2.5 Classwork: Review Compound Interest

2. *[Maximum mark: 14]*

Give all your numerical answers correct to two decimal places.

On 1 January 2005, Daniel invested 30 000 AUD at an annual **simple** interest rate in a *Regular Saver* account. On 1 January 2007, Daniel had 31 650 AUD in the account.

(a) Calculate the rate of interest. *[3 marks]*

On 1 January 2005, Rebecca invested 30 000 AUD in a *Supersaver* account at a nominal annual rate of 2.5 % **compounded annually**.

(b) Calculate the amount in the *Supersaver* account after two years. *[3 marks]*

(c) Find the number of complete years since 1 January 2005 it would take for the amount in Rebecca's account to exceed the amount in Daniel's account. *[3 marks]*

On 1 January 2007, Daniel reinvested 80 % of the money from the *Regular Saver* account in an *Extra Saver* account at a nominal annual rate of 3 % **compounded quarterly**.

(d) (i) Calculate the amount of money reinvested by Daniel on the 1 January 2007.

(ii) Find the number of complete years it will take for the amount in Daniel's *Extra Saver* account to exceed 30 000 AUD. *[5 marks]*

6. [Maximum mark: 6]

In a geometric sequence, the fourth term is 8 times the first term. The sum of the first 10 terms is 2557.5. Find the 10th term of this sequence.

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7. [Maximum mark: 8]

Note: One decade is 10 years

A population of rare birds, P_t, can be modelled by the equation $P_t = P_0 e^{kt}$, where P_0 is the initial population, and t is measured in decades. After one decade, it is estimated that $\frac{P_1}{P_0} = 0.9$.

(a) (i) Find the value of k.

(ii) Interpret the meaning of the value of k. [3]

(b) Find the least number of **whole** years for which $\frac{P_t}{P_0} < 0.75$. [5]

Do **not** write solutions on this page.

Section B

Answer **all** questions in the answer booklet provided. Please start each question on a new page.

8. [Maximum mark: 15]

The price of a used car depends partly on the distance it has travelled. The following table shows the distance and the price for seven cars on 1 January 2010.

Distance, x km	11 500	7500	13 600	10 800	9500	12 200	10 400
Price, y dollars	15 000	21 500	12 000	16 000	19 000	14 500	17 000

The relationship between x and y can be modelled by the regression equation $y = ax + b$.

(a) (i) Find the correlation coefficient.

(ii) Write down the value of a and of b. [4]

On 1 January 2010, Lina buys a car which has travelled 11 000 km.

(b) Use the regression equation to estimate the price of Lina's car, giving your answer to the nearest 100 dollars. [3]

The price of a car decreases by 5% each year.

(c) Calculate the price of Lina's car after 6 years. [4]

Lina will sell her car when its price reaches 10 000 dollars.

(d) Find the year when Lina sells her car. [4]

3. *[Maximum mark: 18]*

Part A

A geometric sequence has 1024 as its first term and 128 as its fourth term.

(a) Show that the common ratio is $\frac{1}{2}$. *[2 marks]*

(b) Find the value of the eleventh term. *[2 marks]*

(c) Find the sum of the first eight terms. *[3 marks]*

(d) Find the number of terms in the sequence for which the **sum** first exceeds 2047.968. *[3 marks]*

Part B

Consider the arithmetic sequence $1, 4, 7, 10, 13, \ldots$

(a) Find the value of the eleventh term. *[2 marks]*

(b) The sum of the first n terms of this sequence is $\frac{n}{2}(3n-1)$.

(i) Find the sum of the first 100 terms in this arithmetic sequence.

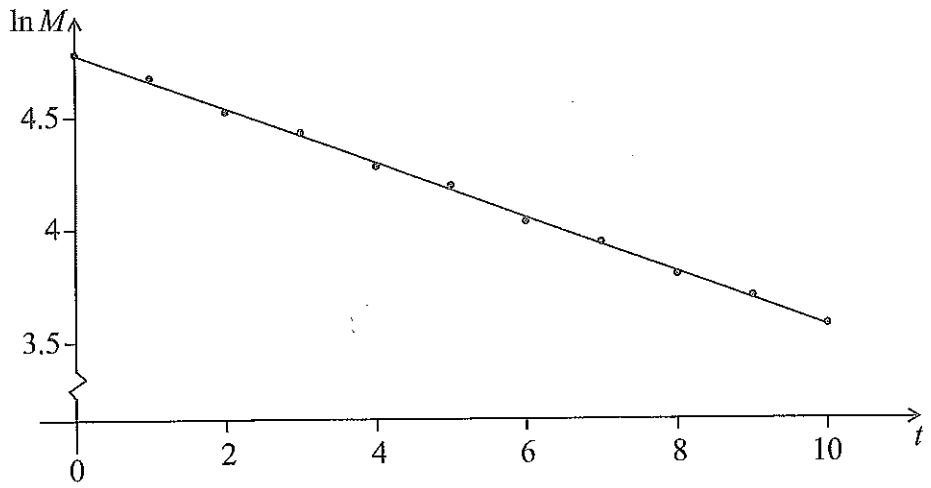
(ii) The sum of the first n terms is 477.

(a) Show that $3n^2 - n - 954 = 0$.

(b) Using your graphic display calculator or otherwise, find the number of terms, n. *[6 marks]*

5. [Maximum mark: 6]

The mass M of a decaying substance is measured at one minute intervals. The points $(t, \ln M)$ are plotted for $0 \leq t \leq 10$, where t is in minutes. The line of best fit is drawn. This is shown in the following diagram.



The correlation coefficient for this linear model is $r = -0.998$.

(a) State **two** words that describe the linear correlation between $\ln M$ and t. [2]

(b) The equation of the line of best fit is $\ln M = -0.12t + 4.67$. Given that $M = a \times b^t$, find the value of b. [4]

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