
(ii) $\boldsymbol{P(1 \leq \times \leq 3)}$
(iii) $\boldsymbol{P(x \geq 2)}$
(iv) $mean\ \boldsymbol{E(x)}$
(v) variance $\boldsymbol{var(x)}$
(vi) median

2. A random variable $\boldsymbol{x}$ has a probability density function given by

$$\boldsymbol{f(x)} = \begin{cases} \boldsymbol{x^k} & \boldsymbol{0 \leq \times \leq 1} \\ \boldsymbol{0} & \boldsymbol{elsewhere} \end{cases}$$

(i) Find the value of $\boldsymbol{k}$
(ii) $\boldsymbol{P(x > 0.5)}$.

3. A variable $\boldsymbol{x}$ has a probability distribution shown below

x	1	2	5	10
$f(x)$	0.5	P	0.12	q

Given that the mean $\boldsymbol{E(x) = 2.5.}$ Find the values of p and q.
Hence find the mode and median

4. A random variable x has a pdf given by $f(\boldsymbol{x})\begin{cases} \boldsymbol{cx} & \boldsymbol{x = 1,2,3,4} \\ \boldsymbol{c\ (8 - x)} & \boldsymbol{x = 5,6,7} \\ \boldsymbol{0} & \boldsymbol{otherwise} \end{cases}$

Find the

(i) value of c
(ii) P($3< x \leq 5$)
(iii)P(x$> 2/x \leq 6$)

Binomial and normal distribution

5. a) Given that $x \sim B(10, P)$ and variance $\frac{15}{8}$. Determine the possible of P
hence find $P(x \geq 7)$ if p is less than 0.5

b) A certain type of cabbage has a mass which is normally distributed with mean $\boldsymbol{1kg}$ and standard deviation $\boldsymbol{0.15kg}$. In a lorry loaded with these cabbages. Find the probability that a cabbage weighs
(i) greater than $\boldsymbol{0.79kg}$
(ii) less than $\boldsymbol{1.13kg}$
(iii)between $\boldsymbol{0.85kg}$ and $\boldsymbol{1.15kg}$
(iv)number of cabbages between $\boldsymbol{0.75kg}$ and $\boldsymbol{1.29kg}$ if $\boldsymbol{10,000\ cabbages}$ were loaded.

Probability

6. At a certain wedding there are $\boldsymbol{5\ light}$ and $\boldsymbol{4\ dark}$ – skinned groomsmen. If $\boldsymbol{7\ groomsmen}$ are selected at random. What is the probability that at least $\boldsymbol{4}$ are light skinned?

7. a) A and B are events such that $\boldsymbol{P(A) = {}^{5}/_{12}}$ $\boldsymbol{P(A \cap B) = {}^{1}/_{4}}$ and $\boldsymbol{P({}^{A}/_{B}) = {}^{3}/_{4}}$ find $\boldsymbol{P(A \cup B)}$
b) Given that $\boldsymbol{P(A) = 4x,\ P(B) = {}^{1}/_{3}}$ $\boldsymbol{P(A \cap B) = x}$ and $\boldsymbol{P(A \cup B) = 8x}$. Find the value of $\boldsymbol{x}$ and $\boldsymbol{P(A^1 \cap B).}$

8. A box has 5 green and 6 white sweets, three sweets are pick at random one after other without replacement. Find the probability that.

(i) All sweets are of the same colour
(ii) Sweets are of different colours
(iii)The third sweet is green.

Statistics

8. The table below shows the marks scored by 100 students in a Math test

$\boldsymbol{Marks}$	$20-$	$30-$	$40-$	$50-$	$60-$	$70-$	$80-$	$90- < 100$
$\boldsymbol{f}$	5	15	20	19	16	15	7	3

a) Construct a frequency distribution table and use it to calculate;
   (i) Mean mark
   (ii) Variance and standard deviation

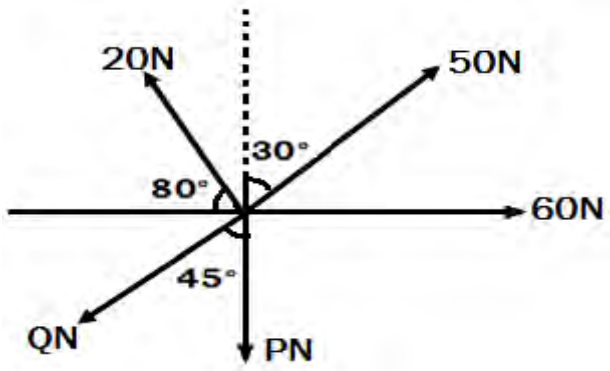
b) Draw an ogive and use it to estimate
   (i) Median mark
   (ii) Pass mark if 60 students passed
   (iii) Compute the modal mark

9. The time taken by Submaths students to complete an exercise was recorded and the following results were obtained. $\mathbf{32.5, 34.5, 33.5, 29.8, 30.9}$, and $\mathbf{31.8}$

Calculate;
   (i) Mean time
   (ii) Variance

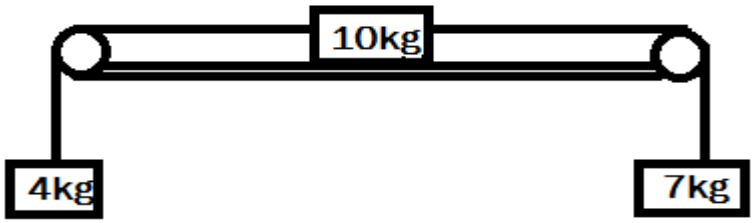
Mechanics

10. Five forces act as shown below and are in equilibrium. Find the forces $\boldsymbol{P}$ and hence find the magnitude and direction of the resultant force.



11. a) Two particles $\boldsymbol{A}$ and $\boldsymbol{B}$ of masses $\mathbf{3kg}$ and $\mathbf{5kg}$ are connected by a light string passing over a smooth fixed pulley. Find
   (i) their common acceleration
   (ii) the tension in the string

12. Three bodies are connected by a light inextensible strings passing over a smooth pulley. A mass of $\mathbf{10kg}$ lies on a smooth surface of a table with the $\mathbf{4kg}$ and $\mathbf{7kg}$ masses hanging freely as shown below.



If the system is released from rest. Find the;

(i) Acceleration and tension in the string

(ii) Distance moved by the $\mathbf{7kg}$ mass after $\mathbf{2\ seconds}$.

13. A car travels along a straight road. The car starts at $\boldsymbol{A}$ from rest and accelerates for $\mathbf{30\ seconds}$ at a constant rate until it reaches a speed of $\mathbf{25ms^{-1}}$. The car continues at $\mathbf{25ms^{-1}}$ for $\boldsymbol{T\ seconds}$, after which it decelerates for $\mathbf{10\ seconds}$ until it reaches a speed of $\mathbf{15ms^{-1}}$ as it passes $\boldsymbol{B}$. The distance $\boldsymbol{AB}$ is $\mathbf{80km}$.
    a) Sketch the velocity – time graph for the journey between $\boldsymbol{A}$ and $\boldsymbol{B}$.
    b) Find the value of $\boldsymbol{T}$. Hence, total time of the journey from $\boldsymbol{A}$ to $\boldsymbol{B}$.

Moving average and scatter diagram

14. The table below shows quarterly income in ($\boldsymbol{millions\ of\ shillings}$) of a certain company over a period of three years.

Quarters	Years		
	2006	**2007**	**2008**
1	70	80	120
2	85	105	115
3	140	150	170
4	60	75	95

    a) Calculate a four point moving average for the above data.
    b) On the same axes, plot the graphs of original data and four point moving averages.
    c) Comment on the results in (a) above and use the graph to estimate the expected revenue in the
        (i) First quarter of 2008
        (ii) Fourth quarter of 2008

15. The table below shows the three point moving totals for a number of tourists who visited a certain National Park over a period of four years.

