La Scuola d'Italia / Huson / IB Math: Sequences   First & last name:

6 November 2025   Grade:

2.6 Test: Sequences, Regression, Interest, Functions, Logs

1. A geometric sequence has first term 24 and common ratio $\frac{1}{2}$.   [10 marks]

   (a) Write down the second and third terms.

   (b) Write an expression for the sum of the first n terms, S_n.

   (c) Hence or otherwise find the sum of the first 10 terms of the sequence S_{10}.

   An arithmetic sequence has a first term 150 and fourth term 111.

   (d) Find the common difference d.

   (e) Find the number of the first negative term in the arithmetic sequence, i.e. n such that $u_n < 0$.

2. Six piano students reported their average weekly practice time and their Music class grade (out of 100). The data are shown below. [7 marks]

Practice time (h)	8	3	5	3	7	9
Grade (G)	85	70	75	85	90	95

(a) Find the Pearson product–moment correlation coefficient r for these data.

(b) Based on the following guidance:

$$0 \le |r| < 0.4: \text{weak}, \quad 0.4 \le |r| < 0.8: \text{moderate}, \quad 0.8 \le |r| \le 1: \text{strong}.$$

Comment on the strength of the correlation for this data.

(c) The relationship between h and G can be modelled by a regression equation $G = ah + b$. Write down the values of a and b.

(d) One of the students says she should have practised more. Based on the data and assuming that she practiced 6 hours per week, estimate what her score would have been.

3. Give all numerical answers correct to two decimal places.   [8 marks]

Sofia invests $1000 in an annuity on 1 January 2020. The investment earns a fixed amount of $60 per year.

(a) Find the value of her investment on 1 January 2022.

Rafael also invests $1000 on 1 January 2020. He deposits his funds in a bank account that pays a nominal annual rate of 5% compounded monthly.

(b) Find his balance after two years.

(c) Determine the number of complete years from 1 January 2020 until Rafael's account first has a greater balance than Sofia's investment.

4. In an experiment the area of a bacteria culture is modelled by [4 marks]
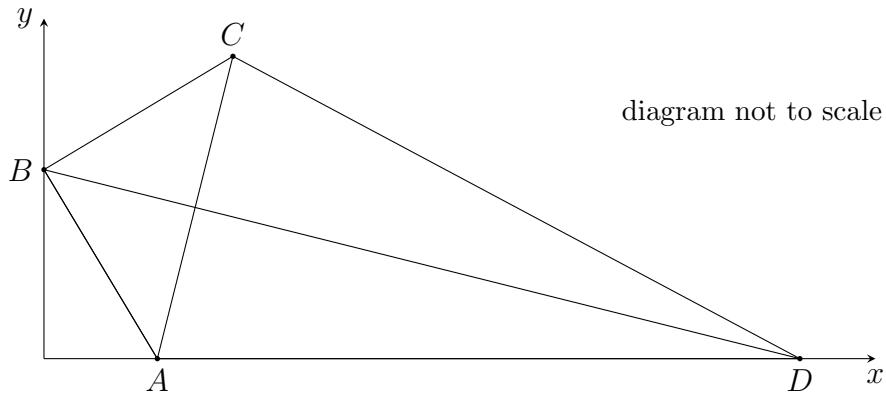
$$P(t) = Ae^{kt},$$

where P is the area in mm^2 and t is the time in hours. At $t = 0$ the area is 80 mm^2, and after 11 hours the area is 612 mm^2.

(a) Write down the value of A.

(b) Find the value of k.

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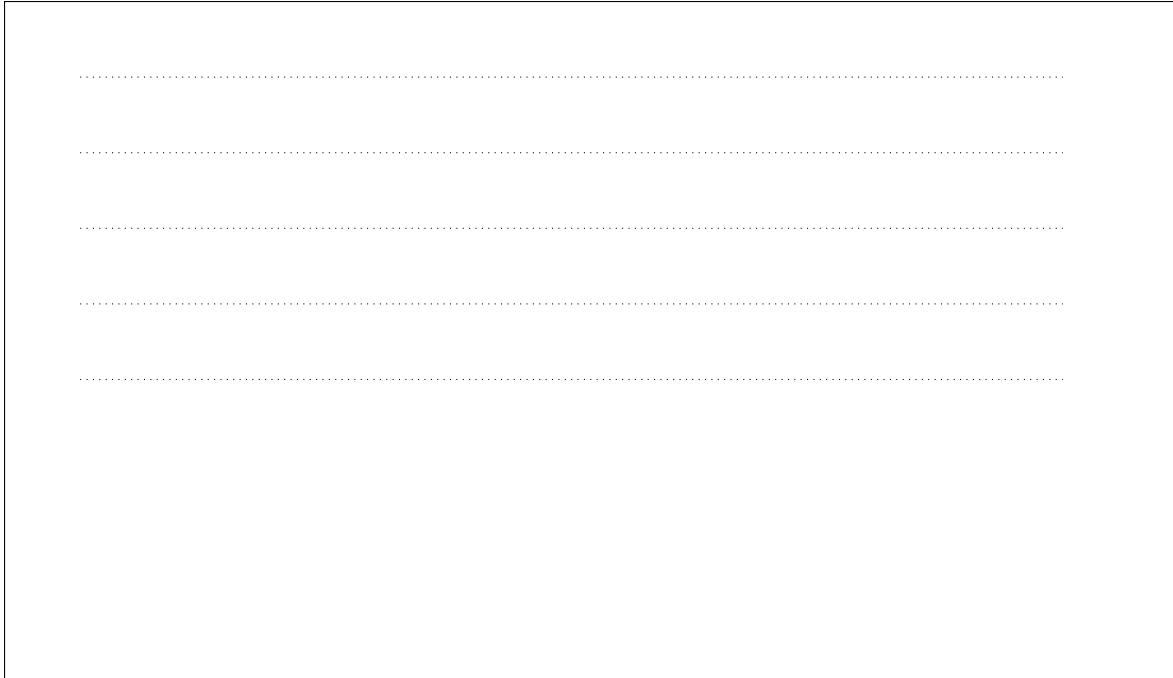
5. Camilla is designing a kite $ABCD$ on a coordinate plane (1 unit $=$ 10 cm). The points are $A(3,0)$, $B(0,5)$, $C(5,8)$, and point D lies on the x–axis. Segment AC is perpendicular to segment BD.   [6 marks]

diagram not to scale

(a) Find the gradient of the line through A and C.

(b) Hence write down the gradient of the line through B and D.

(c) Find the equation of line BD in the form $ax + by + d = 0$, where a, b, d are integers.

(d) Write down the x–coordinate of D.

6. Solve the following, giving exact values when possible. [6 marks]

   (a) $3^x = 243$.

   (b) $\log_5(2x - 1) = 2$.

   (c) $\ln(4) - \ln(x) = \ln(2)$.