ST NOA GIRLS' SECONDARY SCHOOL- ZANA

O'LEVEL *MATHEMATICS- SEMINAR (SAT-23TH JUNE 2018)*

1. (a) Find the equation of a line which is the perpendicular bisector of the line passing through points A(3,4) and B(1,10)

   (b) Find the point of intersection of the lines $y = 2x - 3$ and $y = -x - 3$. Hence find the area of the triangle enclosed between the two lines and the x-axis

   (c) The line passing through the point A$(-3, -4)$ is perpendicular to the line whose equation is $2y + 3x = 8$. Find the equation of the line through A and hence determine the coordinates of points P where this line cuts the $x - axis$ and coordinates of Q where it cuts the y-axis.

2. (a) The cost of hiring a bus is partly constant and partly varies as the square of the distance it will travel. If the cost C is $sh\ 12{,}000$ when distance $d = 10km$ and the cost C is $sh\ 18{,}000$, when distance $20km$ Find

   (i) The equation relating C and d (ii) The cost of hiring a bus when $d = 8km$

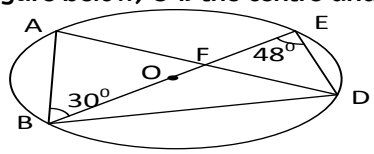
   (b) P varies directly as the cube of Q and inversely as the square of R.

   (i) Given that $P = 16$ when $Q = 2$ and $R = 3$, find R when $P = 228$ and $Q = 4$

   (ii) Q decreased by 30% while R increased by 40%. Find the percentage decrease in P

3. (a) The sum of the interior angles of a polygon is 720°. Find the number of sides and hence the size of the exterior angle of the polygon

   (b) In the figure below, O is the centre and BE is the diameter. Angle $ABE = 30°$ and $< FED = 48°$.

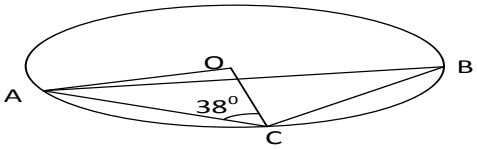


   Find the;

   (i) Angle EBD

   (ii) Angle AFB

   (c) In the figure below, O is the centre of a circle. Angle $ACO = 38°$



   Find the size of the

   (i) Angle AOC

   (ii) Angle ABC

4. (a) The base area of a cylindrical container is 72cm^2. the container is enlarged so that the new container is similar to the old container and has a base area of 128cm^2.

   (i) The radius of the new container is 20cm. Determine the radius of the old container

   (ii) Given that the capacity of the old container is 810 cm^3, calculate the capacity of the new container in litres

   (b) The scale of a map is $1:400{,}000$. On this map two towns are separated by a line 11.25cm long.

   (i) Find the distance between the two towns in Km

   (ii) A game reserve is represented by a square of side 45cm on this map find the area of the game reserve in km^2

5. The distance from Soroti to Jinja is 229km. A bus leaves Jinja at 8:55am and travels at a steady speed of 56km/h towards Soroti. At 9:40am a car leaves Soroti traveling towards Jinja, at a steady speed of 80km/h

   (a) On the same axes, draw a distance time graph for the journeys of the two vehicles. Use a scale of 2cm to represent 1 hour and 2cm to represent 20km. find time and distance from Soroti when the two vehicles meet

   (b) Given that after meeting, the bus now increases its speed by 14kmh, find;

   (i) Time when the bus arrives in Soroti

   (ii) Difference in the time of arrival of the two vehicles

6. The table below shows the marks scored in general paper by some students in mock examiners from a certain school

Marks	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80	81 - 90
Frequency	12	18	14	8	6	2

(a) Draw a histogram and use it to estimate the modal mark

(b) Find the mean, mode and median

7. a) Solve the following inequalities

(i) $\frac{1}{4}x + \frac{1}{3} \leq \frac{1}{3}x + \frac{1}{2}$ (ii) $5 - 3x \leq x - 7 < 11 - 2x$

(b) A transport company is required to transport 375 passengers and 5250kg of luggage. It has 2 kinds of vehicles, type A and type B. Type A which can carry 39 passengers and 300kg of luggage each, and type B which can carry 24 passengers and 450kg of luggage each. The company could only use a maximum of 15 vehicles altogether. If x is number of type A and y the number of type B

(i) Write down five inequalities satisfying the given conditions

(ii) Plot graphs of the inequalities you have formed on the same axes and shade the un wanted region

(iii) What is the least number of vehicles that can be used?