Year	Round 1	Rounds 2	Rounds 3
2015		1530	1310
2016	1300	1290	1205
2017	1194	1110	1096
2018	1052	1014	

    a) Calculate the three point moving averages for the above data.
    b) Represent the moving averages on the same axes and comment on the trend of visitors visiting the National Park.
    c) Use the graph to estimate the totals in $\boldsymbol{Round\ 3}$ of $\mathbf{2018}$.

16. Two adjudicators at a Musical competition awarded marks to ten Pianist as follows

Pianist	A	B	C	D	E	F	G	H	I	J
Adjudicator $\boldsymbol{x}$	78	66	73	73	84	66	89	84	67	77
Adjudicator $\boldsymbol{y}$	81	68	81	75	80	67	85	83	66	78

a) Draw a scatter diagram for the data and comment on your graph.
b) Calculate the spearman's rank correlation coefficient and comment at $\mathbf{5}\%$ level of significance.

Price indices

17. In 1996, the prices of pens, pencils and books were $\boldsymbol{shs.200}$, $\mathbf{50}$ and $\mathbf{400}$ respectively. Their respective prices in 2006 were $\boldsymbol{shs.500,200}$ and $\boldsymbol{P}$. Given the simple aggregate price using $\mathbf{1996}$ as the base year was $\mathbf{136}$. Find the value of $\boldsymbol{P}$.

18. The cost of making toasted bread is calculated from the cost of baking flour, sugar, milk, eggs and food colour.

Item	2017	2018	Weight
Wheat	5100	5700	10
Sugar	4000	3600	5
Milk	1000	1400	4
Eggs	9000	8500	2
Food colour	1000	1300	1

a) Using 2017 as the base year, calculate
   (i) The price relatives for each item.
   (ii) Simple aggregate price index.
   (iii) Average price.
   (iv) Cost of living index and comment
   (v) The weighted aggregate price index.

b) Using the index in (ii) estimate the cost of making bread in 2017 if the cost in $\mathbf{2018}$ was $\mathbf{2,200}$.

~END

PURE MATH QUESTIONS

1. Solve the simultaneous equations below

$$2^{x+3} + 3^{y+2} = 3^2$$
$$2^x + 3^y = 4$$

2. A polynomial $P(x) = x^4 + ax^3 + bx^2 + 5x + 3$ has a remainder of $2x + 1$ when divided by $x^2 + 3x + 2$. Find the values of a and b.

3. Given that $\log(3x + 8) - 3\log 2 = \log(x - 4)$. Find the value of x.

4. Solve for x in $\cos 2x + 5\cos x = 2$ for $0° < \times < 360°$

5. Given that vectors $a = 2\hat{\imath} - 4\hat{\jmath}$ and $b = 3\hat{\imath} + 5\hat{\jmath}$ find the modulus of the vector $5a + 2b$ and the angle between vector **a** and **b**

6. When $H(x) = x^3 - ax^2 - bx + 24$ is divided by $x + 1$, the remainder is 19 and $x + 2$ is a factor of $H(x)$. Find a and b hence factorise.

7. If $\propto$ and β are roots of the equation $2x^2 + 3x + 5 = 0$. Form an equation whose roots are $\frac{\beta}{\propto - 4}$ and $\frac{\propto}{\beta - 4}$

8. The sum of the first 12 *terms* of an arithmetic progression AP is 120. The eighth term is four times the sum of the fourth and fifth terms. Determine the;
   (i) First term and common difference of AP.
   (ii) Sum of the first 20 *terms*

9. Solve for n if $\frac{8^{n+2} \times 4^{2n-1}}{2^n \times 4^{\frac{n}{2}}} = 16$

10. Express $\frac{3\sqrt{2} - 2\sqrt{3}}{3\sqrt{2} + 2\sqrt{3}}$ in the form $a + b\sqrt{c}$ and hence state the values of a, b and c.

11. Given that $\cos A = {}^{4}/_{5}$ and $sinB = {}^{12}/_{13}$ *where A ans b are acute* . find
   (i) $\sin A + \tan A$
   (ii) $\sin(A - B)$

12. Given that $A = \begin{pmatrix} 5 & 1 \\ 4 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & -1 \\ 2 & 4 \end{pmatrix}$. Find A^{-1} and AB.

13. A cake is made up of ingredients, flour oil, eggs and sugar. A sample of three cakes made by a certain bakery was found to have been made form:
   Cake A: $2\,kg\ of\ flour$, $1\ litre\ of\ oil$, $8\ eggs$ and $250g\ of\ sugar$
   Cake B: $3kg\ of\ flour$, $2\ litres\ of\ oil$, $12\ eggs$ and $500g\ of\ sugar$
   Cake C: $5kg\ of\ flour$, $2.5litres\ of\ oil$, $20\ eggs$ and $750g\ of\ sugar$.

In **2017**, the cost of $\boldsymbol{a\ kg\ of\ flour}$, $\boldsymbol{a\ litre\ of\ oil}$, $\boldsymbol{an\ egg}$ and $\boldsymbol{kg\ of\ sugar}$ were at $\boldsymbol{shs.2,200}$, $\boldsymbol{shs.\ 2,500}$, $\boldsymbol{shs,400}$ and $\boldsymbol{shs.3,200}$ respectively.

In **2018,** the cost of $\boldsymbol{a\ kg\ of\ flour}$, $\boldsymbol{a\ litre\ of\ oil}$, $\boldsymbol{an\ egg}$ and $\boldsymbol{a\ kg\ of\ sugar}$ were $\boldsymbol{shs.3,000}$, $\boldsymbol{shs.\ 3,000}$, $\boldsymbol{shs.500}$ and $\boldsymbol{shs.3,600}$ respectively.

(i) Write down a $\boldsymbol{3\times4}$ $\boldsymbol{matrix}$ to represent the ingredients items of the cakes and $\boldsymbol{4\times1}$ **matrix** for the costs of the items in the two years.
(ii) Using matrix multiplication, calculate the total cost of making the three cakes for each years **2017** and **2018.**
(iii) What is the difference between the costs in the two years?

14. The gradient function of a curve at a point $\boldsymbol{(0,13)}$ lies on the curve.
(i) Find the equation of the curve.
(ii) Determine the coordinates and nature of its turning points.
(iii) Sketch the curve hence find the area between the curve and the line $\boldsymbol{y=13}$

15. Find the equation of the tangent to the curve $\boldsymbol{x^2y=2+x}$ at a point when $\boldsymbol{x=-1}$

16. $\boldsymbol{T}$ is a tangent to the curve $\boldsymbol{y=x^2+6x-4}$ at $\boldsymbol{(1,3)}$ and $\boldsymbol{N}$ is the normal to the curve $\boldsymbol{y=x^2-6x+18}$ at $\boldsymbol{(4,10)}$**.** Find
(i) Equation of the tangent $\boldsymbol{T}$
(ii) Equation of the normal $\boldsymbol{N}$
(iii) Coordinates of the point of intersection of $\boldsymbol{T}$ and $\boldsymbol{N}$.

17. The points $\boldsymbol{P}$ and $\boldsymbol{Q}$ have position vectors $\boldsymbol{OP=-2i-5j}$ and $\boldsymbol{OQ=i-2j}$ respectively. $\boldsymbol{R}$ is a point such that $\boldsymbol{OR=OP+\lambda PQ}$.
a) Find the
(i) Value of $\boldsymbol{OP,OQ}$
(ii) Angle between $\boldsymbol{OP}$ and $\boldsymbol{OQ}$

b) Determine the vector
(i) $\boldsymbol{PQ}$
(ii) $\boldsymbol{OR}$ in terms of λ
(iii) Value of λ for which $\boldsymbol{OR}$ is perpendicular to $\boldsymbol{PQ}$.

