EXODUS COLLEGE SCHOOL, WAKISO

MATHEMATICS SEMINAR QUESTIONS 2018

Sets:

1 . In a group of 200 students, none of them had a choice to take one of the following subjects due to the too much English in them. Due to the demand of doctors, teachers and Engineers in Uganda, 75% of the students were forced to take at least one of Mathematics (A), Biology (B) or Physics (C). Given that the number of students who accepted to take physics only was two times as many as those who took all the three subjects. Those who were convinced to take Biology were as many as those who managed to take only Mathematics who were less than those who did not manage to take any of the three subjects by only 2 students but due to their love for becoming Engineers, none of the students did Biology only.
Given that$n(AnBnc^{l}) = n(AnB^{l}nC) - 1 = n(A^{l}nBnC) - 2 = 13$;

a) . Represent the information onto a Venn diagram.
b) . Find how many students managed to take all the three subjects.
c) . Find the number of students who did only two subjects
d) What is the probability that a student selected at random did at most one subject.

2 . In S.4 class, student chose different subjects for their subjects' combination to be done in S.5. 56 chose to take Physics (P), 49 chose Biology (B) and 36 chose Chemistry(C). All the students chose to take at least one of the three subjects except 8 who were absent. 12 students chose Physics and Biology but not chemistry, 30 students chose Physics only, 10 students chose Biology only and 40 students chose more than one subject. Using a Venn diagram, find how many students;

a) Belong to the whole class
b) Chose chemistry only
c) Chose more than two subjects

3 . A group of tourists visited Farm gate Limited, a company offering catering services. It was found out that 20 ate Rice (R) , 30 ate Posho(P) and 15 ate Matooke(M). 6 ate Rice and Posho, 4 ate Posho and Matooke, and 5 ate Rice and Matooke. The number of visitors who ate Posho only is equal to twice the number of visitors who ate Rice only. All the visitors ate atleast one of the foods.

a) Represent the information on a Venn diagram.
b) Find the number of visitors
i) who ate all the three foods.

ii) in the group

c) If a visitor is chosen at random from the group, find the probability that the visitor ate atleast two foods.

4 . In the random sample of 1000 men, the following facts emerged:

i) 271 of the men were bald,

ii) 248 of the men wore spectacles,

iii) 251 of the men were blind,

iv) 64 of the men were both bald and wore spectacles

v) 97 of the men were both bald and were blind,

vi) 59 of the men wore spectacles and were blind and

vii) 434 of the men were not bald, did not wear spectacles and could see.

(a). Represent the information onto a venn diagram.

(b). Find how many were bald, wore spectacle and were blind.

(c). Find how many men were bald but didn't wear neither spectacle nor blind

(d). If a man is chosen at random, what I the probability that he wears spectacles and he is blind.

Linear programming

5 . A car factory assembles two types of vehicles; Land cruiser(x) and Toyota(y) on different assembly lines. An assembly line for a land cruiser occupies an area of $60m^2$ and that of a Toyota $30m^2$ of the floor space. The floor space available for all the assembly lines is $420m^2$. The assembly lines for land cruiser need 10 men to operate it whereas that for a Toyota needs 16 men to operate it. The assembly lines need less than 120 men to operate them.

a) By forming the four inequalities, draw the graphs for the above inequalities and hence shade the unwanted region.

b) The assembly lines for a land cruiser and a Toyota produce 30 vehicles and 20 vehicles per day, find the highest number of vehicles that can be produced per day.

6 . A company constructed a store block which needed 34,000kg of sand. The company hired a lorry and a tipper truck with capacities 7,000kg and 5000kg respectively to transport the sand. The cost per trip either by the lorry or a tipper was 30 pounds. The money available for transportation was 180 pounds. The trips made by the lorry did not exceed those made by the tipper.

a) If x and y represent the number of trips made by the lorry and the tipper respectively.
   (i). Write five inequalities to represent the given information.
   (ii). Plot the inequalities on the same axes and shade the unwanted region.
b) (i). From your graph in (a)(ii) above, list all the possible numbers of trips that each vehicle can make so as to maximize the total mass of sand transported.
c) Find the number of trips made by each vehicle that made the greatest total mass of sand.

