

SMATA POST MOCK SEMINAR

S.6 SUBSIDIARY MATHS 2022



AT

ST. JOSEPH OF NAZARETH HIGH SCHOOL

24th September, 2022

SEMINAR QUESTIONS

PURE MATHEMATICS

INDICES AND LOGARITHMS

- 1 a). Show that $b = a^2$ if $\log_a b^2 + \log_b a^4 = 6$ Provided that $b \neq a$.
- b). Solve for x in $\log_3(3x + 1) - \log_3(3x - 11) - 2 = 0$
- c). Given that $5^x \times 25^{2y} = 1$ and $3^{5x} \times 9^y = \frac{1}{9}$, calculate the value of x and y .

SURDS

2. Given that $\frac{3-2\sqrt{3}}{3+2\sqrt{3}} - \frac{3+2\sqrt{3}}{3-2\sqrt{3}} = a + b\sqrt{3}$

Find the rational values of a and b .

3. a). Given that $A = \begin{bmatrix} 1 & 3 \\ 2 & -2 \end{bmatrix}$, evaluate $\det(A^2 - 2A)$
- b). Given that $P = \begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix}$ and $Q = \begin{bmatrix} 1 & 2 \\ -1 & 5 \end{bmatrix}$
If $C = PQ$, find the Inverse of C .

- c). Find $AB + I$ when $A = \begin{bmatrix} -3 & 1 \\ 2 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 7 & 0 \\ 8 & -6 \end{bmatrix}$ and I is a 2×2 identity matrix.
- 4 a). Without using tables or a calculator, find in surd form the value of $\tan 105^\circ$.
- b). If $\tan \theta = -\frac{8}{15}$ where θ is obtuse, find the value of $\operatorname{Cosec} \theta$ without using a calculator.
- c). 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 $0^\circ \leq \theta \leq 360^\circ$
- 5 a). A Committee of 5 people is to be formed from a group of 6 men and 7 women.
- i). Find the number of possible committees.
- ii). What is the probability that there are only 2 women on the committee.
- iii). What is the probability that the committee has more women than men.

DIFFERENTIATION

6. Differentiate the following with respect to x
- i). $(x+5)^2(x-1)$
- ii). $\frac{1}{x^2} + x^2$
- 7 a). A curve is such that $\frac{dy}{dx} = 3 - 2x$ and a point $p(1, 0)$ lies on the curve
- i). find the equation of the curve.
- ii). Coordinates of the points where the curve meets the x and y axes.
- iii). Coordinates and nature of the turning point.
- b). Sketch the curve in(a) above and find the area enclosed by the curve and the x -axis.

DIFFERENTIAL EQUATIONS

8. Solve the differential equation

$8y \frac{dy}{dx} = 9x^2$ hence, find the solution given that $y=2$ when $x=1$.

9. The population of a certain organism grows at a rate proportional to the number of organisms present at any time t . Initially the population N was 500 and it double every after 36 hours.

- a). Form a differential equation for the growth of the organism hence solve it.
- b). Find the time required for the population to triple.

APPLIED MATHEMATICS

PRICE INDICES

10. The table below shows the prices of items in 2020 and their price relatives in 2021 with the corresponding weights.

Item	Price	Price relatives	Weight
	2020	2021	
Wheat	5100	1.118	10
Sugar	4000	0.9	5
Milk	1000	1.4	4
Eggs	9000	0.944	2
Baking flour	1000	1.3	1

Using 2020 as the base year,

- a). Determine the price of each item in 2021.
- b). Compare the
- i). Simple aggregate price index.
- ii). Weight aggregate price index
- iii). Cost of living index and comment.

PROBABILITY

11. If events A and B are such that $p(A)=0.20$, $p(A'nB)=0.22$ and $p(AnB)=0.18$

Determine i). $p(A')$ ii). $p(AnB')$

- 12 .a). Two bags contain similar balls. Bag A contains 5 red and 4 white balls while bag B contain 4 red and 5 white balls. A bag is selected at random and then a ball is drawn from it. Find the probability that a white ball is drawn.

- b). Events A,B and C are such that $P(A) = \frac{2}{7}$, $P(B) = \frac{3}{8}$ and $P(C) = \frac{3}{5}$.

Given that A and C are independent events while as B and C are mutually exclusive events. Find:

i) $P(AUC)$

ii) $P(BUC)$

- c). A and B are independent events such that $P(A) = 0.3$ and $P(B) = 0.35$ evaluate

i). $P(AnB)$

ii). $P(A/B)$

iii). $P(B/A)$

RANDOM VARIABLES

13. A continuous random variable x has a pdf given by

$$f(x) = \begin{cases} ax, & 0 \leq x \leq 1 \\ -\frac{a}{2}(x-3), & 1 \leq x \leq 3 \\ 0 & \text{elsewhere} \end{cases}$$

Sketch f(x) and hence or otherwise find the value of a.

