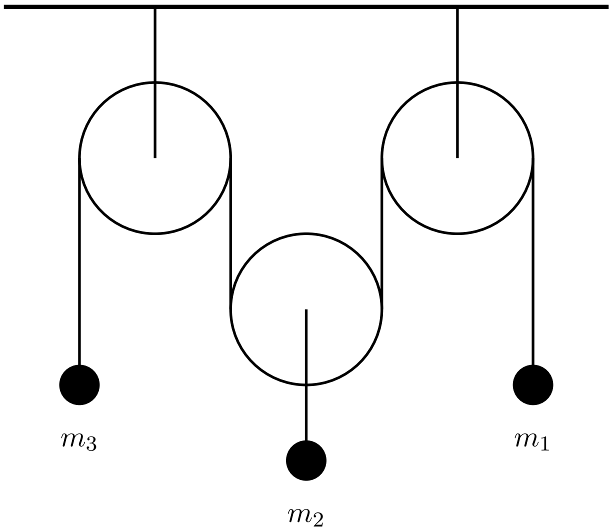
O LEVEL MATHEMATICS REVISION QUESTIONS



PAPER 456/1	PAPER 456/2
1. Statistics	1. Set theory
2. Matrices	2. Vectors
3. Transformations	3. Business Math
(i)Translation	(i) Taxation
(ii)Enlargement	(ii)Intrests and commission
(iii)Rotation	(iii)Exchange rates
(iv)Reflection	(iv)Discounts ,Percentages
(v)Matrix transformation	4. Kinematic graphs
4. Word problems	5. 3 Dimensions
5. Simplification	6. Functions and mappings
6. Closed figures	7. Similarities
7. Linear Programming	8. Equation of lines
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9. Inequalities	10. Ratios and scales
10. Construction	11. Proportions
11. Bearings	(i) Direct
12. Trigonometry	(ii) Inverse,Joint and Partial)
13. Probability	12. Numerical concepts
14. Operations	(i) Decimals
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16. Factorisation	(iii) Indices
17. Equations & Formulae	(iv) Logarithms
18. Circle Properties	(v) L.C.M and H.C.F(G.C.F)

”Yesterday’s failures are today’s seeds that must be diligently planted to be able to abundantly harvest tomorrow’s success.”

Section A Questions

1. Factorise completely
   (i) $a^2 + 2a - b^2 - 2b$ Ans=**(a-b)(a+b+2)**
   (ii) $32y^4 - 162$ Ans=$\mathbf{2[(2y-3)(2y+3)(4y^2+9)]}$
   (iii) $16x^4 - 81$ Ans=$\mathbf{(2x-3)(2x+3)(4x^2+9)}$
   (iv)$x^2 - 18x + 77$ Ans=$\mathbf{(x-7)(x-11)}$
   (v)$4y^2 - 11y - 3$ Ans=$\mathbf{(4y+1)(y-3)}$

2. Given that $x = \sqrt[3]{\frac{y(m-n)}{n}}$,make **n** the subject of the formula.Hence find the values of **n** when y=3,m=8 and x=1 Ans=$\mathbf{n = \frac{ym}{x^3+y}, n = 6}$

3. Given that $A = \sqrt{\frac{m-x}{p-mx}}$,make **x** the subject of the expression Ans=$\mathbf{x = \frac{m-A^2P}{1-A^2m}}$

4. Make **P** the subject in the formula if $R = \sqrt[3]{\frac{1+P}{1-P}}$ Ans=$\mathbf{P = \frac{R^3-1}{1+R^3}}$

5. Given $y = a\left(\sqrt[4]{\frac{x^2-n}{m}}\right)$ Make **X** the subject of the formula Ans=$\mathbf{x = \frac{\sqrt{(y^4m+a^4n)}}{a^2}}$

6. (a)Without using mathematical tables or calculator evaluate:
   (i) $\frac{1}{2}\log_3 81 - 3\log_3 3^{-4} + 13$ Ans=**27**
   (ii) $2\log_{10}40 - \log_{10}256 + 2\log_{10}5$ Ans=**2.1938**
   (iii) $\frac{2}{3}\log_{10}125 - \frac{1}{3}\log_{10}8 + 0.5\log_{10}64$ Ans=**2**
   (iv) $\frac{8.547^2+8.547\times1.453}{0.8547}$ Ans=**100**
   (b) If $\log_5 a = 2.751$ and $\log_5 b = 0.462$,evaluate $\log\sqrt{\frac{a}{b}}$ Ans=**1.1445**
   (c) Use logarithm tables to evaluate : $\sqrt[3]{\frac{0.1623}{42.63}}$ Ans=**0.1561**

7. Express $1.21555\cdots$ as a fraction in the form $P\frac{M}{N}$. Hence, find the value of (N-M)Ans=$\mathbf{1\frac{97}{450}, 353}$.