18. The rate of delay of a radioactive material is proportional to the amount $\boldsymbol{x}$ grams of the material present at any time $\boldsymbol{t}$. initially, there was $\boldsymbol{100g}$ of material. After $\boldsymbol{5\ minutes}$, the material had reduced to $\boldsymbol{90g}$.
a) Form – differential equation for the rate of delay of the material.
b) Solve the differential equation in (a) above.
c) Find the;
(i) Amount of the radioactive material present after $\boldsymbol{20\ minutes}$
(ii) Time taken for the material to reduce to $\boldsymbol{20g}$.

AIM AT GETTING A POINT AT UNEB

SECTION A

1. Given that $\frac{1}{\sqrt{2}} - \frac{\sqrt{2}+1}{1+3\sqrt{2}} = a\sqrt{2} + b$ where a and b are constants, find the values of a and b. ***(5marks)***

2. Events A, B and C are such that $(A) = \frac{2}{7}$, $P(B) = \frac{3}{8}$ and $P(C) = \frac{3}{5}$. Given that A and C are independent events and B and C are mutually exclusive events. Find ;

   (i.) $P(AUC)$

   (ii.) $P(BUC)'$ ***(5marks)***

3. The table shows two variables x and y

X	60	5	30	75	45	36	50	20	10	40
y	38	66	44	28	47	56	48	56	62	54

   Calculate the rank correlation coefficient between x and y and comment on your results. ***(5marks)***

4. Given that $\boldsymbol{a} = 2\boldsymbol{i} + j$, $\boldsymbol{b} = 3\boldsymbol{i} - 4\boldsymbol{j}$ and $\boldsymbol{c} = 2\boldsymbol{a} + \boldsymbol{b}$. Find;

   (i.) Vector **C**

   (ii.) Modulus of vector **c**. ***(5marks)***

5. Solve the equation $2sin2\theta = 3cos\theta\ , for\ 0^o \leq \theta \leq 360^o$. ***(5marks)***

6. The cost of building a house is calculated from the costs of cement, sand, bricks, roofing materials and labour.

   The table below gives the costs of these items in 2010 and 2014.

ITEM	**COST (shs.) PER UNIT 2010**	**COST (shs.) PER UNIT 2014**	**WEIGHTS**
Cement	25000	30000	20
Sand	120000	125000	3
Bricks	230000	290000	2
Roofing materials	600000	800000	1
Labour	400000	450000	1

   Using 2010 as base year , calculate the weighted aggregated price index for 2014. And comment on the result. ***(5marks)***

7. Solve the equation $3(1-x)^2 + 7(1-x) + 4 = 0$. ***(5marks)***

8. A car decelerating at $0.95ms^{-1}$passes a certain point with a speed of $30ms^{-1}$. Find its velocity after 10s and the distance covered in that time. ***(5marks)***

SECTION B

9. (a.) The data below shows the expenditure in thousands of shillings of 8 families during the month of May 2015.

25, 20, 21, 23, 27, 23, 30, y.

If the mean expenditure was shs.24,000. Find the;

(i.) Value of y

(ii.) Modal expenditure

(iii.) Median expenditure. ***(6marks)***

(b.)The total score in Mathematics and English obtained by 30 students were

164 148 138 145 153 157 147 174 143 148
136 154 170 128 140 178 165 121 149 161
143 150 139 151 139 165 151 133 145 126

Copy and complete the frequency distribution table below for the above data

class	**tallies**	**Frequency (f)**	**Class mark (x)**	**fx**	**Cumulative frequency**	**Class Boundaries**
120 – 129						
130 – 139						
140 – 149						
150 – 159						
160 – 169						
170 – 179						
		Ɛf = ...		**Ɛfx = ...**		

Calculate

(i.) The mean mark

(ii.) The median mark. ***(9marks)***

10. The following table shows the milk production in litres of a diary farm in each quarter of the years 2012, 2013, and 2014

year	**1st quarter**	**2nd quarter**	**3rd quarter**	**4th quarter**
2012	2490	3640	5015	1480
2013	2360	3520	4890	1375
2014	2155	3265	4630	1170

(a.)Calculate the four point moving averages. ***(6marks)***

(b.) (i) On the same axes, plot and draw graphs of the original data and the four – point moving averages.

(ii.) Comment on the trend of milk production. ***(6marks)***

(c.)Use your graph in (b) to estimate the amount of milk produced by the farm in the 1st quarter of 2015. ***(3marks)***

11. (a.) The probability mass function of s random variable X is given by

$$P(X = x) = \begin{cases} kx + \frac{1}{5} & ,x=-2,-1,0,1,2. \\ 0 \quad , & elsewhere \end{cases}$$

Where k is a constant.

(i.) Determine the value of k

(ii.) Compute the mean

(iii.) Find the mode

(iv.) Find $P(x < 0)$. ***(15marks)***

12. (a.) Given that $V = 7 + 5t - 3t^2$, find the maximum value of V. ***(4marks)***

(b.) If $\frac{dy}{dx} = 7$, and $x = 1, y = 10,\ find;$

(i.) y in terms of x

(ii.) x when y = 24 ***(7marks)***

(c.) Evaluate $\int_2^5 \left(\frac{x^2}{3}\right) dx$ ***(4marks)***

13. (a.) Use matrix to solve the simultaneous equations

$$8x - y = 6$$
$$3x + 2y = 26$$

(6marks)

(b.) Mukisa ordered for the following items from a shop; 2 kg of sugar, 3 bars of soap and 1 packet of tea leaves. And Okello ordered for 4 kg of sugar, 1 bar of soap and 2 packets of tea leaves. If the cost of sugar is shs. 2500 per kg, soap shs.2100 a bar and tea leaves shs. 1200 a packet.

(i) Form a matrix of order 2 X 3 for the items ordered

(ii) for a matrix of order 3 X 1 for the costs of the items.

(iii) Use matrix multiplication to find the bills paid by each person.

(9marks)

14. (a.) Two points A and B are 2cm apart, if a force of 50N is used to move a body from A to B in 15 s.

(i.) Find the work done.

(ii.) Calculate the rate at which the force is acting. ***(4marks)***

(b.) The point P is 5 metres vertically above point O. A body of mass 0.6 kg is projected from

P vertically downwards with a speed of $3.5ms^{-1}$. Find the speed of the body when it reaches O. ***(11marks)***

End -

(05 marks)

2. The table below shows cost per kg of some items commonly used by a certain family.

Item	Beans	Posho	Salt	G. nuts	Rice
Cost per kg	3000	2000	500	2600	2200

Using **posho** as the **baseprice**, calculate the **cost of living** index and comment on your results. (05 marks)

3. Solve the equation $\mathbf{2}\,\boldsymbol{sec^2}\,\boldsymbol{\theta} - \mathbf{3} + \mathbf{tan}\,\boldsymbol{\theta} = \mathbf{0}$ for values of $\boldsymbol{\theta}$ from $\mathbf{0}°$ to $\mathbf{360}°$ (05 marks)

4. $\boldsymbol{A}$ and $\boldsymbol{B}$ are two independent events such that $\boldsymbol{p}\,(\boldsymbol{A}) = \mathbf{0.3}$ and $\boldsymbol{p}(\boldsymbol{B}) = \mathbf{0.35}$ evaluate;
   (i) $\mathbf{p}\,(\mathbf{A} \cap \mathbf{B})$
   (ii) $\mathbf{p}\,(\mathbf{A} \cup \mathbf{B})$
   (iii) $\mathbf{p}\left(\mathbf{A}/\mathbf{B}\right)$

   (05 marks)

5. Solve the differential equation $\frac{dy}{dx} = \frac{7x^2+1}{8y}$; given that $\boldsymbol{y} = \mathbf{2}$ when $\boldsymbol{x} = \mathbf{0}$ (05 marks)

6. The table below shows the weight of students in a certain class.

Weight (kg)	5 -	10 -	15 -	20 -	25 -	30 -	35 - 40
Cumulative frequency	2	7	15	30	35	38	40

Calculate the variance for the data. (05 marks)

7. The third term of a geometrical progression **(GP**) is **10** and the **sixth** term is **80**. Find the sum of the first six terms. (05 marks)

8. $\boldsymbol{PQRS}$is a square of side "$\boldsymbol{a}$"**.** Forces of magnitude $\mathbf{2}\boldsymbol{N}, \mathbf{1}\boldsymbol{N}, \sqrt{\mathbf{2}\boldsymbol{N}}$; and $\mathbf{4}\boldsymbol{N}$ act along $\boldsymbol{PQ}, \boldsymbol{QR}, \boldsymbol{PR}and\boldsymbol{SP}$respectively. Thedirection being in the order of letters. Find the magnitude and direction of the resultant force. (05 marks)

SECTION B (60 MARKS)

(Attempt **any four** questions**)**

9. The number of customers who visit a certain bank for the days **Monday** to **Friday** were recorded for **three** weeks.