15. A random variable X has a probability distribution given by.

$$P(X = x) = \begin{cases} \frac{x}{5k}; & x = 1, 2, 3, 4, \dots \\ 0; & \text{Elsewhere} \end{cases}$$

Calculate the i). value of k

- ii). $p(1 < x < 3)$
- iii). mean $E(x)$

15. A continuous random variable X has a probability density function $f(x)$ defined by

$$f(x) = \begin{cases} k(x^2 + 5); & -1 \leq x \leq 2 \\ 0; & elsewhere \end{cases} \quad \text{where } k \text{ is a constant.}$$

Determine i). value of k

ii). $P(1 \leq x \leq 1.5)$

iii). Expectation $E(x)$ hence $E(3x + 7)$

iv). Variance of x and hence find the standard deviation of $(3x + 7)$

STATISTICS

16. The time taken in seconds for phone calls by a selected number of students at the school telephone booth were recorded as follows

110, 132, 101, 91, 89, 122, 115, 106, 109, 112, 105 and 106

Find the i). median time

ii). mean time

17. A survey was conducted during the Covid-19 lockdown at Mulago Hospital; it was found out that 72 patients from Kampala had the following ages (yrs).

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
25	38	56	36	42	47	47	54	59	47	58	57
52	42	50	55	60	45	45	56	59	49	44	36
41	23	34	54	52	29	38	56	59	40	43	46

a). Construct a grouped frequency table starting with a class 20 – 24 to represent the above data.

b). Calculate the

i). Mean age

- ii). Modal age
 - iii). Standard deviation
- c). Draw a cumulative frequency curve and use it to estimate.
- i). median age
 - ii). Interquartile range
 - iii). middle 60% percentile.

MOVING AVERAGE

18. The table below shows the number of boxes of Testing Kits of Covid-19 by National drug store from the year 2019 – 2022.

Year	Quarters			
	1 st	2 nd	3 rd	4 th
2019	192	280	329	2260
2020	300	360	380	270
2022	424	480	510	4121

- a) Calculate the four-point moving average for the data given.
 - b) i). On the same axes, plot the original data and the four point moving averages.
 - ii). Comment on the trend of the number of boxes of testing kits over the period.
 - c) Use your graph to estimate the number of boxes of testing kits in the
 - i). 4th quarter of 2018
 - ii). 1st quarter of 2023
19. 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-maths	70	85	70	90	92	88	76	70	73	76

- a) Represent the above data on scatter diagram.
 - i). Draw the line of the best fit.
 - ii). If a student scored 75% in History, predict his score in a Subsidiary mathematics paper using the best line of fit.

- 20 a). The probability that a driver will cause an accident on a journey is 0.3, if he makes 12 such journeys, what is the probability that;
- i). exactly 10 of the journey have accidents.
 - ii). four to five inclusive journeys have accidents.
 - iii). at most 2 journeys have accidents.
- b). The marks obtained in UACE Sub-maths examination of 2021 were found to be normally distributed with mean 50% and standard deviation 10%. Determine the probability that a student scored;
- i). above 60%
 - ii). below 45%
 - iii). number of students who scored between 60% and 75% if 10,000 students sat.
 - vi). Percentage of students who scored between 40% and 60%.

MECHANICS

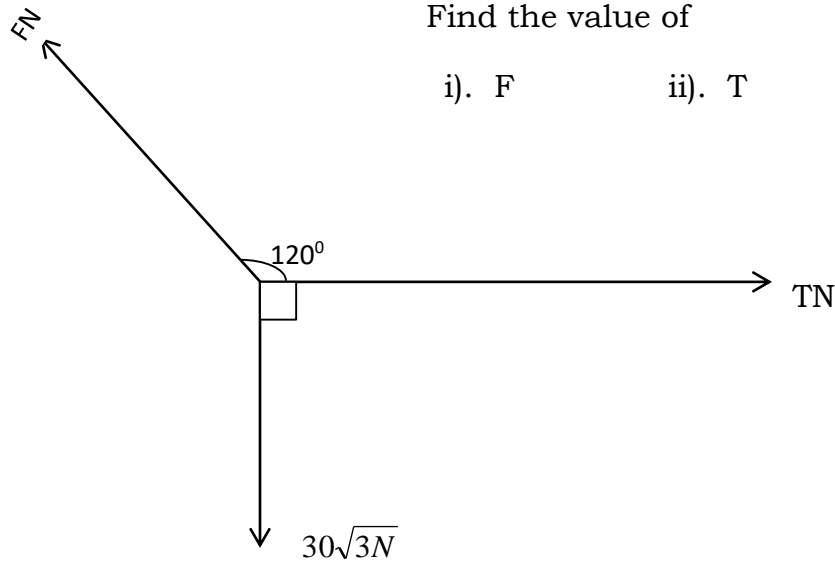
21. A particle starts from rest and accelerates uniformly for 5 seconds acquiring a velocity $V \text{ ms}^{-1}$. It maintains this velocity for 5 more seconds and then brought to rest in 2 seconds. The particle covered a total distance of 68metres.
- a). Sketch the velocity time-graph for the motion of the particle.
 - b). Use the sketch to find the value of V hence find the acceleration for the first part of the journey.
 - c). A particle of mass 0.5kg rests on a rough horizontal table. It is connected by a light inextensible string that passes over a smooth fixed pulley fixed at the edge of the table to another particle of mass 0.8 kg that hangs freely in equilibrium. When the system is released from rest, the 0.8kg mass particle moves a distance of 0.4m in 0.5 seconds.
- Find the
- i). acceleration of the particle
 - ii). Tension in the string.

d). The system of forces given below is in equilibrium.

Find the value of

i). F

ii). T



END

THANK YOU FOR YOUR PARTICIPATION

“SMATA”

Together for Mathematics

smatauganda@gmail.com

0702790079/ 0777088032