8. (a)Without using tables or calculator simplify $\sqrt{243} - \sqrt{108} + \sqrt{75}$ Ans=$\mathbf{8\sqrt{3}}$
   (b) Express each of the following numbers in terms of prime factors.150, 180 and 168 Hence find their LCM and GCD. Ans=$\mathbf{L.C.M = 12600, G.C.D = 6}$

9. The midpoint of the line segment is T. Given that the coordinate of B are (6, 5) and T are (2, 3), determine the coordinates of A. Ans=$\mathbf{A(-2, 1)}$

10. Given the function $f(x) = \frac{1}{x}$ and $g(x) = 2x - 1$. Determine an expression for $gf(x)$ and find the value of x for which $gf(x) = 0$ Ans=$\mathbf{gf(x) = \frac{2-x}{x}, x = 2}$

11. The value of a machine depreciates by 5% each year. If the value is now sh3.61 million, what was the value of the machine 2 years ago. Ans=**shs4000000**

12. (a)The base areas of two similar tins are $24cm^2$ and $54cm^2$. If the volume of the smaller tin is $144cm^3$, determine the volume of the larger tin. Ans=$\mathbf{324cm^3}$
    (b) ABC is a triangular field with AB =70m, BC=65m and AC =85M. Find the area of the field Ans=$\mathbf{2224.8595cm^2}$

13. Two quantities x and y are such that y is partly constant and partly varies inversely as x and that,$y = 11$, when $x = 2$ and $y = 7$ when $x = 6$.Determine the value of y when $x = 4$. Ans=$\mathbf{y = 8}$

14. On a map, a forest of area $7.2km^2$ is represented by $5cm^2$. Find the length of a road represented by $9cm$ on the map. Ans=$\mathbf{10.8km^2}$

15. Express $0.113333\cdots$ in the simplest form of $\frac{a}{b}$ Ans=$\mathbf{\frac{17}{150}, a = 17, b = 150}$

16. Determine the value of $x : 3\log_{10} 5 + \log_{10} x – log_{10} 4 = 3$. Ans=$\mathbf{x = 32}$

17. The sets P, and Q are such that$n(P) = 10, n(Q) = n(P^1 nQ^1) = 8$ and $n(P^1 nQ) = 7$. Represent the information on a Venn diagram hence state $n(PuQ)$. Ans=**17**

18. A line has gradient $\frac{-2}{3}$ and its x-intercept is 6. It cuts the y-axis at point P. determine the :
(i) equation of the line Ans=$\mathbf{3y + 2x = 12}$
(ii) coordinates of P. Ans=$(\mathbf{0, 4})$

19. A forest on a map of scale$1 : 250,000$ is of area $3.2cm^2$. Determine the actual area of the forest in km^2. Ans=$\mathbf{20km^2}$

20. (a) A commission of 10%is given to the hawker for the sales up to Shs 120,000 and 15% commission for sales in excess of Shs 120,000. Calculate the total commission for Shs 230,000 sales Ans=**shs34500**
(b) Find the compound interest on shs 40,000 invested for 3 years at $8\frac{1}{2}1\%$ per annum. Ans=**shs11092**

21. A cyclist moving at $50kmh^{-1}$ set off from P at $11.58a.m.$ and covered $60km$ to Q. When did he arrive at Q.?

22. (a)solve the equation $\frac{x}{x+3} + \frac{7}{x^2-9} = \frac{5}{x^2-9}$
(b)Solve the equation:$3(2x + 3) - 15(1 - x) = 5$.

23. Given that $\sin 30^0 = \frac{1}{2}, \cos 30^0 = \frac{\sqrt{3}}{2}$,Write down:
(i)$\cos 150^0$
(ii)$\cos 60^0$

24. Make t the subject of the formula $S = ut + \frac{1}{2}at^2$

25. A bag contains 3 blue, 4 green and 5 red balls. One ball is picked and not replaced. A second ball is then picked. Find the probability that both balls are of the same colour.

26. Two vehicles are moving towards each other between A and B, a distance of 490km. The car from A moves at a speed of $80kmh^{-1}$ and that from B moves at $60kmh^{-1}$. Assuming that the two cars started moving at the same time, after how long in hours will the cars meet?

27. Nankya Invested sh.60, 000/= in a bank which offers 10% compound interest per annum. How much interest will she have at the end of the third year?

28. A container has a volume of $34,300cm^3$ and surface area of $49,000cm^2$ find the surface area of a similar container which has a volume of $12,500cm^3$.

29. Find the equation of the line which passes through point $A(2, -x)$ and is perpendicular to the line $2y - 6x + 7 = 0$

30. The time taken to build a brick wall is inversely proportional to the number of workers.If three workers took 30 hours to build a wall. What time would it take 5 workers to build the same size of wall?

31. The operation Ψ is defined as $a\Psi b = \frac{(a+b)}{(b-a)}$. Find the value of $2\Psi 3$

32. Given that matrix

$$\mathbf{A} = \begin{pmatrix} y & 1 \\ 3 & 2 \end{pmatrix}$$

and

$$\mathbf{B} = \begin{pmatrix} 2 & 1 \\ 1 & 3 \end{pmatrix}$$

and that the determinant of AB=10.Find the value of y.

33. Solve the inequality $x + 5 \leq 4x + 2 \leq 3x + 6$ and show the solutions on a number line.

34. Point$A(4, 3)$was mapped onto $A^1(-2, 0)$ after an enlargement of scale factor -2.Find the coordinates of the centre of enlargement.

35. Given that $a\psi b = \frac{(b^2-a^2)}{(a^2+b^2)}$ Find the value of ;
(i) $(1\psi\text{–}1)$
$(ii)(1\psi\text{–}1)\psi\text{–}4$

36. Find the inverse of matrix

$$\mathbf{B} = \begin{pmatrix} -1 & 2 \\ -4 & 3 \end{pmatrix}$$

37. (a) Find the highest Common factor 12, 15 and 18.
(b) Use matrix method,substitution,graph work and Elimination methods to solve the simultaneous equations

    (a) $x + y = -8$
    $-3x + 2y = 9$

    (b) $-6x + 3y = 33$
    $-4x + y = 16$

38. Find the discount on a bicycle priced at shs. 120,000 but sold off at a discount of 10%. How much was paid for it?

39. Given that $f(x) = \frac{1}{2}(3x + 5)$Find the value of x such that $f(x) = 10$

40. Given that A(12, 16) and B(4, 1) Find :
(i) vector AB
(ii) Length of AB

41. Given two points A(4, 5) and B (-2, 9) find the equation of a line through A and B.

42. A cylindrical tank of diameter $1.4m$ has a capacity of$3.08m^3$. Find the diameter of a similar tank whose capacity is $83.16m^3$.