(iv) If the cost of running one vehicle of type A is $sh\ 540{,}000$ and that of running one of type B is $sh\ 450{,}000$, find the minimum cost of running the vehicles

8. (a) Given that $\frac{\sqrt{6}}{2-\sqrt{3}} = h\sqrt{6} + k\sqrt{2}$. Hence find the values of h and k

(b) Given that $sin\theta = \frac{\sqrt{2}}{\sqrt{3}}$. Find the value of $\frac{tan\theta + sin\theta}{cos\theta}$

(c) Solve for x in the equation $27^x x 3^{(2x-2)} = 9^{(x+2)}$

(d) Without using calculators find the value of ;

(i) $\log_{10} 96 + \frac{3}{4}\log_{10} 625 - \log_{10} 12$

(ii) $\left(\frac{125}{8}\right)^{1/3} x \left(\frac{25}{16}\right)^{-3/2} x \left(\frac{625}{64}\right)^{1/2}$

(e) Given that $\log 3 = 0.4771,\ \log 5 = 0.6990$ and $\log 2 = 0.3010$. Evaluate $\log 4320$

(f) Use logarithms to evaluate $\sqrt{\frac{65.52x7.392}{3.696x32.76}}$

9. (a) Two fair dice 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

10. (a) Complete the table below for the equation $y = 7 - 3x - 2x^2$

x	-4	-3	-2	-1	0	1	2	3
$-2x^2$		-18		-2		-2	-8	
-3x		9		3		-3		
7		7						
y		-2		8		2		

(b) Use your table to draw a graph of

$y = 2x^2 + 3x - 11$

(c) Use your graph to solve

(i) $7 - 3x - 2x^2 = 0$

(ii) $2x^2 + 4x - 9 = 0$

(d) State the line of symmetry

11. (a) Factorize completely $3x^2 - 11x + 6$. Hence solve $3x^2 - 11x + 6 = 0$

(b) The width of a hall is 4meters shorter than its length. A carpet whose area is $77m^2$ is laid in the middle of the hall leaving a margin 1.5 meters wide between the wall and the carpet all around the hall.

(i) Taking x as the width of the room, express the dimensions of the carpet in terms of x

(ii) Write down the area of the carpet in terms of x

(iii) Determine the dimensions of the hall

(iv) Find the cost of covering the space between the wall and the carpet with a material which costs $sh\ 1500$ per square metre.

12. (a) Solve the simultaneous equations below using matrix method

$3x - 5y = -9$

$2y + 5x = 16$

(b) Solve the following simultaneous equations

(i) $x^2 + y^2 = 10$
$x - y = 2$

(ii) $\frac{x-1}{y+1} = \frac{1}{4}$
$\frac{x+1}{y-1} = \frac{2}{3}$

(c) A trader bought a number of suits at a cost of $sh\ 5{,}760{,}000$ from Ken suits whole salers. Had he bought the same number of suits from Ham whole salers, it would have cost him $sh\ 48{,}000$ less per suit and he would have bought 4 extra suits for the same amount of money

(i) Find the number of suits the trader bought

(ii) The trader later sold each suit for $sh\ 72{,}000$ more than he had paid for it. Determine the percentage profit he made on each suit

13. (a) Factorize completely $45a^2 - 20b^2$ and hence find its value when $a = 5$ and $b = 3$

(b) Opio is now three times as old as his daughter and four times as old as his son. Eight years from now Opio's age will be twelve years more than the sum of the ages of his son and daughter. Find Opio's present age.

(c) A two-digit number is such that sum of its digits is 14 . The number formed when its digits are interchanged exceeds the original number by 18. Find the original number.

14. (a) Evaluate

(i) $\dfrac{9\frac{1}{2} - 3\frac{1}{3} \div \frac{5}{9}}{{}^{3}/_{5}\ of\ 6\frac{1}{4} + 1\frac{1}{2}}$ (ii) $\dfrac{5\frac{3}{5} x 1\frac{3}{4} + 8\frac{1}{3} \div \frac{5}{9}}{5\frac{1}{6} x 1\frac{1}{5}}$

(b) Solve the equations

(i) $\dfrac{2x+1}{3} - \dfrac{x-3}{2} = \dfrac{4x-1}{6}$ (ii) $\dfrac{1}{3x} + \dfrac{1}{4} = \dfrac{3}{5x}$

(c) Eva spends one-third of her salary on food, one-quarter on rent , three-fifth of the remainder on transport and saves the rest. If she spends sh$180{,}000$ on transport, find how much money she saves

(d) Convert the following recurring decimals into fractions

(i) $0.\overline{23}$. (ii) $0.3\overline{21}$.