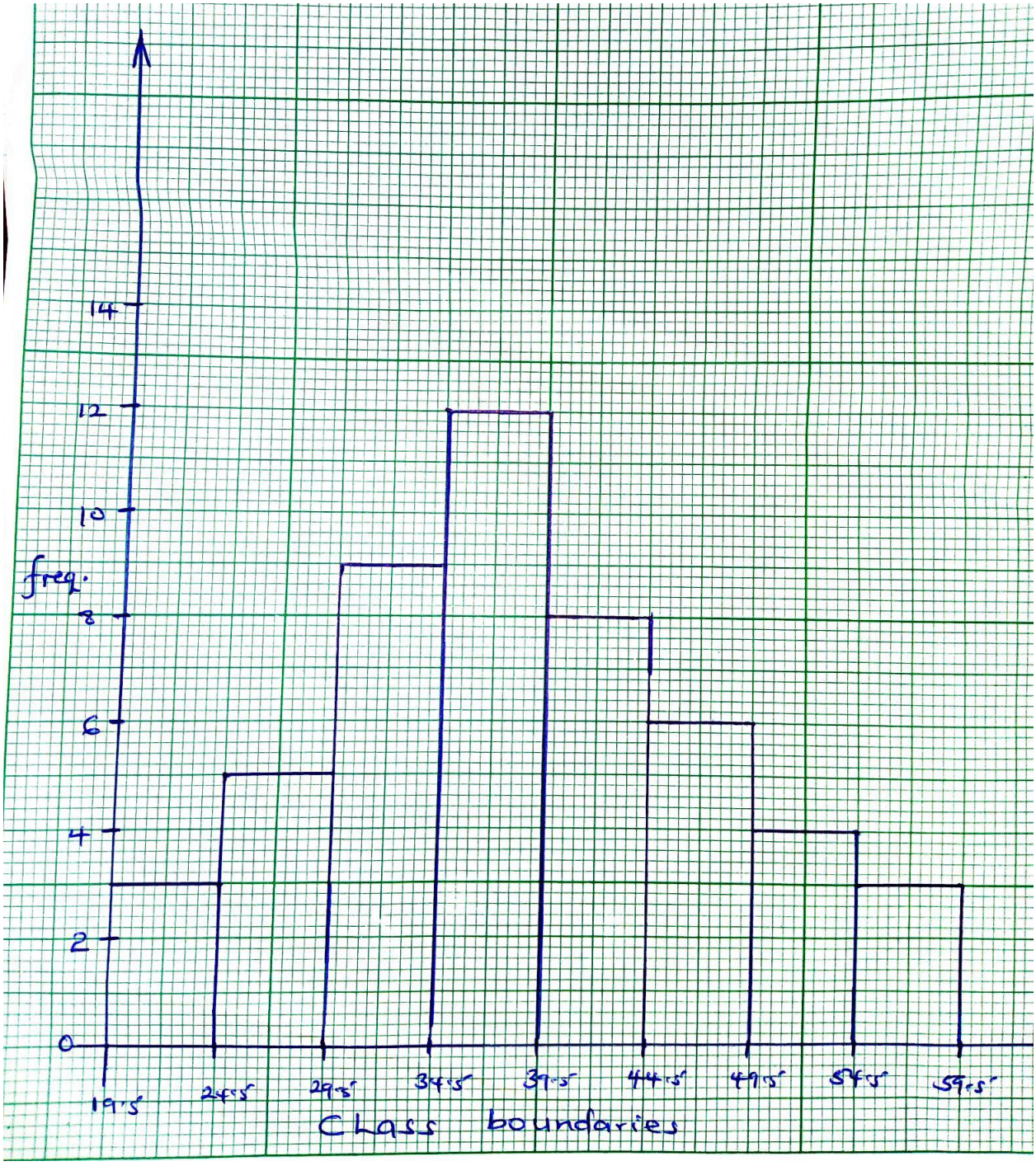
Statistics:

7 . The table below shows results obtained in an experiment to measure the length of the leaves from stalk to the apex.

