HOME PACKAGE

FORM V SENGEREMA SECONDARY SCHOOL

BASIC APPLIIED MATHEMATICS

CALCULATING DEVICES

1. (a) The first order rate constant for the composition of ethyl iodide at initial temperature

$(T_1 = 600\ K)$ is $k_1 = 6.0 \times 10^{-5} s^{-1}$. Its energy of activation (Ea) is $209000\ JmolL^{-1}$.

Using a non-programmable calculator find the rate constant (k_2) of the reaction at final

temperature $(T_2 = 700K)$, if $\log\left(\dfrac{k_2}{k_1}\right) = \dfrac{Ea}{2.303R}\left[\dfrac{T_2-T_1}{T_1T_2}\right]$. Use $R = 8.314\ JmolL^{-1}K^{-1}$.

(b)   Using a non-programmable scientific calculator, calculate modulus and argument of the

following complex number Z if $Z = \dfrac{(3-i)(2+3i)}{3+i}$.

(c)   If $M^{\frac{2}{3}} = \dfrac{\sqrt[5]{w}}{10^{-3} \times \log_3 y + \sin^{-1} z}$, $w = 3.652 \times 10^e, y = e^{10} \times 0.00047$ and

$z = \lim_{x\to 0} \dfrac{\sin x}{x}$. Find the value of M to five decimal places

2. a) By using scientific calculator, compute the value of the following expressions:

i) $\dfrac{\log_3 \begin{vmatrix} 1 & 2 & 3 \\ 0 & 1 & 3 \\ 2 & -1 & 5 \end{vmatrix} - \left(\ln\left[\frac{3}{13}\right]^{1/3}\right)\sin\left(\frac{-\pi}{6}\right)}{\int_{-2}^{3}(x-2)(x+1)(x-1)dx}$

ii) $\dfrac{\sqrt{(\sqrt{19})e^2 \ln 3}}{\sqrt{2}}$ correct to 10 significant figures.

b) By Using scientific calculator, approximate the mean and the standard deviation of the constants:

$\pi, \sqrt{2}, e, \sqrt{3}$, 1.414213, 2.718282, 3.1415, 1.732051 correct to six decimal places.

3. (a) Use a non-programmable scientific calculator to evaluate the following:

(i) $\displaystyle\sum_{x=0}^{10} \dfrac{x\ln(x+3)}{x^2+1}$

(ii) $\dfrac{d}{dx}\left[\left(\dfrac{\cot 2x}{\sec x}\right)^{x+1}\right]$ at $x = 0.2$

4. (a) Using a non-programmable scientific calculator, evaluate

(i) $\sqrt{e^3\sqrt{In8}-\cos 300^\circ}$ correct toe 6 decimal places

(ii) $\sqrt{\dfrac{e^{In2}+\sqrt{\log\sqrt{6}}}{In13}}$ correct to 5 significant figures.

(iii) $2\sqrt{13}\cos\left(\dfrac{1}{3}\arctan\left(\dfrac{18\sqrt{3}}{35}\right)\right)$

(b) Evaluate by a calculator the $\bar{x}$ and σ of the numbers 40, 34, 35, 46, 44, 31 and 60   (04 marks)

5. Use a non-programmable scientific calculator to compute;

a) $\displaystyle\sum_{x=2}^{6}\ln\left(\dfrac{3^x}{\log x+\sqrt[3]{x}}\right)$, to five significant figure

b) Mean and standard deviation of the following observation (correct to six decimal places)

Value	112.25	122.25	132.25	142.25	152.25	162.25	172.25
Frequency	13	25	22	37	17	14	3

c) Solve for x and y $\begin{cases} -3x+8y = 50 \\ 1\frac{3}{4}x - 5y = 31.5 \end{cases}$

6. Use a non-programmable scientific calculator to compute

(a) The value of $\dfrac{3+3(\sqrt[3]{0.65})}{3-3(\sqrt[3]{0.65})}$ correct to 4 significant figures

(b) The mean and standard deviation of $33, 28, 26, 35, 38$ to 2 decimal places.