Week	Mon	Tue	Wed	Thur	Fri
I	142	177	213	171	138
II	125	172	191	170	131
III	114	158	192	155	127

(a) Calculate the **Five – point** moving averages for the data. (06 marks)

(b) (i) On the same axes; plot the original data and the five – point moving averages. (05 marks)

(ii) Comment on the trend of the number of customers who visit the bank over the three weeks. (01 mark)

(iii) Use your graph to estimate the number of customers who will visit the bank on **Monday** in the **Four (IV)**week. (03 marks)

10. The table below shows the percentage preference of nine most popular holiday destinations as sampled by a tour company for two years **2015** and **2016**

Holiday destination	A	B	C	D	E	F	G	H	I
2015 (x)	90	80	78	78	50	40	30	20	10
2016 (x)	79	90	80	60	60	35	30	60	22

(a) (i) Draw a scatter diagram for the data and comment on the correlation between **x** and **y**.

(ii) Draw a line of best fit on your scatter diagram

(iii) Use the line of best fit to find the value of $\boldsymbol{y}$ when $\boldsymbol{x = 45}$ (08 marks)

(b) Calculate the **rank correlation** co – efficient. (07 marks)

11. The points $\boldsymbol{p, Q}$and $\boldsymbol{R}$ have position vectors $\mathbf{2i + 2j}$; $\mathbf{i + 6j}$ and $\mathbf{-7i + 4j}$ respectively.

(a) (i) Find the vectors $\boldsymbol{QR}$ and $\boldsymbol{PQ}$

(ii) Show that triangle $\boldsymbol{PQR}$ is right – angled at $\boldsymbol{Q}$.(07 marks)

(b) Find the angle between $\boldsymbol{PR}$ and $\boldsymbol{PQ}$. (08 marks)

12. A sugar factory sells sugar in bags of **mean** weight **50kg** and **variance 6.25kg**.Given that the weights of the bags are normally distributed;

(a) Find the probability that the weight of any bag of sugar randomly selected lies between **51.5kg** and **53 kg**.

(b) Calculate the percentage of bags whose weights;

(i) exceed **54 kg**

(ii) lies between **46.58 kg** and **55.58 kg**

(c) Determine the number of bags that will be rejected out **1000 bags** purchased for weighing below **45kg**.

(15 marks)

13. (a) Sketch the curve $\boldsymbol{y = x^2 + 2x - 24.}$ (10 marks)

(b) Find the area enclosed by the curve and the $\boldsymbol{x}$ −axis from $\boldsymbol{x = -4}$ to $\boldsymbol{x = 4}$. (05 marks)

14. A motorist sets of from **townA** and accelerates uniformly for $\mathbf{T_1}$ seconds covering a distance of **500m**. He then travels at a speed of **V km/hr** for $\mathbf{T_2}$ seconds covering a further distance of **1000m**. He then decelerates uniformly for $\mathbf{T_3}$ seconds coming to rest at**townB**. If the total time taken is **5minutes** and that $\boldsymbol{T_1 = {}^1/_2 T_3}$;

(a) Sketch a velocity – time graph.

Find; $\mathbf{T_1}$, $\mathbf{T_2}$, $\mathbf{T_3}$, **V** and distance **AB".** (15 marks)

~END~

SUCCESS IS A STRUGGLE!

SECTION A

1. When expression $x^5 + 4x^2 + ax + b$ is divided by $(x^2 - 1)$, the remainder is $(2x + 3)$, find a and b.

2. Solve for θ: $\tan\theta + 2 = 2\sec^2\theta$, for $0^o \le \theta \le 360^o$.

3. The events A and B are independent. If $P(A) = 0.3$ and $P(B) = 0.5$, find
   (a) $P(A \cup B)$ b) $P(A \cap B')$

4. X is a random variable such that $P(X = x) = \begin{cases} \frac{1}{10}x & ; \quad x = 1,\ 2,\ 3 \\ c & ; \quad x = 4,\ 5 \\ 0 & ; \quad \text{elsewhere} \end{cases}$

   Find (i) the value of the constant c (ii) E(X)

5. A box contains 6 blue pens and 10 red pens. Two pens are picked one after with replacement, find the probability that both are of the same colour.

6. Differentiate w.r.t x: i) $y = (x+1)(2x-1)$ ii) $y = \dfrac{(x^2+1)(x^2+6)}{x^2}$

7. Given that $\mathbf{u} = 4\sqrt{2}(\cos 135^o\,\mathbf{i} + \sin 135^o\,\mathbf{j})$ and $\mathbf{v} = 6(\cos 270^o\,\mathbf{i} + \sin 270^o\,\mathbf{j})$, find $|\mathbf{u} + \mathbf{v}|$.

8. Solve the equation: $2x^3 - x^2 - 5x - 2 = 0$.

SECTION B

(Attempt any **FOUR** questions from this section)

9. Below are the marks obtained by students in Sub Mathematics at Rubaga Girls Senior Secondary school.

Class	40 – < 50	50 – < 60	60 – < 70	70 – < 80	80 – < 90	90 – < 100
Frequency	5	8	12	18	4	3

a) Calculate: i) the modal ii) the mean mark

b) Draw an ogive curve and use the graph to estimate:

i) the median ii) 60^{th} percentile

iii) Number of students who scored below 75%.

10a) A random variable X has a probability density function given by

x	0	1	2	3
$P(X=x)$	$\frac{1}{10}$	$\frac{3}{10}$	b	$\frac{2}{10}$

i) Determine the value of b.

ii) Calculate the variance.

b) The following scores obtained by students who competed in the swimming and dancing competitions in 2014.

Swimming(Y)	600	150	375	550	200	450	250	300	525	350
Dancing(X)	110	170	140	115	165	130	155	150	120	145

i) Draw a scatter diagram and use your graph to estimate:

a) a score obtained by a dancer who scored 425 in swimming.

b) a score obtained by a swimmer who scored 180 in dancing.

ii) Calculate the rank correlation coefficient and make a comment.

11a) The table below shows the prices of four commodities and their weights in 2006 and 2007.

Commodity	Price(**U shs**)		**Weight**
	2006	**2007**	
Banana(1 bunch)	3000	8000	4
Meat(1kg)	2500	3000	3
Milk(1 litre)	300	400	2
Sugar(1 kg)	1500	1800	1

Taking 2006 as the base year, find:

i) the price relative for each commodity.

ii) Weighted price index for all the commodities.

b) The average prices of a bunch of a kilo of sugar in each quarter of a year are given in the table below.

	1st	2nd	3rd	4th
1998	4500	5000	5200	5500
1999	5500	5700	6000	6400
2000	6200	6500	6800	7200
2001	7400	Y		

a) Calculate the 5 point moving averages.

b) On the same graph, show the raw data and the 5 point moving averages and hence, comment on the trend of the prices for this period and use your graph to estimate the value of Y.

12a) Evaluate: i) $\int_1^2 3x^2 - 4x + 2\,dx$ ii) $\int_1^4 \sqrt{x} - \frac{4}{\sqrt{x}} + 2\,dx$

b) Determine the turning points of the curve $y = 2x^2 + 5x - 3$ and sketch the curve $y = 2x^2 + 5x - 3$ and hence, find the area enclosed by the curve and the x axis.