43. Without using tables or a calculator,evaluate: $\frac{32.135^2-17.865^2}{0.173}$

44. Scale of a map is 1 : 200000. Two trading centres on a map are $4.5cm$ apart. Determine in km, the actual distance between the trading centres.

45. Given sets: A = All natural numbers less than 30, B = All prime numbers between 10 and 30 Find :
(i) members of set AnB
(ii) $n(AnB)$

46. (a)Simplify $\frac{2}{3}$ of $(1\frac{1}{3}+1\frac{1}{4})$
(b) The sum of interior angles of a polygon is 1080^0 , find the number of sides of the polygon.

47. Find the HCF and LCM of 84, 126 and 210.

48. Six men can dig a farm in 12 days. How many more men must be employed if the farm is to be dug in 8 days.

49. In a class of 30 students, 15 liked Mathematics, 18 liked English and 4 liked neither Mathematics nor English. Find the number of students who like both Mathematics and English.

50. Find the equation of the line passing through the point $P(5, 9)$ and parallel to the line joining the point $Q(15, -2)$ to point $R(-3, 4)$.

Section B Questions

51. In a class of 40 students, 18 play Hokey (H), 15 play Tennis (T) and 22 play Football (F). 7 play Hockey and Tennis, 9 play Tennis and Football, 8 play Hockey and Football. 4 play all the three games.
(a) Represent the given information on a venn diagram
(b) Find the number of students who do not play any of the three games.
(c) Find the probability that a student picked at random plays only:
   (i) one game
   (ii) two games

52. Given that the point $A(-8, 6)$ and vector,$\vec{AB} = (12, 4)$. M is the midpoint of AB.
(a) Find the:
   (i) Column vector $\vec{AM}$
   (ii) Coordinates of M
   (iii) Magnitude of $\vec{OM}$

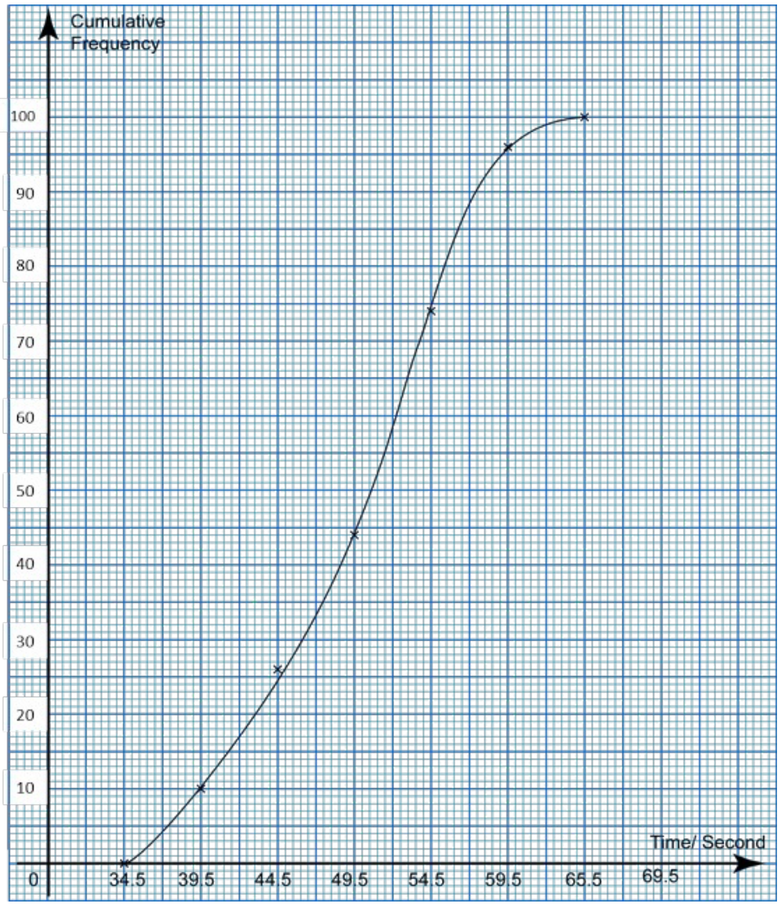
(b) Draw the vector on a graph paper from your graph, state the coordinates of B.

53. A sports club has 80 members. For the three activities Swimming (S), Cycling (C) and Weight lifting (W), 8 members take part in all three activities , 3 members do not take part in any of the three activities , 22 members take part in only S , 23 members take part in S and C, 19 members take part in S and W , 14 members take part in C and W , x members take part in only W, The number of members who take part in only Cycling is twice the number of members who take part in only Weight lifting
(i)Draw a Venn diagram to show all of the above information.
(ii) Determine the value of x.
(iii) Determine $n(Sn(WuC))$
(iv)A member of the club is chosen at random, what is the probability that he takes part in at least 2 activities.

