S.5 MATHEMATICS

SECTION A

1. During a game of Ludo, Cornelius tossed two fair dice. What is the probability that;

(i) The two dice show the same number

(ii) The sum of the numbers on the two dice is greater than 7?

2. The heights of eight (8) leaves (mm) were measured by students in a certain school and the results were recorded as follows.1.10, 2.09, 2.03, 4.06, 2.05, 3.05, 2.21 and 5.01. Calculate the mean and standard deviation of the length of leaves.

3. In a survey conducted in S.5 mathematics class, 35% of the students watched football and not cricket, 10% watched cricket but not football, and 40% did not watch either game. If a student is chosen at random from those in the survey, find the probability that he watches;

(i) football given that he watches cricket

(ii) Football given that he does not watch cricket.

4. The grades of six candidates in Mathematics and English Examinations are presented in the table below.

Mathematics	E	C	B	F	D	A
English	F	A	D	E	C	C

Calculate the rank correlation coefficient and test its significance at 5% level. *(5scores)*

5. A farmer is planning to plant three crops; maize, wheat and beans using a total of 120 acres of land, 1800 hours of labor and 2400 kg of fertilizers. Each acre of maize requires 2 hours of labor and 4 kg of fertilizers. Each acre of wheat requires 3 hours of labor and 2 kg of fertilizers. And each acre of beans requires 1 hour of labor and 3 kg of fertilizers.

   Task: help the farmer to determine how many acres to allocate to each crop.

6. A company's profit p(in million UGX) per month depends on the number of units x sold and is given by $p(x) = \frac{x+2}{x^2-5x+6}$

   Task: What is the range of x units needed for the company to make at least a profit of 1 million?

7. A school engineer has modelled a beam in form of an arch by the equation $x^3 + y^3 - 6xy = 0$.

   Task: Find the equation of line that will make an angle of 90^0 with the tangent at the point (3 , 3).

8. Water is draining from a conical tank at 15ms-1. The tank has a height of 30 cm and a base radius of 10 cm.

   Task: Find how fast the water level is dropping when the water is 12 cm deep.

SECTION B

9. A telecommunication's technician is analyzing the signal strength received by a satellite dish, given by $6\sin\theta - 8\cos\theta$,where θ is the angle of alignment. To optimize the signal, he needs to find the maximum signal strength.

   Task:

   By expressing the expression in the form $R\sin(\theta - \alpha)$, determine the maximum signal strength and the angle where it occurs. Hence obtain other angles in the range $0^0 \leq \theta \leq 360^0$ given that by $6\sin\theta - 8\cos\theta = 5$.

10. A mechanical engineer is studying the response of a spring-mass system, where the system's transfer function is given by $\frac{x^3+3x^2+2x+1}{x(x+2)}$. To analyze the system's behavior, the engineer needs to decompose the function.

    A financial analyst is calculating the time t(in years) for two investments to yield a combined return, modelled by $\log_5 t + \log_4(t-1) = 3$. The analyst needs to determine when the return is achieved.

    Task:

    a) Help the engineer to decompose the function.
    b) Help the financial analyst to obtain the return time.

11. A carpenter is constructing a triangular roof truss with sides 6 m, 8 m and 10 m. o calculate the amount of roofing material needed, the carpenter must find the area and the angles of the truss. If the cost of 1 square meter of roofing material is sh. 2,500/=

    Task: Using the knowledge of trigonometry find the total cost of the material to construct the truss and all the angles of the truss.

9. The school librarian recorded how much time each of the senior five students spent in the library during one visit. The times (minutes) were grouped and recorded as follows;

Time spent (minutes)	**Number of Students**
$110-119$	3
$120-124$	5
$125-134$	9
$135-149$	12
$150-169$	8
$170-179$	3

(a) Calculate the;
    (i) Average time spent in the library.
    (ii) Standard deviation of the time spent.

(b) Construct a histogram to represent the data and use it to estimate the modal time spent in the library.

12. In Paul Mukasa, students can join the Math club (Event A) and the Chess club (Event B). The two events are independent (Joining one club does not affect the chances of joining the other club). The probability that a student is in math club but not in the Chess club is $\frac{1}{4}$ and the probability that a student is not in the math club given that he is in the Chess club is $\frac{1}{6}$. Using the Venn diagram, find the probability that a student is in the;
    (a) Math club
    (b) Chess club
    (c) Both clubs
    (d) Neither of the clubs.

13. The cost of travelling a certain distance away from the city centre is found to depend on the route and the distance away from the centre. The table below gives the average rates of travel charges for distances to be travelled away from the city centres.

Rate (£) (x)	75	100	115	120	134	125	140	175	160	200
Distance (y)	9	12	14	21	24	30	33	45	46	50

    (a) Plot a scatter diagram for the above data.
    (b) Draw the line of best fit and use it to estimate the cost of travelling a distance of 40km.
    (c) Calculate the rank correlation coefficient and comment on your result

END