(c)M^{-1} If $M = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$

7. By using scientific calculator, evaluate

(a) The value of e^m, given that $m = \sqrt{\dfrac{(p-q)(p+q)}{4r(r-q)}}$ if $p = 1.49621, q = 0.04463$

$$r = 0.51010$$

(b) The value of $\int_0^2 (x^2 - 3)^3 \, dx$ in to 1 decimal place

(c) The value of $\sqrt{\pi^{\sqrt{2}} + (\dfrac{\ln 22}{\cos 52})^2}$

8. Use non-programmable calculator, to evaluate the following:

(a) $\dfrac{(12.816 \times 0.024^2)^3}{0.0096 \times \sqrt{12.216}}$ to six decimal places.

(b) The value of (i) AB (ii) $|AB|$ (iii) $(AB)^T$

Given that A= $\begin{pmatrix} 2 & 1 & -1 \\ 3 & 5 & 2 \\ -1 & 2 & 3 \end{pmatrix}$ and B = $\begin{pmatrix} 2 & 3 & -1 \\ -3 & 1 & 2 \\ 3 & -4 & -4 \end{pmatrix}$

(c) (i) Mean $(\bar{x})$

(ii) $\sum fx$

(iii) Standard deviation of the distribution

x	62	63	64	65	66	67	68	69	70
f	25	35	52	84	120	135	101	61	40

FUNCTIONS

9. The function f is defined as $f(x) = \begin{cases} 2x - 1 \ if -2 < x \leq 1 \\ x^2 \ if \ 1 < x \leq 2 \\ 10 - 3x \ if \ 2 < x < 3 \end{cases}$

(a) Sketch the graph of $f(x)$

(b) State domain and range of $f(x)$

10. Given that $(x) = 3x + 3 \ \ g(x) = x + 3$, find

(a) $(fog)(x)$

(b) $(fog)^{-1}(x)$

(c) State domain and range of $(fog)^{-1}$

11. a) Consierthe table as here under of cost mailing parcels

Weight in grams(x)	$0 < x \leq 50$	$50 < x \leq 100$	$100 < x \leq 150$	$150 < x \leq 200$	$200 < x \leq 250$
Cost in Tsh f(x)	500	700	900	1100	1300

Using the above useful information, draw the required graph of the function and state domain and range

b) Given that $f(x) = 3x + 3$ and $g(x) = x + 3$ find:-
   i. $(fog)(x)$
   ii. $(fog)^{-1}(x)$

12. (a) Given that $f(x) = 2x^2 + 3x - 2$ and $g(x) = 2x^2 - 3$. Find

(i) $(f + g)(4)$

(ii) $(f - g)(2)$

(b) Given that $f(t) = 3 - (\frac{200}{200+t})^3$. Find $f(200) - f(0)$

(c) Given that $f(x) = 12 - x - \frac{20}{x+4}$ where $0 \leq x \leq 6$. Find the domain and range of $f(x)$

13.(a) The costs of shaving hair of a different age groups in a certain saloon are as follows
        Here under:-
   i.   Shaving the group aging from 10 to 20 years cost Tzs 2000/=
   ii. Shaving the group of aging from 20 to 30 years exclusively costs Tzs 4000/=
   iii. The group aging 30 and above years cost Tzs 6000/=
   Draw the graph of the above information and hence or otherwise state domain and range what kind of graph is that?