54. A survey conducted on 30 car owners revealed that 7 liked Ipsum (A) and Premio(B) but not Spacio(C), 5 liked Ipsum and Spacio but not Premio, 2 liked Premio and Spacio but not Ipsum while 3 liked neither of the car models. Those who liked Spacio only were twice those who liked all the 3 models and a third those who liked Ipsum only. 8 liked Premio only. Represent this information on a Venn diagram. From the Venn diagram, determine

the how many people liked;
(i) all the 3 models.
(ii) Spacio.
(iii) Ipsum only.
(c) Find the probability that a person chosen at random from the group liked only one type of car.

55. The Ogive below shows the distribution of marks obtained by students in a Math test.



(a) Use the graph to estimate the median mark.
(b)Draw a frequency distribution table from the Ogive.
(c)Calculate the average mark using 52 as the working mean.
(d)Calculate the modal mark.

56. Towns A and B are 10km apart. Opio set off from A at 6.15 a.m. walking towards B at $3kmh^{-1}$. After 2 hours he met a friend and he stopped for 30 minutes charting.

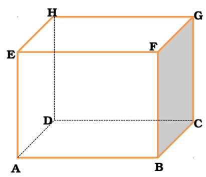
He then continued with his journey at a speed of $2kmh^{-1}$. Meanwhile Batambuze set off from A going to B at 7.15 a.m. moving steadily at $3\frac{1}{2}kmh^{-1}$.
(i) Calculate the times when Opio and Batambuze arrived at B.
(ii) Draw a distance-time graph showing journeys of Opio and Batambuze.

57. A group of 50 students were asked the food they like. Matooke (M), Rice (R) and Posho (P). 27 liked Matooke, 23 liked Posho and 25 liked Rice. 8 liked Posho and Matooke ,7 liked Matooke and Rice only. 9 liked Posho and Rice only. The number of those who liked Rice only was equal to that who disliked the three foods.
(a) Represent the information an a Venn diagram.
(b) Determine the number of students who:
(i) liked all the three foods
(ii) disliked the three foods
(c) A student is chosen at random from the group, what is the probability that he/she liked one of the foods.

58. The distance between two towns A and B is 300km. At 7:15am a Bus sets off from A moving steadily at $75kmh^{-1}$ going to town B. One and half hours later a Saloon car sets off from A going to B and over took the bus at 10:15am.
(a) Calculate;
(i) the distance from A when the saloon car over took the bus
(ii) the speed of the saloon car
(iii) the difference in their times of arrival at B.
(b) Draw the distance-time graph showing the routes of the vehicles.

59. In a group of 35 ladies on a tour visited a certain fruit stall, which had Mangoes (M), Apples (A) and Pineapples (P). 18 ladies bought apples, 13 did not buy mangoes and 18 did not buy pineapples. 3 bought apples and mangoes only, 8 bought apples and pineapples, and 8 bought mangoes and pineapples only. If 3 bought neither fruit;
(a) Represent the information on a Venn diagram
(b) How many ladies bought all the fruits
(c) If a lady is picked at random what is the probability that she bought one type of fruit.

60. Below is a cuboid in which AB = 8cm, BC = 6cm, GC = 5cm, X is the midpoint of HG.



(a) Determine the length;
(i) AH
(ii) AX
(b) angle between AH and plane ADHE:
(c) Angle between ABX and the base ABCD.

61. Given $f(x) = 2x + 5$ and $g(x) = \log_{10} x$ Determine;
(a) $f^{-1}(x)$
(b) value of x if $f(x) = 12$
(c) an expression for $gf(x)$
(d) value of x for which $gf(x) = 1$
(e) Value of $fg(1)$

62. Given $f(x) = x^2 + 7$ and $g(x) = 4x - 13$ Determine;
(a) $fg(x)$.Hence evaluate $fg(-2)$
(b) $f^{-1}(x)$
(c) $f^{-1}(32)$

63. The function f is such that $f(x) = 3x + 1$.Find:
(a)f(5)
(b) $f^{-1}(x)$
(c)$f^{-1}(4)$
(ii) Given that $g(x) = yx^2 + 2x$ and $g(3) = 24$,find the value of ;
(a) y
(b) g(-3)

64. The table below shows the distribution of weights of a certain type of fruit

Weights(grams)	Frequency
$30 - 39$	4
$40 - 49$	3
$50 - 59$	23
$60 - 69$	54
$70 - 79$	16
$80 - 89$	9
$90 - 99$	7

(a) Calculate the
 (i) mean weight
 (ii) median
(b) Draw a histogram of the data and use it to estimate the modal weight

65. Copy and complete the table below of the fuction $y = 6 + 3x - 2x^2$

x	-2	-1	0	0.5	1	2	3
y	-8					4	

(b) Draw the graph of $y = 6 + 3x - 2x^2$ for domain $-2 \leq x \leq 3$,taking 2cm for 1 unit on the x-axis and 1cm for 1 unit on the y-axis
(c) Use your graph to solve the equation
(i) $6 + 3x - 2x^2 = 0$
(ii) $3 + x - x^2 = 0$

66. Find the inverse of matrix

$$\begin{pmatrix} 5 & 3 \\ 2 & 2 \end{pmatrix}$$

and hence solve the simultaneous equation
$5x + 3y = 7$
$2x + 2y = 2$

(b) The inverse matrix

$$\mathbf{A^{-1}} = \begin{pmatrix} 1 & -1 \\ -1\frac{1}{2} & 2 \end{pmatrix}$$

Find the matrix A and show that AA^{-1}=I,where I is a 2×2 identity matrix

67. (a) Two fair dices are tossed and the outcome on each dice recorded. Find the probability that the sum shown on both dice is greater than or equal to 7