Class limits	Mid mark(x)	Frequency(f)	Cumulative frequency	fx	Class boundary
6.0-6.9		2			
		5			6.95-7.95
		9			
		12			
		5			9.95-10.95
		3			
		2			
		_	40		12.95-13.95

Complete the table above and use it to compute;
(a). the mean length
(b). the mode
(c). the median

8 . The graph below shows a histogram for the marks obtained by S.4 students in the a mathematics exam. Study it carefully and use it to answer the questions that follow.



(a). Construct a frequency distribution table using the assumed mean of 44%

(b). Calculate; (i). the actual mean mark.

(ii). the median mark.

(c). Use the graph to estimate the modal mark (12 marks)

9 . The table below shows the weight (kg) of students in a class with their corresponding cumulative frequency

marks	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
c.f	4	8	15	25	33	40	44	46	54

(a). Construct a frequency distribution and use it to calculate;

i) the mean mark

ii) the modal mark.

(c). Construct a cumulative frequency curve and use it to estimate the median mark.

Construction:

1 0 . Points A, B and D are in a straight line where $\mathrm{AB} = 6\mathrm{cm}$ and $\mathrm{AD} = 2\mathrm{AB}$. Angle $\mathrm{ABC} = 82.5^0$and $\mathrm{ADC} = 60^0$. Point $E$is in line BC where the line through E from A meets the line DC normally at F.

(a) With the help of a compass, clearly and accurately show the information by drawing

(b) Find the area of the circle that passes through ADF.

(c) Find the area of the circle that inscribes the triangle BDC.

(d) Find the area of triangle ABE.

1 1 . Construct using a pair of compasses and a ruler only, a triangle ABC where $\langle ABC = 75^0$, $\langle BAC = 30^0$ and $\overline{AB} = 8.5cm$.

Construct a perpendicular at C to to meet line AB at M. Draw a circle to pass through the points ACM and state the radius of the circle

1 2 . Using a ruler, pencil and a pair of compasses only, Construct a triangle PQR, where angle QPR = 135°, PQ = 8.4cm and QR=12.5cm. State the length of PR. S and T are points such that TS bisects QR where T is on QR and S on the same side as PQ. Point E is on line RQ such that a line from P through E meets PR at 90^0 is on line RQ such that a line from P through E meets PR at 90 to a point Z such that PR = EZ. Find the area between the circumcircle and inscriber of QRZ.

Business:

1 3 . a) A man who banked 1.508 million shillings on his savings account foundout after a certain period of time that he has 1.944 million shillings on his account. If the bank was paying him a simple interest rate of 8% per annum, fid the period in which he left his money to accumulate to 1.944 million shillings. Give your answer in months.

b) Find the rate at which the Bank was charging peter if he borrowed 5.08 million shillings on a compound interest from the bank for 2 years and the money accumulated to 5.96 million shillings.

c) A hawker selling text books earns a commission of 10% for the first 800 books sold and earns a commission of 3% on the total extra sale exceeding 800 books. If he sold worth 6,000,000 shillings on a particular day and each book costs 6,000/=, find: -

a. How many books he sold in total.

b. His total commission for the day.

1 4 . The income tax structure is shown in the table below.

Taxable income	Tax rate
Per month in shs	%
01 - 50,000	10.0
50,0001 - 110,000	20.0
110,001 - 200,000	24.5
200,001 – 350,000	35.0
350,001 – 600,000	40.0
Above 600,000	49.0

(a) Calculate Mr. Okello's

(i) Taxable income (05 marks)

(ii) Income tax (05 marks)

(b) Express the income tax as a percentage of his monthly gross salary (02marks)

1 5 . Below is an advertisement for a brand new laptop.

LAPTOP LAPTOT LAPTOP LAPTOP

HURRY WHILE STOCK LASTS!

PRICE: SHS 1,200,000.

CASH PAYMENT: GET A DISCOUNT OF 15%

HIRE PURCHASE: DEPOSIT 20% OF THE PRICE AND EITHER PAY SHS . 390,000 MONTHLY FOR 3 MONTHS OR SHS. 100,000 WEEKLY FOR 13 WEEKS.

Calculate the cost of purchasing a laptop using;

i) the weekly hire purchase terms.

ii) the monthly hire purchase

c) Find the savings one would make by paying cash rather than using weekly hire purchase terms.