(b) If PP is inversely proportional to (r) (r) and the square root of (ss)
and that $P = 2p = 2$, when $r = \frac{1}{8}$ and $s = \frac{1}{4}, r = \frac{1}{8}$ and $s = \frac{1}{4}$.
Find (i) A formula giving p in terms of (r) and (s)

                    (ii) The Value of p when $r = \frac{3}{8}$ and $s = \frac{1}{9}$

.
$r = \frac{3}{8}$ and $s = \frac{1}{9}$,
   (c) Given that $f(x) = 2x^2 + 3x - 2$ and $g(x) = 2x^2 - 3$,
   $f(x) = 2x^2 + 3x - 2$ and $g(x) = 2x^2 - 3$, find: (i) $(f+g)(x)(f+g)(x)$ (ii)
   $(f-g)(x)(f-g)(x)$

ALGEBRA

14. (a) Solve for x and y

$$x - 2y = 7$$
$$x^2 + 4y^2 = 37$$

(b) Evaluate $\sum_{r=7}^{13} (3r - 2)$

(c) Find the sum to infinite of $\sum_{r=1}^{n} 5^r$

15. a) i) Solve the simultaneous equation by substation method

$$\begin{cases} 2c + 2d = c - d \\ 2d + 2 = c + 1 \end{cases}$$

ii) Find the value of x satisfying the equation $4^x - 6(2^x) - 16 = 0$

b) The sum to infinite of geometric series whose second term is 4 is 16 find;
1. the first term
2. the common ratio

16. (a) The sum of the first n terms of a series is 3×4^n. Find the first three terms of the series.

(b) Find the sum of $\sum_{k=0}^{\infty} \frac{12}{100^k}$

(c) Use series to express 0.999... as a fraction

17. (a) Solve the simultaneous equations $x^2 - 2y = 7$ and $x + y = 4$ use substitution method.

(b) Given the series $-5 - 2 + 1. . .$
   i. express it in sigma notation
   ii. find the 88th term of the series

18. The sum of two whole numbers is twelve and the product of the same numbers is twenty, what is the difference between the two numbers?

(b) Find the sum to infinity of the series $\frac{3}{10} + \frac{3}{100} + \frac{3}{1000} + \cdots$

(c) The arithmetic mean of two numbers is 34 and their geometric mean is 16. Find the

5

numbers.

DIFFERENTION

19. By using the first principles, find the derivative of $f(x) = ax^2 + bx + c$

    (b) By using implicitly of differentiation find $\frac{dy}{dx}$ of $x^3 + 3x^2y + 3xy^2 + y^3 = 0$

    (c)A particle moves through a distance (s) in time t and its displacement function is given

by $s(t) = 3t + t^3$. Calculate the velocity and acceleration after 2 seconds.

20. a) Apply first principle of differentiation to find the derivative of $f(x) = \sqrt{x}$

    b) Find the slope of the tangent to the curve $8x^3 + xy^3 - 5y^2 = 0$ at $(1, -1)$

    c) Use second derivative test to classify the stationary points of the curve
$$f(x) = 2x^3 + 3x^2 - 12x - 5$$

21. (a) Find the gradient of the functions: -
    (i) x^2
    (ii) $3x^5$
    (iii) $10x^5 - \frac{1}{4}x^3 - \frac{6}{x}$.

    (b) Differentiate from the first principle
    (i) $3x^2$
    (ii) $y = \sqrt{2x - 3}$

22. Differentiate from 1st principles

    (i) $y = \sqrt{2x^2 + x}$

    (ii) $y = \frac{1}{\sqrt{2x}}$

    (iii)(a) Find the derivative of each of the following
    (iv)   (i) $y = (2 - x)^3$

            (ii) $y = \sqrt{(3x^3 - x^2}$

    (b) Find $\frac{dy}{dx}$, Given that $x^3y + xy^3 = 4$

23. (a) Find the gradient of the polynomial $y = 2 - 4x - x^2$

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(b) The volume V of a sphere of radius r is $V = \frac{4}{3}\pi r^3$ and the area A is $A = 4\pi r^2$. The Volume is increasing at the steady rate of $10\ cm^3/s$. If t is the time in seconds, find

    (i) $\frac{dr}{dt}$ At the instant when $r = 7cm$

    (ii) $\frac{dA}{dt}$ At the instant when $r = 7cm$

    (c) Suppose that the cost function is $C(x) = 0.005x^3 - 3x$, what is the marginal cost when $x = 1000$

INTEGRATION

.26. (a) Find $\quad \int \frac{x}{2+3x^2}\,dx$

    (c) Find the area bounded by the lines $y = 0$, $y = 1$ and $y = x^2$.