15. (a) Kayiima left $11{,}658{,}000/=$ in his will to be share between his wife, daughter and son in the ration $1:2:3$. His wife decided to divide her share equally between her daughter and son. Determine how much the son finally got.

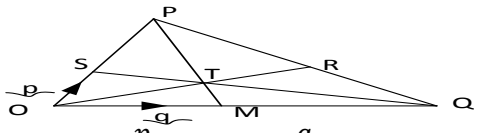
(b) If the ratio $a:b = 3:5$,and $a:c = 4:7$ find the ratio $a:b:c$.

(c) It would take 15men 8 days to dig a trench 240m long. Find how many days it would take 18 men to dig a trench 360m long working at the same rate

16. Given the column vector $\underset{\sim}{a} = \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}$, $\underset{\sim}{b} = \begin{pmatrix} 6 \\ -3 \\ 9 \end{pmatrix}$ and $\underset{\sim}{c} = \begin{pmatrix} -3 \\ 2 \\ 3 \end{pmatrix}$ and that $\underset{\sim}{p} = 2\underset{\sim}{a} - \frac{1}{3}\underset{\sim}{b} + \underset{\sim}{c}$, find;

(a) the column vector $\underset{\sim}{p}$ (b) Magnitude of $\underset{\sim}{p}$

17. The figure below shows a triangle in which $OS:OP = 1:3$, $PR:RQ = 2:1$ and T is the midpoint of OR



(a) Given that $OP = \underset{\sim}{p}$ and $OQ = \underset{\sim}{q}$, express the following vectors in terms of $\underset{\sim}{p}$ and $\underset{\sim}{q}$

(i) OR

(ii) QT

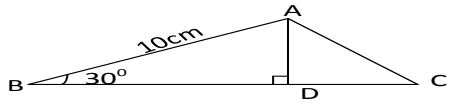
(b) Show that Q, T and S are collinear

(c) M is a appoint on OQ such that $OM = k\ OQ$ and PTM is a straight line. Given that $PT:TM = 5:1$ find the value of k

18. (a) Given that $tan\alpha = \frac{15}{8}$. Find;

(i) $cos\alpha$ (ii) $4cos\alpha - sin\alpha$

(b) In the diagram blow ABC is a triangle in which $AB = 10cm$ and angle $ABC = 30°$. Line AD is perpendicular to BC and $BD:DC = 2:1$



Calculate the length of AC

(c) From a point A on the horizontal ground, the angle of elevation of the tree top is 25°. From another point B which is 10m from the base of the tree, the angle of elevation of the top of the tree is 36.5°. Find the;

(i) height of the tree (ii) Distance between A and B

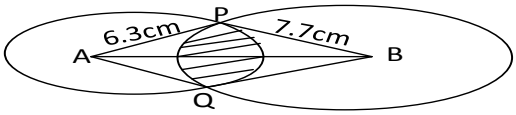
19. (a) The wheel of a bicycle is rotating at the rate of 130 revolutions per minute. If the speed of the bicycle is 18.4km/h, calculate the diameter of the wheel **take** $\pi = 3.14$

(b) Starting from noon the minute hand of a clock moved so that the clock is 25 minutes to one

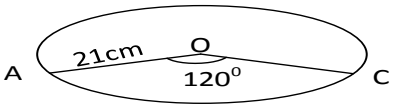
(i) Find the angle through which the minute hand has moved

(ii) Given that the minute hand is 6cm long, find the length of the arc it describes. (take $\pi = \frac{22}{7}$)

(c) Two circles have a common chord 10cm long. If their radii are 6.3cm and 7.7cm. Find the area of the shaded region



20. The figure below shows a circle centre O and radius 21cm. The minor arc ABC subtends an angle of 120° at the centre of the circle. (take $\pi = \frac{22}{7}$)



(a) Find the area of the minor sector

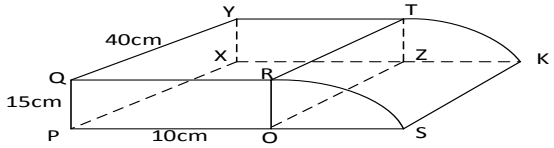
(b) The minor sector is cut off and folded to form a hollow cone. Find the;

(i) base radius of the cone

(ii) Vertical height of the cone

(iii) Volume of the cone

21. The diagram below shows a piece of wood of uniform cross section PQRS in which OPQR is a rectangle and ORS is quadrant of circle, centre O. the other rectangles are PQYX and PXZS.



