DEPARTMENT OF MATHEMATICS

S6 MATHEMATICS TEST 1 2026

TIME: 2 HOURS 20 MINUTES

Answer all the four (4) items.

1. A company produces three types of products: A, B and C. The production process involves three departments; Assembly, Painting and Quality control.

   The time required for each product in each department is given below:

Product	Assembly(hrs)	Painting(hrs)	Quality control(hrs)
A	5	2	4
B	3	3	2
C	7	5	3

   The total time available for each department is:

   Assembly: 169 hours

   Painting: 104 hours

   Quality control: 106 hours

   The profits in the company increase in the ratio of 1.5 after each corresponding month. The profit was \$1000 in December 2024.

   (a) If the company intends to utilize all the available time, how many units of each product should be produced?

   (b) Determine the total profit made between January and November 2025.

2. A physicist is investigating how the intensity of a signal changes along a straight line passing through a reference point O. The position x is measured in metres from O, where values of x may be **positive** or **negative** depending on the direction along the line. The signal intensity at position x is modelled by the function $P(x) = \dfrac{8x}{(1+x)^2}$.

   (a) Sketch the graph of $P(x)$, showing clearly its behaviour for both negative and positive values of x.

(b) The physicist is interested in the total signal effect on the positive side of the curve between $x = 0m$ to $x = 2m$. Determine the area bounded by the curve P(x), the x – axis and the lines $x = 0$ and $x = 2$.

3. (a) A racing car is travelling along a level road with a uniform acceleration $a\ ms^{-2}$. The car passes a fixed point O on the road with a velocity $u\ ms^{-1}$.Given that the car covers distances of 10 *m* and 12 *m* in the fifth and seventh seconds of its motion, calculate its velocity when it is 34 *m* from O.

(b) A tractor of mass 800 kg is attached by a horizontal chain to a cart of mass 400 kg. The backward frictional force on the cart is 600 N while the tractor experiences no friction. The system has a forward acceleration of $2\ ms^{-2}$. Determine the

(i) tension in the chain.

(ii) forward force exerted by the engine of the tractor

4. (a) The bank manager of a certain bank branch found out that the number of clients to the bank in a week, was uniformly distributed in the interval $\alpha \le x \le \beta$ clients. He also found out that the probability that more than 60 clients come to the bank was $\frac{7}{8}$ and the probability that less than 90 clients come to the bank was $\frac{5}{16}$. Help the bank manager to find the average number of clients who come to the bank and the 80^{th} percentile.

(b) Kamau is the quality assurance manager of TFP packers. The products are packaged in containers whose mean volume is 450mls and variance 900 mls^2.

Kamau randomly decided to test 1000 packets of the product. Determine the number of packets he found to contain between 380mls and 427mls.

END