13a) The second term of an Arithmetic progression is 15 and the fifth term is 21. Find the first term and the common difference and hence find the sum of the first 20 terms of the Arithmetic progression.

b) Given that $A = \begin{pmatrix} 1 & 3 \\ 2 & -2 \end{pmatrix}$, evaluate $\det(A^2 - 2A)$.

c) Use the matrix method to solve the simultaneous equations. $\begin{matrix} 2x + y = 3 \\ 3x + 5y = 5 \end{matrix}$

14i) A car initially moving at a speed of $80m\,s^{-1}$ decelerates uniformly and attains a velocity of $40m\,s^{-1}$ for $20s$ and comes to rest in the next $30s$. Sketch a velocity – time graph and use it to calculate the average velocity.

ii) Forces of magnitude $2\sqrt{2}N$, $4N$ and $6N$, act on a body at angles 45^o, 240^o, 330^o with the positive $x-$axis. Draw a clear force diagram and find the resultant force.

END

UGANDA ADVANCED CERTIFICATE OF EDUCATION

MOCK EXAMINATIONS, 2016

SUB-MATHEMATICS

S475/1

INSTRUCTIONS TO CANDIDATES

Answer **ALL** questions from section A and **FOUR** questions from section B

Show all the working clearly

Scientific non-programmable calculators and mathematical tables with a list of formulae may be used

where necessary use g = 9.8ms^{-1}

SECTION A

1. Given that $\frac{1}{\sqrt{2}} - \frac{\sqrt{2}+1}{1+3\sqrt{2}} = a\sqrt{2} + b$ where a and b are constants , find the values of a and b.

(5marks)

2. Events A, B and C are such that $(A) = \frac{2}{7}$, $P(B) = \frac{3}{8}$ and $P(C) = \frac{3}{5}$. Given that A and C are independent events and B and C are mutually exclusive events. Find ;

   (i.) $P(AUC)$

   (ii.) $P(BUC)'$ ***(5marks)***

3. The table shows two variables x and y

X	60	5	30	75	45	36	50	20	10	40
y	38	66	44	28	47	56	48	56	62	54

Calculate the rank correlation coefficient between x and y and comment on your results.

(5marks)

4. Given that $\boldsymbol{a} = 2\boldsymbol{i} + j$ and $\boldsymbol{b} = 3\boldsymbol{i} - 4\boldsymbol{j}$ and $\boldsymbol{c} = 2\boldsymbol{a} + \boldsymbol{b}$ **.** Find;

   (i.) Vector **C**

   (ii.) Modulus of vector **c**. ***(5marks)***

5. Solve the equation $2sin2\theta = 3cos\theta$, $for\ 0^o \leq \theta \leq 360^o$.

(5marks)

6. The cost of building a house is calculated from the costs of cement, sand, bricks, roofing materials and labour.

   The table below gives the costs of these items in 2010 and 2014.

ITEM	COST (shs.) PER UNIT 2010	COST(shs.) PER UNIT 2014	WEIGHTS
Cement	25000	30000	20
Sand	120000	125000	3
Bricks	230000	290000	2
Roofing materials	600000	800000	1
Labour	400000	450000	1

   Using 2010 as base year , calculate the weighted aggregated price index for 2014. And comment on the result. ***(5marks)***

7. Solve the equation $3(1-x)^2 + 7(1-x) + 4 = 0$.

(5marks)

8. A car decelerating at 0.95ms^{-1}passes a certain point with a speed of 30ms^{-1}. Find its velocity after 10s and the distance covered in that time. ***(5marks)***

SECTION B

9. (a.) The data below shows the expenditure in thousands of shillings of 8 families during the month of May 2015.

25, 20, 21, 23, 27, 23, 30, y.

If the mean expenditure was shs.24,000. Find the;

(i.) Value of y

(ii.) Modal expenditure

(iii.) Median expenditure. ***(6marks)***

(b.)The total score in Mathematics and English obtained by 30 students were

164 148 138 145 153 157 147 174 143 148

136 154 170 128 140 178 165 121 149 161

143 150 139 151 139 165 151 133 145 126

Copy and complete the frequency distribution table below for the above data

class	**tallies**	**Frequency (f)**	**Class mark (x)**	**fx**	**Cumulative frequency**	**Class Boundaries**
120 – 129						
130 – 139						
140 – 149						
150 – 159						
160 – 169						
170 – 179						
		Ɛf = **……**		**Ɛfx =** **…….**		

Calculate

(i.) The mean mark

(ii.) The median mark. ***(9marks)***

10. The following table shows the milk production in litres of a diary farm in each quarter of the years 2012, 2013, and 2014

year	**1st quarter**	**2nd quarter**	**3rd quarter**	**4th quarter**
2012	2490	3640	5015	1480
2013	2360	3520	4890	1375
2014	2155	3265	4630	1170

(a.) Calculate the four point moving averages. ***(6marks)***

(b.) (i.) On the same axes, plot and draw graphs of the original data and the four – point moving averages.

(ii.) comment on the trend of milk production. ***(6marks)***

(c.) Use your graph in (b) to estimate the amount of milk produced by the farm in the 1st quarter of 2015. ***(3marks)***

11. (a.) The probability mass function of s random variable X is given by

$$P(X = x) = \begin{cases} kx + \frac{1}{5} & ,x = -1,0,1,2. \\ 0 \quad , & elsewhere \end{cases}$$

Where k is a constant.

(i.) Determine the value of k

(ii.) Compute the mean

(iii.) Find the mode

(iv.) Find $P(x < 0)$.

(15marks)

12. (a.) Given that $V = 7 + 5t - 3t^2$, find the maximum value of V.

(4marks)

(b.) If $\frac{dy}{dx} = 7$, and $x = 1, y = 10,$ $find;$

(i.) y in terms of x

(ii.) x when y = 24 ***(7marks)***

(c.) Evaluate $\int_2^5 \left(\frac{x^2}{3}\right) dx$ ***(4marks)***

13. (a.) Use matrix to solve the simultaneous equations

$$8x - y = 6$$
$$3x + 2y = 26$$ ***(6marks)***

(b.) Mukisa ordered for the following items from a shop; 2 kg of sugar, 3 bars of soap and 1 packet of tea leaves. And Okello ordered for 4 kg of sugar, 1 bar of soap and 2 packets of tea leaves. If the cost of sugar is shs. 2500 per kg, soap shs.2100 a bar and tea leaves shs. 1200 a packet.

(i.) Form a matrix of order 2 X 3 for the items ordered

(ii.) for a matrix of order 3 X 1 for the costs of the items.

(iii.) Use matrix multiplication to find the bills paid by each person.

(9marks)

14. (a.) Two points A and B are 2om apart, if a force of 50N is used to move a body from A to B in 15 s .

(i.) Find the work done.

(ii.) Calculate the rate at which the force is acting. ***(4marks)***

(b.) The point P is 5 metres vertically above point O. A body of mass 0.6 kg is projected from

P vertically downwards with a speed of $3.5ms^{-1}$. Find the speed of the body when it reaches O. ***(11marks)***

THE END

SECTION A: (40 MARKS)

Attempt ***all*** questions in this section.

1. Three matrices **P**, **Q** and ***I*** are such that $\boldsymbol{P}=\begin{pmatrix} a & a+1 \\ a-1 & a+2 \end{pmatrix}$ is singular and ***I*** is an identity matrix. Find the value of a and hence the matrix Q if $\boldsymbol{P}+\boldsymbol{I}=\boldsymbol{Q}$. *(05 marks)*
2. Given that A(1,2),B(4,3) and C(5,-1) are vertices of a triangle ABC, find angle ABC. *(05 marks)*
3. If $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ are the roots of the equation $4x^2-8x+1=0$, find the equation whose roots are α and β. *(05 marks)*
4. Two bags contain similar balls. Bag A contains 4 red and 3 white balls while bag B contains 3 red and 4 white balls. A bag is selected at random and a ball is drawn from it. Find the probability that a red ball is drawn. *(05 marks)*
5. When a polynomial $g(x)$ is divided by x^2+2x-3, the remainder is $2x-2$. Find the remainder when $g(x)$ is divided by
   (i) $x-1$ *(03 marks)*
   (ii) $x+3$ *(02 marks)*
6. The table below shows the price per kg of three food crops .

