# DEPARTMENT OF MATHEMATICS

# S6 MATHEMATICS TEST 1 TERM 2 2026

# TIME: 2 HOURS 30 MINUTES

**Answer all the four (4) items.**

1. SUREGO SACCO lends a total of UGX 5,000,000 to a group of women, who mobilised themselves to improve their households through small scale production industries. The manager has determined that each of the women is to repay a fraction $r = \frac{x}{2x-1}$ of the remaining balance every month. The SACCO in turn expects to collect UGX 8,750,000 in total over an infinite number of months. The manager seeks assistance to be helped to set up an infinite geometric series equation and solve for *x*.

   The SACCO manager has also modelled the profit they are to generate using the polynomial $P(x) = ax^4 + 7x^3 + x^2 + bx - 3$, where *a* and *b* are operating cost coefficients.

   Due to break – even point, the SACCO business analyst has found out that $P(1) = P(-1) = 0$ but wishes to find which values of *a* and *b* should satisfy this. So that he finds the values of *x* for which the profit P(x) > 0.

   **TASK**

   As a student of mathematics guide the SACCO manager and business analyst to find out whether they should adopt their repayment fraction and thus determine the values of *x* for the SACCO to break – even.

2. A small home based factory produces goods such that the instantaneous production rate in units per hour is modelled by the function $f(t) = \frac{2t^3 + 7t^2 - 45t + 19}{(t+7)(t-2)}$, $t \geq 0$, where t is the time in hours after the factory starts operations at 8:00 a.m. The manager wishes to know the average production rate in a specified time interval.

   **TASK**

   As a student of mathematics, using the techniques of integration, help the manager to determine the average production rate between 10:00 a.m and 2:00 a.m and guide whether, if the factory aims for an average of at least 50 units per hour in this period, they meet the target.

3. An entrepreneur has an A-level student whom he consults over analysis of his two companies. One in Arua (A) that produces sweets in the ratios of 4 red and 3 green sweets and another in Bushenyi (B) in ratios of 7 red and 4 green in thousands. A buyer's selection of A is twice as likely that of B, if two sweets are randomly picked one at a time without replacement and wants the student to analyse the probability that both sweets are of the same colour and that they are from A given of the same colour. He would also want the students to prepare a probability distribution function for the number of green sweets in his companies of which this distribution he wants to know its mean and standard deviation.

   There are another 10 companies that follow the same trend as in A and B of the entrepreneur and would like to know the probability that at most 2 of them are using probability of success that represented by that of company A.

   **TASK**
   As a mathematics student, help the entrepreneur to interpret, show him the methodology and make judgment for him.

4. Researchers from IRS A need to reach an endangered bird habitat in town P, 920km away due north – east of A. A helicopter with a speed of 350 $kmh^{-1}$ leaves the base A at 6:30am and must fly to town P. There is wind blowing from $025^0$ at $55\,kmh^{-1}$ . The pilot needed to know the course taken and the duration of the journey.

   After landing at P, the researchers drive to town Q, ; which journey has three stages. They cover the first part of the journey at 80 $kmh^{-1}$ for 2.5 hours, the next part of the journey at 60 $kmh^{-1}$ for 1 hour 15 minutes and the last 120 km of the journey at 40 $kmh^{-1}$, due to slippery road surface.

   **TASK**

   Help the program coordinator ascertain the course taken by the helicopter, the time the helicopter lands at P and the average speed for the whole journey from P to town Q.

END