(b) A box contains 4 red balls and 6 black balls. Two balls are randomly drawn one after the other with out replacement. Find the probability that
(i) Both balls are red
(ii) Both balls are of different colours

68. A triangle ABC with vertices $A(6,0), B(6,-5), C(2,-5)$ and is mapped onto triangle $A^1B^1C^1$ by a negative quarter turn about the origin. Triangle $A^1B^1C^1$ is then mapped onto triangle $A^{11}B^{11}C^{11}$ by a reflection about the line $y=-x$
(a) Draw on the same axes triangles ABC, $A^1B^1C^1$,$A^{11}B^{11}C^{11}$
(b) Find the co-ordinates of $A^1B^1C^1$ and $A^{11}B^{11}C^{11}$
(c) Use your graph to fully describe a single matrix which will map $A^{11}B^{11}C^{11}$ back to ABC and describe it fully

69. In a senior four class of 30 students, 18 take Fine Art (F), 15 take Luganda (L), 13 take Enterprenuer (E). The number of students who take all the three subjects equals the number of those students who do not take any of these subjects. Ten students take both F and L, and 3 take only E and L. Represent the information on a venn diagram
(a) How many students take all the three subjects
(b) Find the number of those who take only one game
(c) If a student is picked at random from this class, what is the probability that a student takes two or more of these subjects

70. The points $A(1,0), B(3,0), C(3,1)$ and $D(1,1)$ are vertices of triangle .The images of A,B,C and D under a transformation represented by the matrix

$$\mathbf{T} = \begin{pmatrix} 3 & -4 \\ -6 & 9 \end{pmatrix}$$

are A^1, B^1, C^1, D^1 respectively.The images of A^1, B^1, C^1, D^1 are then mapped onto the points $A^{11}, B^{11}, C^{11}, D^{11}$ respectively under a transformation represented by a matrix

$$\mathbf{M} = \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix}$$

(a) Determine the coordinates of the points
(i)A^1, B^1, C^1, D^1
(ii) $A^{11}, B^{11}, C^{11}, D^{11}$
(b) Find a single matrix of transformation that would map $A^{11}B^{11}C^{11}D^{11}$ back onto ABCD.

71. (a) Given that the position vectors of P and Q are (-2,4) and (7,7) respectivelyand also that M is on PQ suc that PM:MQ=1:2.Determine
(i) Vector PQ
(ii) Length of vector OM

(b) Vectors $\mathbf{a}, \mathbf{b}, \mathbf{c}$ are such that $\mathbf{a} = (2, y), \mathbf{b} = (1, 3)$and $\mathbf{c} = (-5, 5)$.
Given that $|a| = |b - c|$.Find the possible values of $\mathbf{y}$
(c) A parallelogram has vertices at$A(0, -1), B(2, -5), C(2, 3)$ and$D(x, y)$.Use vector method to find the coordinates of D
(d) Given that $p = 8a + 6b, q = 10a - 2b, r = 2ma + 2(m + n)b$,where m and n are scalars .Find the values of m and n such that $r = 6p - 8q$

72. (a) Given that $f(x) = ax = b, g(x) = \frac{x^2}{2}, f^{-1}(-11) = 2$ and $f^{-1}(21) = 4$,Find the values of a and b.Hence evaluate $gf(-2)$
(b) If $h(x) = \frac{x+3}{2}$ and $g(x) = \frac{1-2x}{5}$,determine the values of x ,for which $hg(x) = \frac{8x^2+24x+9}{10}$
(c) For the mapping $x- >3x - 5$,Find the domain when the range is $[4, 10, 16]$
(d) Given that $k(y) = 3y + 2$ and $kh(y) = 6y + 11$,
(i) Form an expression for $h(y)$
(ii) Hence find $h(0)$

73. (a)Given that $\frac{(a^{\frac{1}{3}}b^{\frac{-1}{2}})^3}{a^{\frac{-2}{3}}b^{\frac{1}{2}}} = a^p b^q$,find the values of the constants p and q
(b) The L.C.M of two numbers is 144 and their GCF is 12 .If one of the numbers is 36,find the other number.
(c) Simplify :$\frac{1\frac{1}{2}-(8\frac{1}{3}\div 2\frac{1}{2})}{1\frac{1}{5}of(1\frac{1}{4}+1\frac{2}{3})}$

74. (a)Use tables to evaluate $\sqrt{(\frac{45.3\times 0.00697}{0.534}}$
(b) Solve the equation for a : $\log(a - 1) + \log(a + 2) = 1$
(c) Express $\frac{2}{\sqrt{5}-\sqrt{3}} - \frac{1}{\sqrt{5}+\sqrt{3}}$ in the form $a\sqrt{b} + c\sqrt{d}$

75. (a) Using a ruler and a pair of compass only construct a parallelogram ABCD whose diagonals AC and BD intersect at a point O, given that AC= 16cm and BD = 10.8cm and angle AOB = 120^0.
(b) Measure and state the length of AB and BC.
(c) Construct the circum circle of triangle BOC.
(d) Calculate the area of the circumscribed circle.

76. (a) Using a ruler ,pencil and a pair of compass only construct a triangle KLM such that $KL = 9.6cm$,$< LKM = 60^0$ and $KM = 8.2cm$.Measure the length of LM.
(b)Draw an inscribed circle to triangle KLM.Measure the radius of the circle and calculate its area.

