

Topic 1

Equations of lines

Question 1

A helicopter search and rescue crew is considering the shortest path a helicopter at position (14,4) should take so that it is perpendicular to the score line passing through the points (1,3) and (4,1). The helicopter occupies $800m^3$ of space. The helicopter is similar to a smaller helicopter that occupies $100m^3$ of space. the height of the smaller helicopter is 5 metres less than that of the bigger helicopter.

Task

- a) Write down the equation of the shortest path.
- b) Work out the height of the helicopters.

Question 2

Your elder brother loves playing different games. One day while playing hockey, a hockey puck leaves the blade of a hockey stick at point $(-4,0)$, bounces off a wall at point $(0,8)$, and travels in a new direction to position $(-4,16)$, the wall is represented by the equation $x = 0$. Your friend claims the path of the puck forms a right angle. The image of the puck is formed after it is reflected through a glass wall represented by the equation $x = 3$.

Task

- a) Determine whether or not your friend is correct.
- b) Determine the area occupied by the image of the puck

Question 3

You are the head prefect of your school. Students claim that there is no clean water in school. In response to the above claim, the school is proposing to buy pipes for the construction of a new blue water pipe that will pass through $(2,0)$. The new water pipe will be perpendicular to the old green pipe passing through $(-3, -1)$ and $(0,3)$. 3 blue and 6 green pipes are sold at UGX363000 while 8 blue and 2 green pipes are sold at UGX436000 from the same point. The school is prepared to buy only 3 blue pipes.

Task

- a) Show the design of the construction of the new pipe on the Cartesian plane and write an equation that represents the new pipe.
- b) How much money will the school spend in buying the pipes.

Question 4

Your school is considering starting a sports academy. The school will charge initial registration fee of UGX.50000 and a monthly fee of UGX 250000. The school will register only 100 sports players who participate in either basketball, soccer or tennis. 40 players will be for basketball, 30 for soccer and 20 for tennis. Some players registered will play more than one sport as 10 players will play basketball and soccer, 5 will play basketball and also tennis and 15 players will play both soccer and tennis. 3 will play soccer, tennis and basketball. Players who will be registered but refuse to play any one of the three sports will pay the school additional monthly fee of UGX475000 each as compensation fee.

Task

- How much money will the school receive from players after 4 months?
- Determine the number of players that will pay the compensation fee to the school.

Question 5

You are designing a new logo for your math club. Your teacher asks you to include at least one pair of green lines that pass through (3,1), (5,2) and (1,2), (7,5) respectively and at least one pair of purple lines that pass through (-1,2), (3,3) and (2,4), (3,0) respectively. The club has up to 20 members consisting of boys and girls who contribute money to the club weekly. The boys contribute more than girls but they contribute less than twice as much money as girls. Each girl contributes UGX10000 weekly and each boy contributes UGX15000 weekly.

Task

- Sketch your logo in a coordinate plane and write the equations of the green and purple lines formed.
- By using a suitable graph, determine the maximum amount of money the members contribute to the club in a week.

Question 6

Your school lies directly between your house and the movie theater. Your house is located at point $(-4, -2)$ and the movie theatre is located at $(5,2)$. The distance from your house to the school is one-fourth of the distance from the school to the movie theater. The school has promised to put all learners in boarding section if they perform with an average above 47.5 in an end of year cycle marked out of 80. The results of the learners are shown below;

33	27	11	13	15	16	18	22	33	45
28	39	55	68	67	56	70	23	44	58
17	45	72	51	24	15	17	27	45	44
41	43	35	37	58	62	60	53	55	23
24	22	21	20	39	46	68	77	78	57

Task

- Write an equation that represents the path from your house to school
- Determine whether or not all the learners will be put in the boarding section.

Question 7

Grace plans to plant 3 manzano bananas, 2 apple bananas and 5 lady finger bananas in January. 6 manzano bananas and 4 apple bananas in march. She also plans to plant 3 manzano bananas and 7 lady finger bananas in may in her new triangular garden whose vertices are (1,3), (6,3) and (6,8). She bought each square unit of the garden at UGX380000. Each banana planted yields a bunch that that can be sold in the market after 1 year. Each bunch of manzano is sold at UGX50000, each bunch of apple banana is sold at UGX65000 and each bunch of ladyfinger is sold at UGX80000.

Task

- How much did grace buy the garden?
- Determine the equation of each of the boundaries of the garden
- Which month did grace receive the highest income from the sales of her bunches of bananas?

Topic 2

Trigonometry 1

Question 1

Mr.Muleme plans to make two different types of cards for Mathematics Club activities of your school. He wants to ensure that one card is a square whose one side is of length $x\text{cm}$ and the other card is a rectangle whose one side is 1cm more than twice the other side. The shorter side of the rectangular card must be the same as one side of the square card. Mr. Muleme wants to ensure that the total area of the two cards is 114cm^2 . It will cost Mr. Muleme UGX 5000 to buy materials for making 1cm of the card.