16. The tax structure on income of Ministry of Education was as below

Taxable income	Rate(%)
0 – 50.000	3.0
50.001 -110.000	9.0
110.001 – 200.000	15.0
200.001 -300.000	21.0
300.001 – 380.000	24.0
Above 380.000	32.0

Obaita is an employee of the ministry of Education and In December 2009, he paid an income tax of $sh.83.000/=$.

a) Calculate Oguta's taxable income

b) If Oguta was paid a tax free allowance of $\frac{1}{5}$ of his gross income, calculate his gross income and allowances received.

Kinematics

17. A lorry leaves Arua for Kampala at a speed of 50km/h. Thirty minutes later a pick up leaves Arua for Kampala at 60km/h. Calculate how far from Arua the pick-up overtakes the lorry.

18. Mbarara is 260km away from Kampala. A express bus leaves Kampala for Mbarara at 6:45am travelling at a steady speed of 52km/hr. A commuter taxi leaves Kampala $1\frac{1}{2}hrs$ later travels non-stop at a speed of 84km/hr. Draw on the same axes a distance-time graph for the journey of the two vehicles using a scale of 2cm for 1 hour and 2cm for 3km. hence or otherwise, determine the time and distance form Kampala when the commuter overtook the bus. Calculate the difference in their times of arrival.

19. Gate way bus A started from Iganga, 100 miles away from Kampala at 12:00 and it is to repot to Kampala office at 14:00. After 30minutes, the bus gets a puncture that lasted for 24minute being repaired and resumed its journey to Kampala. At 13:00, gate way bus B started from Kampala to Iganga at a speed of 30miles per hour, however after 15minutes, the driver stopped for lunch in Mukono town for 24minutes and resumed the journey at a steady speed as before.

(a). Represent the motion of the two buses on the same distance-time graph

(b). Find the speed of A after the puncture

(c). Find when and where the two buses met from Kampala

(d). How far is Mukono from Kampala

(e). Find the time when B would get to Iganga without stopping at Mukono

Trigonometry

20. Points A, B and C are on the same horizontal plan. A man stand at a point C to view a bird at the top of the pole at a point A at an angle of elevation 30^0. Another man at point B views the same bird at an angle of elevation 75^0. If points B and C are 12cm apart, find the how point C is from the foot of the pole and the height of the pole.

Variation and proportionality

21. The expenditure of a certain family is in two parts, one part is a constant and the other varies as the square of the number of children. A family of 3 children, spends 4500/= whereas that of 3 children spends 2750/= a day.

(a). Write the expression for the total expenditure.

(b). Find the expenditure for;

(i). a family of 7 children

(ii). A family which no child but 5 defendants

(iii). A childless family.

22. (a). Given that p varies directly as q but inversely as the square of w. If $p = 75, q = 400\ when w = 2$, find the value of $p when q = 900\ and w = 3$.

(b). Given that y is directly proportional to x and inversely proportional to z. $if y = 2x = 20\ when z = 2$, find z when $y = 3x = 90$.

Matrices and transformation:

2 3 . If the matrix, $\begin{pmatrix} 9 & x \\ x^2 & 3 \end{pmatrix}$ is singular, find the value of x.

2 4 . In the market, there were four men who were selling different commodities of which only three commodities were on market a week.

	Dodo(kg)	Gonja	Matooke	Rice(kg)
Musoke	20	2	2	50
Katamba	2	3	1	20
Ssekimpi	5	1	3	25
Wamala	12	2	1	40

Given that the unit costs of Dodo, Gonja, Matooke and Rice are respectively; 2,000/=, 7,000/=, 12,000/= and 3,000/=, Dodo was not on market in the first week which was put back and Gonja scraped off the following week.

(a). With the help of matrix method, find the difference in the total earnings of the company which the above men were working for.

(b). Given that the government tax varied from 20% in the first week to 25% in the second week, find how much the government gained from the company in these two weeks.

2 5 . Given the transformations represented by matrices; $T_1 = \begin{pmatrix} 2 & 1 \\ -1 & -2 \end{pmatrix}$ and $T_2 = \begin{pmatrix} 3 & 1 \\ 1 & 3 \end{pmatrix}$ and T_1 followed by T_2 can be represented by a single matrix T.