Item	Price per kg (sh.)		weights
	2000	2010	
Beans	4000	5000	3
Millet	3000	4000	3
Maize	2500	3000	4

   (a) Calculate the price index of each item for 2010 basing on 2000. *(03 marks)*
   (b) Calculate the weighted price index for 2010. *(02 marks)*
7. The number of computers sold by JA company in a period of 8 months is as shown below.

No. of computers	250	200	220	270	220	260	300	240
month	Jan	Feb	Mar	Apr	May	June	July	Aug

   Calculate the four point moving averages for the data. *(05 marks)*

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8. Three forces of magnitudes 5N,12N and 10N on bearings of 060^0,210^0 and 330^0 respectively act on a particle . Find the resultant of the system of forces. *(05 marks)*

SECTION B: (60 MARKS)

Attempt only ***four*** questions in this section.

9. The table below shows the cumulative frequency distribution of marks of 800 candidates who sat a national mathematics contest.

Mark(%)	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
F	30	80	180	330	480	610	700	760	790	800

(a) Calculate the mean and standard deviation. *(08 marks)*

(b) Construct an Ogive for the data and use it to estimate the

(i) Median mark *(04 marks)*

(ii) Quartile deviation *(02 marks)*

(iii) Proportion of candidates that failed if the pass mark was 50%. (01 mark)

10. A quadratic curve has gradient function $(k-2x)$ and is such that when $x=1, y=2$ and when $x=-1,\ y=0$.

(a) Find the value of k and state the equation of the curve. *(07 marks)*

(b) Sketch the curve *(05 marks)*

(c) Find the area bounded by the curve and the x - axis. *(03 marks)*

11. The table below gives marks obtained in a mathematics exam (**M**) and physics exam (**P**) obtained by 10 candidates.

(a) (i) Draw a scatter diagram and comment . *(07 marks)*

(ii)Find the score in mathematics by a candidate who scored 82 in physics. *(02 marks)*

(b)Calculate the rank correlation coefficient and comment on your result.

(06 marks)

12.(a) A and B are events such that $P(A)=1/3$, $P(A \text{ or } B \text{ but not both})=5/12$ and $P(B)=1/4$. Calculate

(i) $P(A\cup B)$ *(04 marks)*

(ii) $P(A'\cap B)$ *(02 marks)*

(iii) $P(B'/A)$ *(02 marks)*

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(b)Two men fire at a target. The probability that Allan hits the target is $1/2$ and the probability that Bob does not hit the target is $1/3$.Allan fires at the target first followed by Bob. Find the probability that

(i) Both hit the target *(02 marks)*

(ii) Only one hits the target *(03 marks)*

(iii)None of them hits the target. *(02 marks)*

13.(a) Given that $2\sin(A-B)=\sin(A+B;)$

(i) Show that $\tan A=3\tan B.$ *(03 marks)*

(ii) Hence determine the possible values of A between -180^0 and 180^0 when $B=30^0$. *(03 marks)*

(b) Solve the equation $2\sin 2x-\cos 2x=1$ for $0^0\le x\le 360^0$. *(06 marks)*

(c) Without using tables or calculators, show that $\cos 75^0=\dfrac{\sqrt{2}\left(\sqrt{3}-1\right)}{4}$.

(03 marks)

14.(a) Bodies of mass 6kg and 2kg are connected by a light inextensible string passing over a smooth fixed pulley with the masses hanging vertically. Find the acceleration of the system when released from rest. *(05 marks)*

(b)A body of mass 2kg moves along a smooth horizontal surface with speed of $2ms^{-1}$. It then meets a rough horizontal surface whose co-efficient of friction is 0.2. Find the horizontal distance it travels on the rough surface before it comes to rest. *(05 marks)*

(c) A particle of mass 5kg rests on a smooth surface of a plane inclined at angle of $30^0$to the horizontal. When a force X acting up the plane is applied to the particle, it rests in equilibrium. Find the normal reaction and force X. *(05 marks)*

END

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SENIOR 6A & 6B SUBSDIARY MATHS 1(S475/1) REVISION EXERCISES

Students are advised to do as many questions as possible.

SECTION A TYPE OF QUESTIONS. (17 questions)

1. Two events are such that P(A')= $\frac{11}{13}$, P(B')= $\frac{3}{5}$ and P(A $\cap B'$)= $\frac{2}{5}$.

   Find (a) P(A $\cap B$) (b) P(A $\cup B'$)

2. Differentiate with respect to x; (a) y= $x^5 - 4x^3 - 6$ (b) y= $-4x^{-2} - \frac{1}{x^4}$

3. Two events A and B are such that P(B)=0.6 and P(A $\cup$ B)= 0.94.

   Find (a) P(A) (b) P(A $\cap B'$)

4. Mary takes $1/15$ minutes to cover a distance of 0.03km. If she accelerates at 2m/s^2 ,

   Calculate the; (a) initial speed

   (b) new speed.

5. An Aeroplane lands at Entebbe International airport at 216km/hr. If the plane covers a distance of 1500 m to come to rest, find the;

   (a) time it takes to stop.

   (b) acceleration of the plane.

6. Find the gradient of the curve y= 3x^2 (5x-1) at the point B (2,4).

7. Solve the equation 2Sec$^2\theta$ +3tanθ -3= 0 such that $0° \leq \theta \leq 180°$

8. Solve the equation $\cos\theta = \sin 2\theta$ for values of θ from 0^0 to 360^0 .

9. The position vectors of points A and B are 3 **i** -5 **j** and 5 **i** +9 **j** respectively. Find the

   (a) position vector of the midpoint M of vector **BA**

   (b) angle between vector **OM** and **OB**

10. Solve the simultaneous equations; **2x -2y =1** and **x^2 - xy - 4=0**.

11. The table below shows the marks(x) and the frequency(f)

	21	23	24	45
f	4	2	3	6

Calculate the (a) mean mark

(b) standard deviation

12. The displacement vector of the particle is given by $\mathbf{r}=4t^2\,\mathbf{i}-5t\,\mathbf{j}$ metres, where t is the time in seconds. Find the speed of the particle after 2 seconds.

13. Use matrices to solve for x and y given that $A=\begin{pmatrix}3 & 2\\ 5 & 4\end{pmatrix}$, $M=\begin{pmatrix}x\\ y\end{pmatrix}$ and $C=\begin{pmatrix}1\\ -4\end{pmatrix}$ such that AM = C.

14. In the crested tower building, a lift is used for regular movements. A Lift is currently parked on the third floor and someone on the seventh floor calls for it, then gets in and travels to the ground floor. Each floor is 3.5m and the whole process takes 50 seconds. Find the (a) overall average speed of the lift.

(b) overall average velocity of the lift.

15. A car increased its velocity from 5m/s to 72km/hr in a distance of 50m. If the car moved with uniform acceleration, find its;

(a) acceleration

(b) velocity when it had covered 20m.

16. Express $3x^2+4x+6$ in the form $A(x+B)^2+C$, where A, B and C are constants. Hence find the minimum value of the expression.

17. The table below shows the grades scored by a group of seven students.

Maths	E	B	D	C	A	O	D
Physics	O	B	E	D	B	C	A

Calculate the rank correlation coefficient for the data. Comment on your result.