27. Find the following: -

(a) $\int \left(x - \frac{1}{x}\right)^2 dx$

(b) $\int x\left(\sqrt{x} - -2\right)^2 dx$

(c) $\int x^{\frac{1}{2}}(2x - 3)dx$

28. . (a) Integrate $\int \frac{x+1}{\sqrt{(x^2+2x)^3}}\,dx$

    (b) Integrate $\int_0^2 (2x^2 - 3x)\left(\frac{2}{3}x^3 - \frac{3}{2}x^2 - 3\right)dx$

    (c) Find the area enclosed between the curve $y = 2x^2 - 2$ and $x - axis$ from $x = -2$ to $x = 2$

29. (a) Integrate $\int_2^4 \left(3x^2 - ax - \frac{16}{x^2}\right)dx = 40$. Find the value of a.

    (b) Evaluate $\int \frac{3x^2+2}{(x^3+2x)^5}\,dx$

    (c) Find the volume of solid revolution covered by the curve $y = x^2$ from $y = 0$ to $y = 2$ about $y - axis$.

30. (a) If $f'(x) = x^2 + 1$ and $f(3) = 2$. Find $f(x)$.

    (b) Integrate $\int (x + 1)\sqrt{x^2 + 2x + 3}\,dx$

    (c) Find the volume of the solid generated by rotating about $x - axis$, the area bounded

by $y^2 = x^2 + 2$ and $x - axis$ between $x = 1$ and $x = 4$

STATISTICS

31. The following table shows the distribution of marks on a final examination in Basic Applied Mathematics

Marks	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69
Frequency f	2	5	13	16	9

   a) Estimate the mode by using histogram
   b) Draw the cumulative frequency curve (ogive) and use it to estimate the median.
   c) By coding method calculate mean and standard deviation
      (Use Assumed mean $= 44.5$)
   d) Find P_{10} (10 percent) and P_{90} (90 percent) of the distribution

32. The following table shows the distribution of marks on a final examination in Physics

Marks	$45 - 49$	$50 - 54$	$55 - 59$	$60 - 64$	$65 - 69$	$70 - 74$	$75 - 79$	$80 - 84$
No. of students	5	10	9	15	17	7	3	6

Calculate;

   a) The mode

   b) The upper quartile

   c) The 88th percentile of the distribution

33. The weekly wages packets of 100 workers in a small industry are distributed as follows

$Wages(USD)$	$30 - 34$	$35 - 39$	$40 - 44$	$45 - 49$	$50 - 54$	$55 - 59$
$No. of workers$	15	19	26	16	13	11

   Find:-
   a) Mean
   b) Median
   c) Mode

34. The table below represents the height to the nearest centimeter of orange trees in a garden.

Height (cm)	110	130	150	170	190
No. of trees	10	31	24	2	2

   calculate

(i) Mean $\bar{x}$

(ii) Standard deviation σ_{n-1}

(iii) Variance.

35. a) Given the distribution 8,5,3,4,7,6,2,9. Find

i) mode

      ii) median

      iii) semi-inter quartile range

b) Given the following distributions

Class intervals	14.5-19.5	19.5-24.5	24.5-29.5	29.5-34.5	34.5-39.5	39.5-44.5	44.5-49.5
Frequencies	9	27	43	55	63	68	69

Find (i) Lower and Upper quartiles (ii) 25th and 75th percentiles.