77. (a) Using a ruler and a pair of compasses only construct a triangle ABC such that $AB = 10.0cm$,$< ABC = 105^0$ and $BC = 9.2cm$.Measure the length of AC.
(b)Construct an inscribed circle of triangle ABC with centre O.Measure the radius of the circle and calculate its area.

78. (a) If $\frac{3}{7} = \frac{a+b}{3a-b}$,express a in terms of b.Hence find the values of $\frac{a^2+65b^2}{3ab}$
(b) The cost C of producing mattresses is given by $C = A + Bn$ where A and B are constants and n is the number of mattresses produced.The cost of producing 20 mattresses is $shs.250,000$ and the cost of producing 50 mattresses is $shs.520,000$.Find the cost of producing 80 mattresses.

79. The marks obtained by,40 students S.3 of Nyenga seminary in physics are as follows

46	52	62	55	61	48	57	46
70	60	54	49	47	52	48	52
60	55	50	53	64	54	54	53
57	58	51	64	56	61	52	58
41	59	57	44	51	58	68	65

(a) Construct a frequency distribution table with equal class intervals beginning with $41-45$ class
(b) Calculate the mean marks of the S.3 students
(c) Draw a cumulative frequency curve (Ogive) for the distribution and use it to estimate the median

80. (a) Copy and complete the table below for the graph $y = x^2 + 2x - 3$

$4x$	-4	-3	-2	-1	0	1	2	3
x^2	16				0			
$2x$	-8				0			
-3	-3				-3			
y	5				-3			

(b) On the same axes,draw the graphs of $y = x^2 + 2x - 3$ and $y = x - 1$(Use a scale of 1cm:1 unit on x-axis and 2cm;2units on y-axis)
(c) Use your graph to solve the equation $x^2 + x - 2 = 0$

81. Three bags A, B and C each has some coloured balls. The probability of picking a black ball from bag A is $\frac{3}{7}$ from bag B is $\frac{7}{9}$ and from bag C is $\frac{1}{8}$. Two balls are picked from the bags and the first bag to be picked from is bag A. If the ball is black then the second ball is from bag B otherwise it would be bag C
a) Determine the smallest number of balls in each bag
b) Represent the above information on tree diagram
c) Find the probability that:
(i)Two balls picked are black
(ii)At least a ball picked is black.

82. Nyenga seminary has to take 384 students for a tour. There are two types of buses available. Type X and type Y. Type X can carry 64 passengers and type Y can carry 48 passengers. They have to use at least 7 buses.
(a) Form all linear inequalities which will represent the above information
(b) On a graph paper, draw the inequalities and shade the un-wanted region
The charges for hiring the buses are
Type X: Ugx. 25,000
Type Y: Ugx 20,000
(c) Use your graph to determine the number of buses of each type that should be hired to minimize the cost.

83. A tailoring business makes two types of garments, A and B. Garment A requires 3 metres of material while garment B requires $2\frac{1}{2}$metres of material. The business uses not more than

600 metres of material daily in making both garments. It must not make more than 100 garments of type A and not less than 80 of type B each day.
(i) Write down four inequalities from this information.
(ii) Graph these inequalities.
(iii) If the business make a profit of Sh. 80 on garment A and a profit of sh. 60 on garment B, how many garments of each type must it make in order to maximize its total profit? (Assume that all the garments made are sold on the same day).

84. (a)In 2019 Namilyango high school used 15 bags of maize , 8 bags of beans, 16 bags of maize flour and 4 bags of rice in the first term. The prices are sh.1000, sh.1,200, sh.1400 and sh.1,400 respectively. In the second term, the school used 16 bags of maize, 10 bags of beans ,18 bags of maize flour and 5 bags of rice at sh. 1400, sh.2600, sh.1600 and sh.1500 respectively. In the third term the school used 12 bags of maize, 5 bags of beans, 12 bags of maize flour and 3 bags of rice at sh.1800, sh.2200, sh.2,000 and sh.1,500 respectively. Using a matrix method, find the total cost of foodstuff in 2019.
(b) Given the matrices

$$\mathbf{A} = \begin{pmatrix} 2 & 1 \\ -3 & 4 \end{pmatrix}$$

$$\mathbf{B} = \begin{pmatrix} 1 & -2 \\ 3 & 1 \end{pmatrix}$$

$$\mathbf{C} = \begin{pmatrix} 2 & 0 \\ -1 & 1 \end{pmatrix}$$

Find a matrix M such that $M = 2AB + 3C^2$

85. Two towns P and Q are 550km apart. A bus starts from town Q towards P at 8:45 am at average speed of 80km/h. A car starts from P towards Q at 10:00 am at an average speed of 100km/h, Calculate
(a). The distance covered by the bus before the car starts its journey
(b). How far from Q the two vehicles meet
(c). The time the two vehicles met
(d). The time the car arrived at town p.

86. (a) In 2017 the total cost of manufacturing an article was Sh.1250 and this was divided between the cost of material, labour and transport in the ratio 8: 14: 3. In 2018 the cost of the material was doubled, labour cost increased by 30% and transport costs increased by 20%. Calculate the cost of manufacturing the article in 2018.
(b) For the same article in (a) above, the cost of manufacturing in 2019 was sh. 1981 as a result of increase in labour costs only. Find the percentage increase in labour cost of 2017.