Tasks

- a) How much money does he need to make the rectangular card
- b) How much more money is needed to make the rectangular card than the square card?

Question 2

UGX 4.5 million in buying one metre of the plot. One side of the plot of land is 15 metres less than the other side. When he measured the plot of land using a rope, he found that the area is $250m^2$. The value of the plot of land is increasing at a rate of 5% every year. Odyek plans to sell the plot of land in 2028 to his neighbor and divide the money among his four children martin, Mariam, mary and Margret in the ratio of 2: 1: 3: 8.

Tasks

- a) How long is the rope he used to measure the plot of land?
- b) Determine his profit after selling the plot of land to his neighbor.
- c) Determine the sum of money each child will get

Question 3

Jasmine is a student of Makerere high School. She wants to place a 17 metre piece of rod on a wall of a rectangular base school building. She has discovered that if she is to place her rod successfully, she has to stand at a distance of 15 metres from the base of the school building and look at the top of the building at an angle of 60° . The base of the building is of dimension 8 metres by 6 metres and it is roofed with iron sheets inform of a pyramid. The height of the roof from the wall is 12 metres.

Task

- a) Where from the base of the wall should jasmine place the rod?
- b) Determine the length of the iron sheets used in roofing the building.
- c) Determine the total area of the roof covered by the iron sheets

Question 4

A building is constructed on top of a cliff that is 300 meters high. Joan is standing on level ground below the cliff. She plans to buy the building but does not have enough money; she decides to borrow a loan of UGX.1, 500,000 to top up on what she has from a school Sacco that charges 4.8% interest per month. Joan is to pay back the money in 2 years. Her friend Achen who is also standing at the same point observes that the angle of elevation to the top of the building is 72° and the angle of elevation to the top of the cliff is 63° . She is also interested in buying the building. The building will be sold on

either by cash or hire purchase agreement by first making a deposit of UGX 22.5 million and paying 4.5 million monthly installments for 2 years. The building is currently valued at UGX 118 million. Joan wants to buy the building on cash basis since she will be given 10% discount while Apio wants to use hire purchase agreement.

Task

- a) How much more money will Apio pay for the plot of land than Joan?
- b) How much interest will Joan pay to the Sacco?
- c) How high is the building and How far away are the two people from the base of the cliff?

Question 5

You are standing on a ladder leaning on a wall from the ground. You see two similar small cups of volumes 125cm^3 and 216cm^3 respectively placed on a table with a rectangular top whose area is 10500cm^2 . One side of the table is 5cm more than the other. The ladder is 300cm above the ground and makes 60° with the ground level. The smaller cup on the table is of height 16cm .

Task

- a) How far is the table from the wall?
- b) Determine the height of the bigger cup
- c) Determine the perimeter of the table.

Question 6

You and a friend stand back-to-back. You run 20 feet forward then 15 feet to your right. At the same time, your friend runs 16 feet forward then 12 feet to her right. She stops and hits you with a snowball. Your friend predicts that you will be making more runs in the future since you would have grown older by that time. She says that the ratio of your ages will be 11:9 in three years' time. Your present ages are in the ratio of 5: 4.

Task

- a) How far does your friend throw the snowball?
- b) How old will each of you be in 10 years' time?

Question 7

A Flat screen television in one of the shops in Kampala can be bought by cash at UGX 1800000. Anyone interested in purchasing the TV but does not have enough money can also first make pay UGX420000 and pay equal amounts of UGX336000 monthly for 4 months. Joan does not have enough money but wants to buy the TV. The flat screen is rectangular with width 24 inches. The length of the screen makes an angle of 38.9° with its diagonal. FLAT SCREEN Televisions are advertised by the lengths of their diagonals. A store has a sale on televisions 40 inches and larger.

Task

- a) How much money will Joan pay for the flat screen television?
- b) Is the television on sale? Explain

Topic 3

Data collection and display

Question 1

The head teacher of your school stressed in a staff meeting that all his teachers should try to follow time and should arrive at school before 7:00 am. The head teacher further said that all teachers will start reporting to his office immediately the majority of the teachers have arrived in school. In response to the communication, all his teachers recorded the time in minutes in which they arrived earlier to the school on the following day as shown below;

10	12	15	20	15	10	33	45	58	51
27	26	33	34	24	55	66	77	66	55
47	55	22	33	15	18	22	27	38	48
38	37	49	51	28	33	37	38	47	50

Task

- a) Using the above data and basing on your calculation. Determine the time the teachers will begin reporting to the head teacher's office.
- b) Using a suitable graph, present the data to the head teacher and hence determine the time at which most teachers reported to school.