(a). Find the matrix T and its inverse.

(b). The point $A^{11}(7 , -11)$, $B^{11}(-7 , -13)$, and $C^{11}(-8 , 16)$ are images of A,B and C under T_1 followed by T_2. Find the coordinates of A, B and C.

(c). Find the coordinates of A^1, B^1 and C^1, the image of A, B and C under a single transformation T_1.

2 6 . The points A(1, 0), B(3, 0), C(3, 1) and D(1, 1) are vertices of a rectangle ABCD. The triangle is reflected through the line $y + x = 0$ to obtain the image A'B'C'D'. the image A'B'C'D' is further transformed by a rotation through a positive quarter turn to obtain the image A''B''C''D''

a) State the two transformations

b) Find the coordinates of the images A'B'C'D' and A''B''C''D''

c) Find a single matrix of transformation which would maps rectangle A'',B'',C'',D'' back onto ABCD.

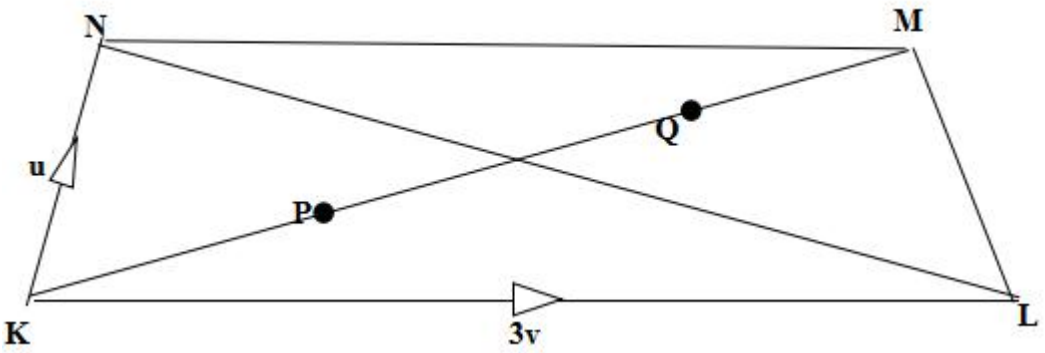
Vectors.

2 7 . The coordinates of A and B are (-6, 15) and (4, 5) respectively, X is a Point of **AB** such that **AX : XB** = 1: 4. Find;

i) **AB**

ii) The position Vector of X.

2 8 . The fig: KLMN is a trapezium. **NM** is parallel to **KL** and **NM** :**KL** = 2:3



Express in terms of **u** and **v**

a) **NM** b) **LM** c) **KM** d) **LN**

P is a point on km such that **KP** = m **KM** and Q is on **LN** such that **LQ** = n **LN**

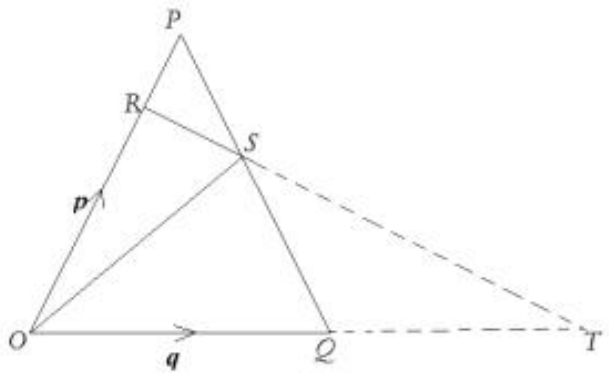
Express in terms of u, v, m and n

i) **KP**

ii) **KQ**

iii) Hence find the scalars m and n if **KP** = **KQ**

2 9 . In the figure below, ***OP*** = ***p***,***OQ*** = ***q***, $2\overline{OP} = 5\overline{OR}$, and $4\overline{PQ} = 5\overline{PS}$. When *RS* and *OQ* are produced, they meet at *T*.