87. (a) Kaziba wanted to exchange Kenyan shillings Ksh 540 , 000 to Tanzanian shillings (TZsh) . It is given that 1 Ug sh = 1.8 TZsh and 1 Ksh = 25 Ugsh . Calculate how much (TZsh) Kaziba got.
(b)If the simple interest on shs. 3,200,000 for 6 months is shs. 40,800, find the interest rate per annum.
(c) Mr Frank bought a car valued at sh 1,000,000 the value of the car depreciated at 7.5%semi annually. How long would it take its value to depreciate to sh 500 000

88. On a wedding ceremony 71 guests were asked which flavours of Mirinda (M), Novida (N) and Fanta (F) they each prefer. It was found out that an equal number of guests preferred M and N. 10 guests preferred M and F, 11 guests prefer F and N while 6 preferred M and N only. 26 preferred F and 5 preferred M only. The number of guests who preferred F only doubles those who preferred N only.
(a) Represent the above information on a venn diagram
(b) Find the number of guests who;
(i) Preferred N only
(ii) Preferred all the flavours
(iii) did not like any of the three
(c) If a guest is chosen at random from the group, find the probability that he/she preferred atmost two drinks.

89. A group of 36 boys were asked which games they played from Football (F), Volleyball (V) and Tennis (T). It was discovered that 12 play F, of which 2 play F and T only. An equal number of boys play V and T. Six play F and V while 5 play all the games. Those who play V and T only are one less than those who play F only and half those who did not play any of the three games.
(a)Represent the information on a Venn diagram.
(b) How many boys play Volleyball only?
(c) How many boys play Tennis?
(d)What is the probability that a boy chosen at random plays at least two games?

90. (a)Given that Z varies directly as square of X and inversely as the square root of y. If $X = 2, y = 9$when $Z = 3$ .Find Z when x =3 and y = 4
(b) If A varies directly as the cube of B and inversely as C and A=5 when B=2 and C=6, find B when A=27 and c=7.5.
(c)P is inversely proportional to the square of q. When P = 8, q=3. Find the equation relating p and q. Hence find the value of p when q =12.

91. (a)ABCD is a quadrilateral inscribed in circle, centre O, and AD is a diameter of the circle. If angle CDB = $46^0$and ADB = 31^0. Calculate
(a) the angle ABC
(b) the angle BCD
(c) the angle BAD.

92. Chords AB and BC of a circle are produced to meet outside the circle at T. a tangent is drawn from T to touch the circle at E. Given AB = 5cm, BT = 4cm and DC = 9cm, Calculate
(a) CT
(b) TE
(c) the ratio of the areas of triangle ADT to BCT
(d) the ratio of the areas of triangles BET to AET

93. (a) OAB is a triangle with $OA = a$ and $OB = b$. R is the point on AB such that R divides AB internally in the ratio 13:12. Express OR in terms of a and b.
(b)OPQ is a triangle with OP=p, OQ=q. R is the point on PQ such that 2PR =RQ and Z is the point on OQ such that 30Z =2ZQ. Y is the point of intersection between OR and PZ. If OY =mOR and PY = nPZ:

(a)Express OR and PZ in terms of p and q .
(b)Find the values of m and n.

94. (a) A bag contains 6 red pencils and 5 green pencils . Two pencils are drawn from the bag at random simultaneously. Find the probability that the pencils drawn are
(i)Both green
(ii)Both red and
(iii) One red and one green
(b) A basket contains 6 mangoes and 4 oranges. Three fruits are removed from it without replacement. Use tree diagram to work out the following probabilities
(i)P(three mangoes are removed)
(ii)P(a mango and two oranges are removed)
(c) A fair coin and a die are tossed together. The tail and head from coin scores are awarded 3 and 4 respectively. The sum of top score is recorded. Find the probability that the sum is:
(i) prime number
(ii) square number
(iii) odd number

95. (a) Draw the graph of $y = 5x - x^2$ for values of x from -4 to 5 and use the graph to solve the equation $2x^2 - 5x - 10 = 0$
(b)Draw the graph of $y = 2^x - 3x - 7$ taking values of x from -2 to 4

96. (a)The scale of a map is 1:20000. What is the area in km^2 of land represented by $8cm^2$ on the map?
(b)On a map whose scale is 1 : 30,000, a rectangular farm measures 3 cm by 4cm.Calculate the perimeter of the farm in metres.
(c)Without using tables or calculator evaluate the following:

(i) $\frac{\cos 60^0 \sin 30^0}{\tan 45^0}$

(ii) $\frac{\sin 45^0 \cos 45^0}{\tan 60^0}$

97. (a) A factory produces three types of portable radio sets called Sanyo, National and Haiwa. A sanyo set contains 1 transistor (T), 10 resistors (R) and 5 capacitors (c). A National set contains 2T, 18R and 7C. A Haiwa set contains 3T, 24R and 10C. Arrange this information in matrix form. If the factory's monthly out put is 100 Sanyo, 200 National and 80 Haiwa sets, find its monthly requirements of capacitors, resistors and capacitors. Transistors cost Sh 10,000/=, resistors Sh 5,000/= and capacitors Sh 20,000/=. Find, by matrix multiplication, the cost of these components.
(i) for each set
(ii) per month.
(b) Jane wants to go shopping and buy 3 writing pads (W), 4 exercise books (B) and 5 ball pens (P). Her sister Eva wants to buy 2 writing pads, 6 exercise books and 3 ball pens. In Entebbe (E), writing pads cost shs 800, exercise books cost shs 300, and ball pens cost shs 150 each. In Kampala (K), writing pads cost shs 700, exercise books cost shs 500, and ball pens cost shs 100 each. Use matrix multiplication to find out where it is better to shop from.