SECTION B TYPE OF QUESTIONS (06 questions)

18.(a) Given that matrix Q= $\begin{pmatrix} 1 & -2 \\ 3 & 1 \end{pmatrix}$, find Q^{-1}. Hence, solve the equations;

x- 2y = - 4 and 3x + y = 9.

(b) Given that α and β are the roots of the equation $\mathbf{2x^2 + 5x - 4 = 0}$, find the equation whose roots are $\alpha^3\beta$ and $\alpha\beta^3$.

19. The equation of the curve is $\mathbf{y = 3 + 2x - x^2}$.

(a)Determine the (i) coordinates and nature of the turning point of the curve.

(ii) y and x intercepts of the curve.

(b)(i) Sketch the curve (ii) Find the area enclosed by the curve and the x- axis.

20. The following are the final exam results which were scored by twelve students in Economics (x) and Geography (y)

x	35	56	65	78	49	62	22	90	77	35	52	93
y	57	72	63	76	53	100	38	82	82	19	43	79

(a) Draw a scatter diagram for the data.

(b) Draw the line of best fit and comment on the graph. If x =70, estimate the value of y from the graph.

(c) Calculate the rank correlation coefficient between x and y.

21. The table below shows the ages in years of the mothers at the time they had their first child.

Age	15-	20-	25-	30-	35-	40-45
Frequency	2	14	29	43	33	9

(a) Calculate the mode, mean and the variance of the distribution.

(b) Draw an ogive (cumulative frequency curve) and use it to estimate the

(i) median age, (ii)inter quartile range

22.The table below shows the prices (ug sh) of the items and their corresponding weights.

Item	**Price for year 2000**	**Price for year 2004**	**Weight**
Food	55000	60,000	4
Housing	48,000	52,000	2
Transport	15,000	29,000	3

Using year 2000 as base period, calculate the

(a) price relative for each item

(b) weighted aggregate price index and comment on your result

(c) weighted price index

(d) simple aggregate price index

23. A car travelling on a straight road ABCD starts from rest at A. It travels to B with uniform acceleration until it attains a speed of 12m/s after 2 seconds. It then changes to a uniform acceleration of $1m/s^2$ for 8 seconds until it reaches C. The car then retards to rest at D after a further 10 seconds.

(a) Find the (i) acceleration of the car
(ii) retardation of the car

(b) Sketch the velocity- time graph for the motion and find average speed.

SECTION A (40 MARKS)

Answer all the questions in this section.

1. If $5^x \times 25^{2y} = 1$ and $3^{5x} \times 9^y = \frac{1}{9}$, calculate the value of x and y. (5marks)

2. The table below shows the original marks of six candidates in two examinations.

Candidate	A	B	C	D	E	F
English	38	62	56	42	59	48
History	64	84	84	60	73	69

Calculate the spearman's rank correlation coefficient and comment on the value of your results. (5marks)

3. A and B are acute angles such that $\sin A = \frac{12}{13}$ and $\cos B = \frac{4}{5}$. Without the use of tables or a calculator, find the value of $\sin(A - B)$. (5marks)

4. A committee of 5 people is to be formed from a group of 6 men and 7 women.
   a) Find the number of possible committees. (2marks)
   b) What is the probability that there are only 2 women on the committee? (3marks)

5. The fifth term of an A.P is 23 and the twelfth term is 37. Find the first term and the common difference of the series. (5marks)

6. Three events A, B and C are such that $P(A) = 0.6$, $P(B) = 0.8$, $P(B/A) = 0.45$ and $P(B \cap C) = 0.28$. find
   a) $P(A \cap B)$
   b) $P(C/B)$ (5marks)

7. If α^2 and β^2 are the roots of $x^2 - 21x + 4 = 0$ and α and β are both positive, find;
   i) $\alpha\beta$
   ii) $\alpha + \beta$ (5marks)

8. Find the constant force necessary to accelerate a car of mass 1000 kg from 15 ms^{-1} to 20 ms^{-1} in 10 seconds against a resistance of 270 N. (5marks)

SECTION B (60 MARKS)

Answer only four questions from this section.

9. Eggs laid at Hill farm are weighed and the results grouped as shown below:

Mass (g)	Frequency
– 50	3
– 54	2
– 58	5
– 62	12
– 66	10
– 70	6
– 74	2

a) i) Draw a cumulative frequency curve for the data.
ii) Use the curve to estimate the number of eggs of mass less than 60 g.

b) Calculate the:-
i) median mark
ii) variance (15marks)

10.a) Find the angle between the vectors $\boldsymbol{e} = -i - 2j$ and $\boldsymbol{f} = 2i + j$. Give your answer to the nearest degree.

b) The points A, B and C have position vectors **a**, **b** and **c** respectively referred to an origin O.

i) Given that the point X lies on AB produced so that AB : BX = 2:1, find the position vector of **X** in terms of **a** and **b**.

ii) If Y lies on BC so that BY : YC = 1 : 3, find the position vector of Y, in terms of **b** and **c**. (15marks)

11.a) The masses of packets from a particular machine are normally distributed with mean of 200g and standard deviation of 2g. Find the probability that a randomly selected package from the machine weighs:
i) less than 197g
ii) more than 200.5g
iii) between 198.5g and 199.5g (10marks)

b) Given that $X \sim B[10,0.8]$, find
i) P(X=8)
ii) the expectation (5marks)

12.a) Sketch the curve $y = x^2 - 6x + 5$, showing all the necessary points. (10marks)

b) Find the area between the curve $y = x^2 - 6x + 5$ and the x-axis from $x = 0$ to $x = 3$. (5marks)

13. A bag contains 5 black counters and 6 red counters. Two counters are drawn, one at a time and not replaced. Let X be the r.v "the number of red counters drawn". Find E(X). (15marks)

14. A motorist moving at 90 kmh^{-1} decelerates uniformly to a velocity V ms^{-1} in 10 second. He maintains this speed for 30 seconds and then decelerates uniformly to rest in 20 seconds.

a) Sketch a velocity – time graph for the motion of the motorist.(6marks)

b) Given that the total distance travelled is 800m, use your graph to calculate the value of V. (5marks)

c) Determine the two decelerations. (4marks)

END

MOUNT OF OLIVES COLLEGE KAKIRI
INTERNAL EXAMINATION 2016
SUBSIDIARY MATHEMATICS

Duration: *2hrs 40mins*
Instructions: *Answer all the eight questions in Section and only four question in Section B*
Any additional questions will not be marked
Begin each answer on a fresh sheet of paper where necessary take acceleration due to gravity as $g = 9.8ms^{-2}$
Silent non-programmable scientific calculators and mathematical tables with a list of formulae may be used

SECTION A (40 marks)
Answer all questions in this section

1. Evaluate; $\int_2^3 (6x^2 - 1)dx$ 5mks

2. Solve for x: $\log_3^{(2x+1)} - \log_3^{(3x-11)} - 2 = 0$. 5mks

3. If vectors $\boldsymbol{r}_1 = 3\boldsymbol{i} + 2\boldsymbol{j} + 7\boldsymbol{k}$ and $\boldsymbol{r}_2 = 2\boldsymbol{i} + 4\boldsymbol{j} - 5\boldsymbol{k}$.
Find the angle between vectors $\boldsymbol{r}_1$ and $\boldsymbol{r}_2$ 5mks

4. The weights of a group of students form a normal distribution with mean 67.6kg and standard deviation 6.2. Find the probability that the weight of a student chosen at random lies between 66kg and 79kg.5mks

5. A random variable X has a probability distribution;

x	0	1	2	3
f(x)	0.1	0.3	0.5	0.2

Calculate the variance of x. 5mks

6. A motor car, starting from rest and moving with uniform acceleration, goes 9.5m in the 10^{th} minute after starting. Find the acceleration of the car, and the distance covered during 5 seconds form the start. 5mks

7. Use matrix method to solve the equations;
$3x + y = 4$
$4y + 26 = 2x$ 5mks

8. The table shows marks obtained in Submaths and Economics for ten students;

Economics	90	40	66	85	50	50	28	75	74	34
Submaths	86	40	64	80	45	56	29	80	67	37

Calculate the rank correlation coefficient for the data. Hence comment on your result. 5mks

SECTION B(60 marks)

Attempt any four questions from this section

9. a) The sum of the 5^{th}, 6^{th} and 7^{th} terms of an arithmetic progression is 95 and 10^{th} term is 49. Find the;

   i) Common difference and first term 7mks

   ii) Sum of the first 22 terms of the progression. 2mks

   b) An employee decided to make monthly savings of his salary by starting with Shs. 60,000 in January 2010. He constantly increased the savings every month by Shs. 5,000. Find the total of his savings at the end of August 2011. 6mks

10. The following table shows the number of pairs of shoes sold by a certain shoe company in each quarter of the years 2013, 2014 and 2015.