Question 2

A day school holds a weekly assembly every Monday starting at 8:00AM. The head teacher has noticed a trend of learners arriving late for assembly. Since the school gates are opened

at 7:30M to make an informed decision about the assembly's start time. The collected data was as follows:

15	18	20	22	17	25	23	28	26	21
30	33	35	32	36	39	42	37	41	28
45	48	29	31	26	27	30	33	34	31
28	35	40	42	37	39	36	38	29	43
46	47	30	32	31	45	27	44	46	49
52	53	55	51	50	56	57	58	59	51

Task:

- Giving a reason, based on calculations using the data collected; suggest the time the assembly should always start.
- The deputy Head teacher advised the Head teacher to always start the assembly when at least 75% of the students are present. Based on the advice, determine the time the assembly should start.
- If you were the Head teacher, which of the two suggested assembly start times from (a) and (b) would you consider more appropriate and why?

Question 3

The statistical data collected by Uganda National Health Research organization (UNHRO) shows that more Ugandans are becoming obese with 5 people from the age of 0 to 9 years, 7 people from the age of 10 to 19 years, 15 people from the age of 20 to 29 years, 13 people from the age of 30 to 39 years, 7 people from the age of 40 to 49 years and 10 people from the age of 50 to 59 years suffering from overweight according to the research done in Opatoyere village. Other surveys also found that number of overweight and obese people from 60 to 69 years is 20% of the number of people from 0 to 39 years. The UNRO wishes to display the health level of the people in the village to create awareness among people with obesity and motivate them adopt a healthy lifestyle

Tasks:

- As a student of mathematics who has studied data collection and display, help the organization to display the data.
- What is the average number of people with obesity in Opatoyere Village?

Question 4

In Makerere high school, there are 70 teachers. Each teacher travels to school every morning to school in his or her own car. All lessons begin at 7:30am in a term incase teachers follow time and all lessons begin immediate all the teachers arrive in school. The distribution of the driving times (in minutes) from home to school for teachers who arrived after 7:30am in second term is shown below

2	3	4	5	6	7	8	11	10	20
12	14	16	17	19	33	40	22	33	27
29	40	33	27	39	19	46	28	13	14
13	12	17	21	44	11	50	27	28	21
22	13	7	6	17	24	50	25	26	24
27	67	78	16	78	21	47	44	46	38
32	31	50	12	17	14	26	28	31	40

Task

- The Head teacher of the school wants to know the arrival time of the majority of the teachers in second term, help him to address this challenge. Use appropriate method to display this data to the head teacher.
- At what time did the lessons start in second term?

Question 5

Aceiteka ball games organization body normally admits students from various schools to participate in the tournament every year. Schools with students with average mass below 60.5 are denied the chance to participate in the most prestigious tournament and students who weigh below 62kg are not allowed to participate. Emmanuel College has decided to take 40 students with the following mass for the tournament this year.

55	70	57	73	55	59	64	72
60	48	58	54	69	51	63	78
75	64	65	57	71	78	76	62
49	66	62	76	61	63	63	76
52	76	71	61	53	56	67	71

Task

- Will the school be allowed to participate in the tournament? Give a reason to support your answer.

- b) Using appropriate method, determine the number of students that may not be allowed to participate.
- c) Using a suitable method, determine the mass with the highest number of students and present this data to the school administration.

Question 6

A football coach of a Ugandan premier league club has promised to increase the weekly salary of all his players if they run an average of more than 18km this week. The following players made runs as follows this week.

9	3	4	7	8	30	19	34	18	39
11	21	28	23	35	16	32	11	33	17
10	40	41	6	25	47	8	45	9	44
42	13	47	8	46	15	14	43	13	18
11	48	5	26	22	7	13	19	40	15

He has also decided that after the increment, the 50 players available will be taken to Dubai to have fun. More senior players will be taken than junior players and the number of junior players will not exceed 10. Each senior player will spend UGX 500000 and junior player will spend UGX200000 but the club is prepared to spend UGX4000000 on the players.

Task

- a) Determine whether or not the club will increase the salary of the players
- b) Determine the distance covered by most of the players this week
- c) State the maximum number of junior and senior players that the club will spend its money on.

Question 7

A certain school is planning to participate in a general knowledge quiz competition this month in one of the schools in Kampala. In preparation for the competition two school students Kimera and Patricia took part in fourty trial quizzes. The following tables show their scores marked out of 50.

The scores of Kimera is shown below

26	28	40	33	43	32	29	47
16	21	14	36	41	31	49	37

33	17	34	35	45	42	46	28
33	20	38	37	38	18	27	39
32	29	24	41	35	44	23	36

The scores of Patricia is also shown below

34	23	24	41	23	34	24	50
48	27	10	35	29	28	47	38
43	17	24	45	50	47	23	27
36	28	48	27	28	38	17	29
42	27	21	40	36	40	33	37

The school wishes to send only one student for the competition.

Task

- Basing on a suitable calculation, determine which student the school should send for the competition
- Using a suitable method, present clearly the scores obtained by the two students in the trial quizzes.

End