(a) Express in terms ***p*** and ***q*** the vectors

(i) ***OR***

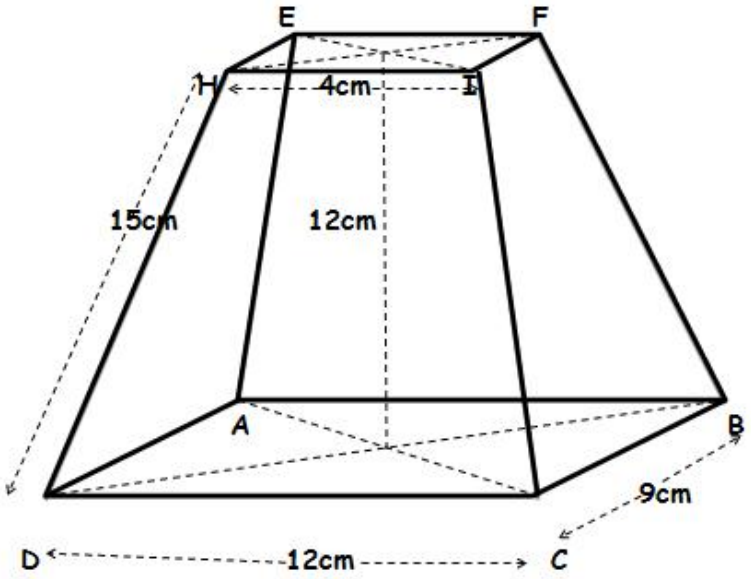
(ii) ***OS***

(iii) ***RS***

(b) Given that $\overline{OT} = n\overline{OQ}$ and $\overline{RT} = m\overline{RS}$, find the values of *m* and *n*

3-DIMENSION

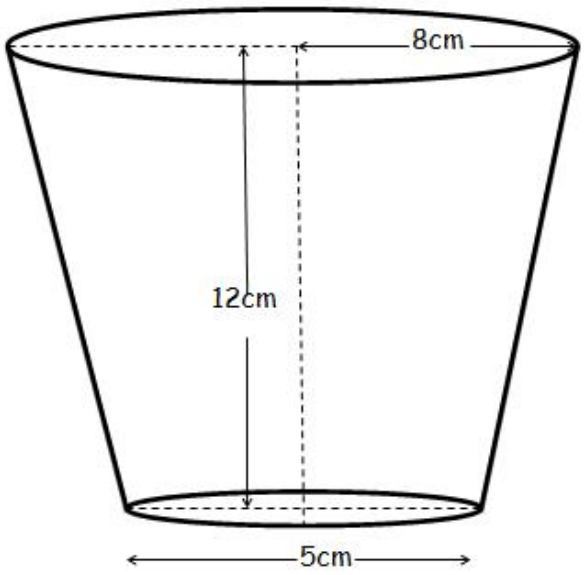
3 0 . The figure below shows part of a pyramid whose top was cut.



(a). Find the;(i). Volume of the figure . (ii) Angle between DCO and the base.

(ii). Angle between CDO and ADO where O in the tip **of** the pyramid

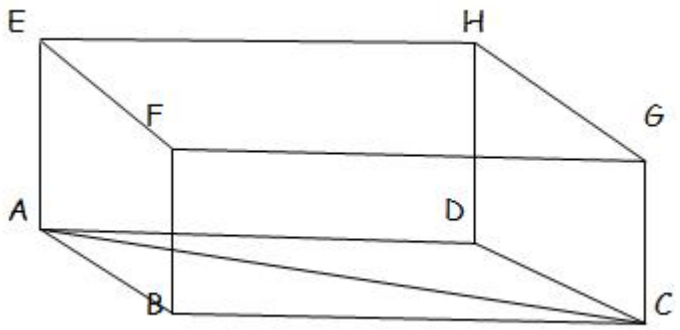
3 1 . The figure below is a glass used to drink milk at a take-away restaurant. The open-end has a radius 8cm and the bottom of diameter 5cm wide.



A can in a cylindrical shape with diameter 28cm and height 36cm is fully-filled with milk. Determine the;

a) Volume of the glass
b) Number of fully-filled glasses that can be got from the can.

3 2 . The figure below is a cuboid with square faces ABFE and DCGH. Where BC = 12cm and AC = 13cm.



Calculate; (a). the lengths BF and BH.
(b). the angle between BH and ABCD.
(c). the angle between ABGH and EFGH

END