98. The table below shows the income tax of a certain country for government employees. This is applied after the allowances have already been deducted. A married employee has a gross

Taxable monthly income in Shs	Tax rate % per month
1–100,000	0
100,001–200,000	5
200,001–300,000	10
300,001–450,000	20
450,001–550,000	30
550,001 and above	50

monthly income of Shs600,000 and is entitled to the following allowances.
Marriage Shs120,000 per annum
Housing and transport 10% of the gross monthly income
Medical care Shs 240,000 per annum .Calculate
(a) the amount he pays as monthly income tax(P.A.Y.E)
(b)his net monthly income

99. (a)The vertical electricity pole TR is supported by two wires PT and QT.The points P,Q and R are collinear and on the horizontal ground.The angle of elevation of T from P is 30^0 and the distance between P and Q is 10m.Given that the length of PT is 20m.calculate to the nearest whole numbers
(i) The length of wire QT
(ii) The length of elevation of T from Q
(iii) The length TR of the electricity pole
(iv) The length of P from R
(v) In a triangle OPQ, X is a point such that OX
(b)In triangle ABC,the mid points of $\vec{BC}, \vec{AC}, \vec{AB}$ are L,M and Nrespectively.$\vec{AM} = \mathbf{a}$

100. (a)A line L_1 passes through the point (-1,2) and has gradient $\frac{-1}{2}$.Another line L_2 passes through the points Q(2,-3) and R(4,5).Find
(i) The equation of L_1
(ii)The gradient of L_2
(iii)The equation of a line through point (0,5) and is perpendcular to L_2
(iv) The equation of a line through point R and is parallel to L_1
(b) Find the lengths of the straight lines joining the following pairs of points:
(i) A(l, 2) and B(5, 2)
(ii) C(3,4) and D (7,1)
(c) Find the distance of the point (— 15, 8) from the origin.

END

Quantity	**Formula**
midpoint between $A(x_1, y_1)$ and $B(x_2, y_2)$.	midpoint $=(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2})$
length/distance between points $A(x_1, y_1)$ and $B(x_2, y_2)$	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Gradient of $A(x_1, y_1)$ and $B(x_2, y_2)$	$G = \frac{y_2-y_1}{x_2-x_1}$
Equation of line joining $A(x_1, y_1)$ and $B(x_2, y_2)$	$\frac{y-y_1}{x-x_1} = \frac{y_2-y_1}{x_2-x_1}$
Equation of a line	$y = mx + c$,m=gradient,c=y-intercept
For two parallel lines i.e $y_1 = m_1x + c$ and $y_2 = m_2x + c$	$m_1 = m_2$
For two perpendicular lines i.e $y_1 = m_1x + c$ and $y_2 = m_2x + c$	$m_1.m_2 = -1$
Addition of logarithms	$\log_a x + \log_a y = \log_a xy$
Subtraction of logarithms	$\log_a x - \log_a y = \log_a \frac{x}{y}$
power law	$\log_a x^m = m \log_a x$
same base	$\log_a a = 1$ e.g $\log_{10} 10 = 1$
Mean	$\bar{x} = \frac{\sum fx}{\sum f}$
Mean	$\bar{x} = A + \frac{\sum fd}{\sum f}$ d=x-A
Mode	$M = L_1 + (\frac{D_1}{D_1+D_2})C$
Median(second quartile)	$M = L_1 + (\frac{\frac{N}{2}-CF_b}{F_m})$
Lower quartile	$Q_1 = L_1 + (\frac{\frac{N}{4}-CF_b}{F_m})$
Upper quartile	$Q_3 = L_1 + (\frac{\frac{3N}{4}-CF_b}{F_m})$
Inter quartile range	$Q_3 - Q_2$
Semi Inter quartile range	$\frac{Q_3-Q_2}{2}$
Magnitude/modulus of a vector **A(x,y)**	$\|A\| = \sqrt{x^2 + y^2}$
Compound interest formula	$A = P(P + \frac{r}{100})^n$
Hire purchase(H.P)	H.P = Deposit + Total Installments
Taxable income(T.I)	T.I = Gross income –Tax free income.
Matrix of rotation(θ= angle of rotation)	$\begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$
Matrix of enlargement	$\begin{pmatrix} k & 0 \\ 0 & k \end{pmatrix}$ k=scale factor
Area scale factor(A)	$A = \frac{\text{Area of image}}{\text{Area of object}}$
Area of image (A_I), M=Transformation matrix	$A_I = \|\text{det}M\| \times$ Area of object
Circumference of a circle	$C = 2\pi r$ or C=πd, d=2r
Area of a circle	$A = \pi r^2$,$A = \frac{\pi d^2}{4}$
The length of arc	$L = \frac{\theta}{360^0} 2\pi r$
Area of sector	$A = \frac{\theta}{360^0} \pi r^2$
Total surface area of cuboid	$T.S.A = 2(lh + wh + lw)$
Surface area of cube	$S.A = 6l^2$
Surface area of a open cone	$S.A = \pi rl$
surface area of a closed cone	$S.A = \pi r(r + l)$
Surface area of a sphere	$4\pi r^2$
Surface area of a hemisphere	$3\pi r^2$
Volume of the cylinder	$V = \pi r^2 h$
Volume of the cone	$V = \frac{1}{3}\pi r^2 h$
Volume of the sphere	$V = \frac{4}{3}\pi r^3$
Total angle sum of a polygon	$T.A.S = (n - 2)180$,n=number of sides