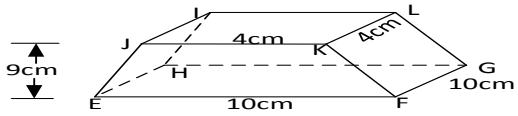
Given that PQ= $15cm$, PO= $10cm$ and QY= $40cm$. calculate

(i) Area of cross section PQRS

(ii) Volume of the wood

(iii) Total surface area of the piece of wood

22. The diagram below EFGHIJKL is a square base frustrum whose dimensions are shown. The perpendicular ehigth of the frustrum is 9cm. given that $EF = FG = GH = HE = 10cm$ and $JK = KL = IJ = 4cm$



calculate;

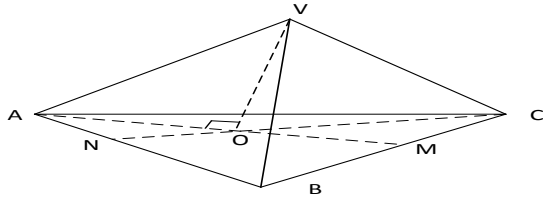
(a) Vertical height of the original pyramid

(b) Angle between the line FK and the base EFGH

(c) Angle between the line LG and EF

(d) Volume of the frustrum

23. The figure below shows a tetrahedron. The length of each edge is 8cm. O is the centre of triangle ABC



Calculate;

(a) The length VO

(b) The angle between the line AV and the plane ABC

(c) The angle between the planes ABC and VBC

(d) Volume of the tetrahedron

24. (a) The cost of making a sofa seat is divided into materials, labour, tax and other charges. In a certain year these costs were as follows

$Material$	47,500	Tax	18,000
$Labour$	60,000	$Other$	20,000

In the following year the cost of materials doubled, the cost of labour increased by 50%, government tax decreased by $33\frac{1}{3}\%$ and other charges increased by 15%.

(i) Calculate the percentage increase in the cost of making the seat

(ii) The carpenter now sells the seat at a whole sale price and makes a profit of 40%. Determine the whole sale price

(b) The cost of manufacturing a car is divided into the cost of materials, labour and other expenses in the ratio $5:2:1$. In a certain year the cost of materials increased by 30%, the cost of labour increased by 40% and the other expenses decreased by 10%. Determine the percentage increase in the cost of manufacturing the car

(c) In the first year Kigwee had forty more goats than sheep and half as many cows as sheep. In the second year he noticed that his goats had increased by 50%, his cows decreased by 10% and his sheep increased by 20%. At the end of the second year he counted all his animals to be 690. Find the percentage increase of his animals during the second year

25. (a) Solve for y for which the matrix $\begin{pmatrix} y & -5 \\ -3 & y-2 \end{pmatrix}$ has no inverse

(b) If $A = \begin{pmatrix} 1 & -1 \\ 3 & -2 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & -1 \\ 1 & 1 \end{pmatrix}$ Find matrix C, such that $B^2 = C + AB$

(c) Given that $P = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$ and $E = \begin{pmatrix} 3 & 2 \\ 1 & 0 \end{pmatrix}$ find D such that $PD = E$

(d) A square of area $10cm^2$, is mapped onto a square of area $110cm^2$ by a transformation $\begin{pmatrix} 5x & 2 \\ -3 & x \end{pmatrix}$ find the value of x.

(e) A triangle PQR with vertices $P(1,-2),\ Q(-1,2),\ R(4,3)$ and is mapped onto triangle $P^1\ Q^1\ R^1$ by a matrix $M = \begin{pmatrix} 2 & -3 \\ -1 & 1 \end{pmatrix}$. Find the co-ordinates of $P^1\ Q^1\ R^1$

(f) Triangle PQR is mapped onto $P^1\ Q^1\ R^1$ with vertices $P^1\ (3,-8),\ Q^1\ (-5,4)\ R^1(7,0)$ by the transformation matrix $\begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$. Find the co-ordinates of $P, Q\ and\ R$