TRIGONOMETRY

36.   Solve the equation. $4\sin x = \sec x$ for all angles between 0 and 2π radians

37. Prove the identity $\tan\left(\dfrac{1}{4}\pi - A\right) = \dfrac{1 - \sin 2A}{\cos 2A}$

38.   given that $\tan 30^0 = \dfrac{1}{\sqrt{3}}$, without using tables or calculators

show that $\tan 15^0 = 2 - \sqrt{3}$

39.   Given that in triangle PQR P=50cm. R= 60cm and Q=$120^{0.}$ find q and <R

40. Prove the following identities:-

41. $\dfrac{\cos 2\theta}{\cos\theta + \sin\theta} = \cos\theta - \sin\theta$

42. $\dfrac{\cos\theta}{\sin\alpha} - \dfrac{\sin\theta}{\cos\alpha} = \dfrac{2\cos(\theta + \alpha)}{\sin 2\alpha}$

PROBABILITY

1. (a) Solve $\begin{pmatrix} n \\ n-2 \end{pmatrix} = 6$

(b) Tunu needs to buy 4 long sleeved blouses and 2 skin tights for her graduation party. In how many ways can she do this if she can select from 6 long sleeved blouses and 8 skin tights.

(c) Given that A and B are mutually exclusive events with probabilities P(A)=0.25 and P(B)=$\frac{2}{3}$ find $P(A \cup B)'$

(d) How many distinguishable code symbols can be formed from the letters of the name, "CRICENCIAA".

MATRICES

1. (a) Find the possible value of x and t if

$$\begin{pmatrix} x^2 & x \\ 3 & t \end{pmatrix} \begin{pmatrix} 2 \\ 4 \end{pmatrix} = \begin{pmatrix} 10 \\ 2t \end{pmatrix}$$

(b) Find the value of K for which the given matrix is singular.

$$\begin{pmatrix} 1 & 5 & 5 \\ 4 & 2k & 2 \\ 2 & 1 & 4 \end{pmatrix}$$

(c) Use cramer's rule to solve the system of simultaneous below.

$$a+b+c = 6$$
$$2a+b-c = 1$$
$$a-b+c = 2$$

(d) Mainland premier league table stood as follows on 23rd march 2017

$$\begin{array}{c} \\ Simba \\ Yanga \\ Azam \end{array} \begin{pmatrix} Win & Draw & Loss \\ 17 & 4 & 3 \\ 16 & 5 & 3 \\ 12 & 8 & 4 \end{pmatrix} \begin{array}{c} \\ W \\ D \\ L \end{array} \begin{pmatrix} POINTS \\ 3 \\ 1 \\ 0 \end{pmatrix}$$

Multiply the matrices and state the team which has the least points.

2. a) Find the product of AB when $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{pmatrix}$ and $B = \begin{pmatrix} 7 \\ 8 \end{pmatrix}$.

(b) If $A = \begin{pmatrix} 5 & 7 \\ 2 & 3 \end{pmatrix}$, $B = \begin{pmatrix} 4 & -5 \\ 0 & 7 \end{pmatrix}$ and $C = \begin{pmatrix} 2 & -3 \\ 1 & 1 \end{pmatrix}$. Show that $A+B-2C$ is a singular matrix.

(c) Find the values of x, y, z and w such that $\begin{pmatrix} 1 & 1 \\ 2 & 1 \end{pmatrix}\begin{pmatrix} x & w \\ z & y \end{pmatrix} = \begin{pmatrix} 10 & 1 \\ -1 & 2 \end{pmatrix}$.

LINEAR PROGRAMMING

1. (a) Maximize $f_{(x,y)} = 2500x + 7500y$ subject to

$x + y \leq 60$

$x + 5y \leq 100$

$x \geq 0 \; y \geq 0$

2. A tailor has clothing materials of the following lengths:

	Cotton	Silk	Wool
Suit	2m	1m	1m
Gown	1m	2m	3m

If a suit sells at 35,000/= and a gown sells at 15,000/=. How many of each garment should the tailor make out of the clothing materials available to maximize his revenue from the sales?