Year	Quarter			
	1	2	3	4
2013	234	926	653	431
2014	275	978	704	472
2015	296	1003	728	498

   a) Calculate the four point quarterly moving averages. 5mks

   b) On the same axes, plot and draw graphs of the given data and the four point moving averages. 7mks

   c) Use your graph in (b) to estimate the number of shoes which were sold in the first quarter 2016. 3mks

11. a) Events A and B are independent where $P(A \cap B) = \frac{1}{4}$ and

$P(A \cup B)^{\prime} = \frac{1}{4}$. Find;

i) P(A)

ii) ii) P(B) 7mks

b) At a certain police traffic checking point, the probability that a driver is found drunk is 0.6. Out of 8 drivers checked, find the;

i) Expected number of drunkard drivers

ii) Probability that exactly 3 drivers are found drunk

iii) Probability that more than 6 drivers are found drunk 8mks

12. a) A curve has the equation $y = x^3 - \frac{3}{2}x^2 - 6x + 12$.

i) Write down an expression for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.

ii) Find the x – coordinates of the two stationary points on the curve. Hence determine the nature of the stationary values.

10mks

b) Solve the differential equation, $\frac{dy}{dx} = 3 + 9x$, given that y = 15 when x = 2. 5mks

13. The table below shows the age at which women marry in a certain country;

19	20	19	22	28	22
30	31	36	21	29	24
34	33	39	23	26	21
32	18	21	37	25	27
17	35	24	25	27	22
16	38	36	26	38	21

a) Form a frequency distribution table with class intervals of 5 with the lowest age of 16.

b) Calculate;

i) Mean

ii) Modal age

c) Draw a cumulative frequency curve and use it to estimate the percentage of women who marry at the age of 30 and above.

14. a) A block of mass 200kg rests on a rough horizontal plane.
The coefficient of friction between the block and the plane is 0.25.
Calculate the frictional force experienced by the block when a horizontal force of 50N acts on the block.

b) A force acting on a particle of mass 5kg moves it along a straight line with a velocity of $10ms^{-1}$. The rate at which work done by the force is 50 watts. If the particle starts from rest, determine the time it takes to move a distance of 100m. 8mks

END

SECTION A: (40 MARKS)

*Attempt **all** questions in this section.*

1. Find the value of a if $(x-1)^2$ is a factor of $2x^2-5x^2+4x-1$. Hence solve the equation $2x^3-5x^2+4x-1=0$. *(05 marks)*

2. In a geometric progression, the second term exceeds the first term by 20 and the fourth term exceeds the second by 15. Find the possible values of the first term. *(05 marks)*

3. Given that $\frac{dy}{dx}=\frac{4x-3}{3y^2}$ and that $y(0)=1$, obtain an equation relating x and y. *(05 marks)*

4. Two events A and B are such that $P(A)=P(B), P(A\cap B)=1/3$ and $P(A'\cap B')=1/6$, by use of a venn diagram, find $P(A\cap B')$. *(05 marks)*

5. Show that $b=a^2$ if $\log_a b^2+\log_b a^4=6$ provided $b\neq a$. *(05 marks)*

6. The weights of a large number of children are normally distributed with mean of 16kg and standard deviation of 2 kg.Find the probability of children who weigh between 14 and 16 kg. *(05 marks)*

7. The table below shows the cumulative distribution of marks obtained by 25 students in a test.

marks	0	1	2	3	4	5	6	7	8	9
Frequency	1	2	4	3	a	5	c	2	1	1
Cum. freq	1	3	7	10	13	b	21	23	24	25

Given that the median is 13, find the values of a,b and c. Hence calculate the mean mark. *(05 marks)*

8. Five forces of 1,3,5,6 and 7N act along the lines AB,CB,AD,DB and CD respectively of a triangle ABCD. The direction of the forces is given by the order of the letters. The 6N force makes an angle of 30^0 with DC.Taking AB as horizontal, find the magnitude and direction of the resultant. *(05 marks)*

SECTION B : (60 MARKS)

*Attempt only **four** questions from this section. All questions carry equal marks.*

9. (a) The table below shows the probability distribution function of a discrete random variable X.

X	-1	0	1	2
$P(X = x)$	0.4	0.1	0.3	0.2

(i) Calculate $P(X < 2 / X > 0)$ *(04 marks)*

(ii) Obtain the variance of X *(04 marks)*

(b) The pdf of a continuous random variable X is given by

$f(x) = \begin{cases} 3kx^2; 1 \le x \le 3 \\ 0 \quad ; \text{elsewhere} \end{cases}$. Find

(i) the value of k *(03 marks)*

(ii) the expectation of X. *(04 marks)*

10. The table below shows the number of years a certain patient has smoked Marijuana and the corresponding percentage scored in an aptitude exam.

Patient	A	B	C	D	E	F	G	H	I	J
No. of smokers	15	22	25	28	31	33	36	39	42	48
Exam score	75	70	72	60	35	57	30	55	50	30

(a) Plot the pairs of values on a scatter diagram and use it to identify the type of correlation between the pairs of values. *(07 marks)*

(b) Calculate the rank correlation co-efficient and advise the public accordingly. *(08 marks)*

11. The table below shows the quarterly revenue in shillings of Paroma limited over a three year period.

Year	1st quarter	2nd quarter	3rd quarter	4th quarter
2008	14,000,000	17,000,000	28,000,000	13,000,000
2009	18,000,000	21,000,000	30,000,000	15,000,000
2010	24,000,000	23,000,000	34,000,000	19,000,000

(a) Plot these data on a graph paper using a suitable axes. *(04 marks)*

(b) Calculate the four quarterly moving averages and plot these on the graph obtained in (a) above. *(07 marks)*

(c) Draw a trend line and use it to estimate the income expected in the first quarter of 2011. *(03 marks)*

(d) Comment on the general trend of the revenue over the three year period. *(01 mark)*

12. (a) Show that $\frac{\cos^2\theta}{1-\sin\theta} = 1+\sin\theta$. Hence solve the equation

$\frac{\cos^2\theta}{1-\sin\theta} = \cos 2\theta$ for $0^0 \le \theta \le 360^0$. *(08 marks)*

(b) Without using tables or calculator, find in surd form the value of $\tan 105^0$. *(04 marks)*

(c) If $\tan\theta = -8/15$ and θ is obtuse, find the value $\cos ec\,\theta$ without using a calculator. *(03 marks)*

13. A curve y has a gradient function $6-2x$ and it passes through the point $(-1,5)$.

(a) Find the equation of the curve *(05 marks)*

(b) Sketch the curve *(06 marks)*

(c) Obtain the area bounded by the curve and the x-axis. *(04 marks)*

14. A stone Q is projected vertically upwards with a speed of $5ms^{-1}$ from the top of a cliff 10m above the ground. At the same time another stone P is projected vertically upwards from the bottom of the cliff at $12ms^{-1}$. Calculate the

(a) Vertical distance between the two stones when Q is at its maximum. *(07 marks)*

(b) Velocity of P when the first stone is at its maximum. *(02 marks)*

(c) Time that elapses and position jusy before the two stones collide. *(06 marks)*

END