26. A triangle ABC with vertices $A(6,0),\ B(6,-5), C(2,-5)$ and is mapped onto triangle $A^1\ B^1\ C^1$ by a negative quarter turn about the origin. Triangle $A^1\ B^1\ C^1\ D^1$ is then mapped onto triangle $A^{11}\ B^{11}\ C^{11}\ D^{11}$ by a reflection about the line $y = -x$

(a) Draw on the same axes triangles ABC, $A^1\ B^1\ C^1$ and $A^{11}\ B^{11}\ C^{11}$

(b) Find the co-ordinates of $A^1\ B^1\ C^1$ 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 $A\ B\ C$ and describe it fully

27. Triangle PQR has vertices $P(2,2),\ Q(5,3), R(4,1)$. Triangle PQR is mapped onto $P^1\ Q^1\ R^1$ by the transformation matrix $\begin{pmatrix} 1 & -1 \\ -2 & 1 \end{pmatrix}$.

(a) Find the co-ordinates of $P^1\ Q^1\ R^1$

(b) Triangle $P^1\ Q^1\ R^1$ is mapped onto $P^{11}\ Q^{11}\ R^{11}$ with vertices at $P^{11}(-2,-2),\ Q^{11}\ (-5,-3),\ R^{11}\ (-1,-4)$. Find the matrix of transformation

(c) Find a single transformation which maps rectangle$P^{11}\ Q^{11}\ R^{11}$ back onto PQR

28. (a) A trader bought an item at $sh\ 640{,}000$. If he sold it making a profit of 20% what was the selling price

(b) By buying an item cash, Mary was given a discount of $sh\ 50{,}000$. If she paid $sh\ 330{,}000$ cash, what was the percentage discount.

(c) A sales lady is paid a commission at a rate of 3% for all the goods she sells. During one she sold 12 woofers at $sh\ 155{,}000$ each, 8 DVD players at $sh\ 56{,}500$ each and 4 TV sets at $sh\ 217{,}000$ each. Calculate the total commission she earned in that month

(d) The hire purchase value of a sewing machine is 25% more than its cash price. The HP terms require a customer to pay 32.5% of the HP price deposit followed by 9 monthly installments of $sh\ 150000$ each. Calculate the cash price of the sewing machine

29. (a) A certain amount of money was invested for 4 years at a rate of 6% per annum simple interest. If the interest was $sh\ 180{,}000$, find the amount that was invested

(b) Calculate the compound interest on $sh\ 900{,}000$ for 2 years at 12.5% P.A compounded half yearly.

(c) A certain property whose value was $sh\ 550{,}000$ had its value decrease by 10% in the first year and by 30% for the following two years. What was its value after three years

(d) Given that 1 pound sterling $£ = U\ sh\ 4800$ and 1 US dollar $\$ = U\ sh\ 4000$. Find how many dollars can be exchanged for 25 sterling pounds

30. 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 aany 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

31. Using a ruler, a pencil and a pair of compass only.

(a) Construct a triangle PQR, where angle $QPR = 30°$, angle $PQR = 90°$, $\overline{PR} = 9.6cm$ and $\overline{QR} = 4.8cm$

(b) S is a point on $\overline{QR}$ produced 2.7cm away from $\overline{PQ}$. Construct angle $QST = 45°$ with $\overline{ST} = 10.1cm$. Construct a circle circumscribing triangle PRS such that it also passes though the point T.

(c) Measure

(i) Length PQ and QT

(ii) Angle PSR

32. A plane flew due west from Entebbe at a speed of 2080kmh^{-1} for $1\frac{1}{2}$ hours to reach Kabale. At Kabale It then altered its course and flew North-east to Soroti at 150kmh^{-1}. The total time when the plane was in air was 5 hours.

(i) By scale drawing, determine the distance and bearing of Entebbe from Soroti. (Use 1cm to represent 50km)

(ii) On its way to Soroti the plane passed over Gulu which is North of Entebbe. Estimate the distance between Soroti and Gulu

(iii) If the plane flew back to Entebbe via Gulu at a speed of 200kmh^{-1}, determine the time it took to fly from Soroti to Entebbe

33. (a) Given that $f(x) = \frac{8}{1-x^2}$. Find

(i) $f(3)$

(ii) x when f$(x) = -1$

(iii) the value of x for which $f(x)$ is undefined

(b) Given that $f(x) = x^2 + 1$ and $g(x) = x - 1$. find

(i) $f^{-1}(5)$

(ii) $g^{-1}(x) = -2$

(iii) The value of x for which $fg(x) = gf(x)$