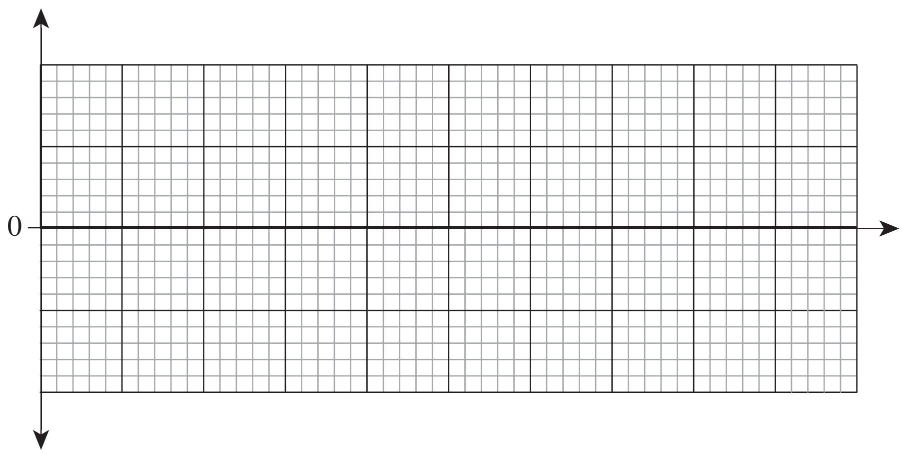
QUESTION 1 (4 marks)

The data below was collected relating a person's salary and how much they paid for their car.
The equation of the least-squares regression line for the data was calculated to be $y = -42.933 + 0.878x$.

Salary ($1000's)	Amount paid for car ($1000's)
50	6
60	3
70	10
80	20
90	40
100	50
60	18
70	22
80	25
90	35

Create a residual plot of the data on the axes below and assess the linearity of the association between a person's salary and how much they paid for their car.



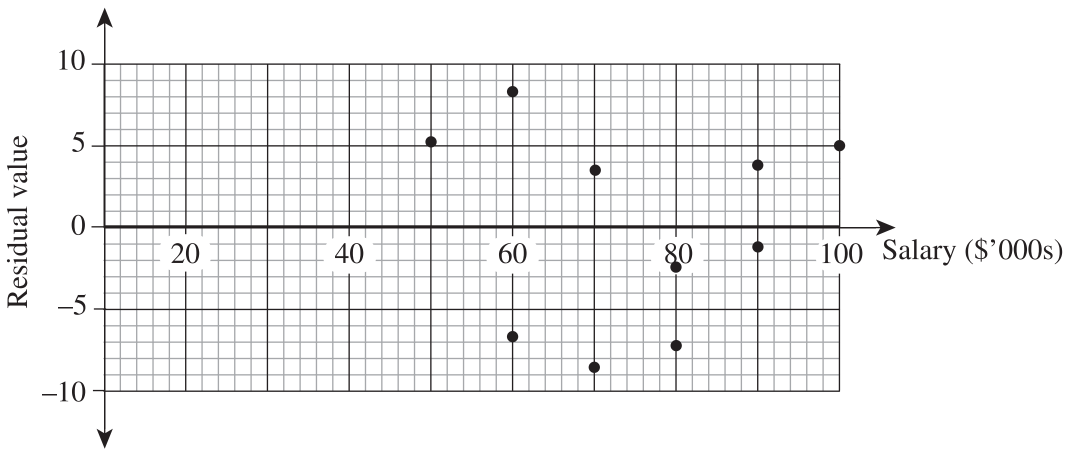
SECTION 1

QUESTION 1 (4 marks)

Salary ($1000's)	Amount paid for car ($1000's)	Predicted value	Residual value
50	6	0.97	5.03
60	3	9.75	–6.75
70	10	18.53	–8.53
80	20	27.31	–7.31
90	40	36.09	3.91
100	50	44.87	5.13
60	18	9.75	8.25
70	22	18.53	3.47
80	25	27.31	–2.31
90	35	36.09	–1.09

For example:

$$\begin{aligned}\text{predicted value of } y &= -42.933 + 0.878 \times 50 \\ &= 0.97 \\ \text{residual value} &= \text{actual value of } y - \text{predicted value of } y \\ &= 6 - 0.97 \\ &= 5.03\end{aligned}$$



The residual plot is randomly scattered across the x-axis which suggests the presence of a linear association between a person's salary and how much they paid for their car.

[4 marks]
1 mark for calculating the predicted values of y.
1 mark for calculating the residual values.
1 mark for plotting the residual values on the graph.
1 mark for correctly interpreting the residual plot in terms of linearity.

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QUESTION 5 (8 marks)

First year:

$M = 285$

$i = 2.35\%$

$= \dfrac{\frac{2.35}{52}}{100}$

$= 0.00045192307\ldots$

$n = 1 \text{ year} \times 52$

$= 52$

$$A_{FV} = M\left(\frac{(1+i)^n - 1}{i}\right)$$

$$= 285\left(\frac{(1+0.00045192309\ldots)^{52} - 1}{0.00045192309\ldots}\right)$$

$$= 285 \times 52.60378868\ldots$$

$$= 14\,992.07977\ldots$$

Second year to fifth year:

$M = 1386$

$i = 2.21\%$

$= \dfrac{\frac{2.21}{12}}{100}$

$= 0.00184166666\ldots$

$n = 4 \text{ years} \times 12$

$= 48$

$$A_{FV} = M\left(\frac{(1+i)^n - 1}{i}\right)$$

$$= 1386\left(\frac{(1+0.00184166666\ldots)^{48} - 1}{0.00184166666\ldots}\right)$$

$$= 1386 \times 50.13729886\ldots$$

$$= 69\,490.29622\ldots$$

Compound interest on first year amount from second year to fifth year:

$i = 2.21\%$

$= \dfrac{\frac{2.21}{12}}{100}$

$= 0.00184166666\ldots$

$n = 4 \text{ years} \times 12$

$= 48$

$$A = P(1+i)^n$$

$$= 14992.07977\ldots(1+0.00184166666\ldots)^{48}$$

$$= 16376.39133\ldots$$

Total amount in annuity account:

$16\,376.39133\ldots + 69\,490.29622\ldots = 85\,866.68755\ldots$

Anna will have saved \$85 866.69 in her annuity account after 5 years. As this is more than the \$85 000 she requires, she will be able to afford her holiday.

[8 marks]

1 mark for correctly determining the i and n values for the first year.

Note: This mark may be implied by subsequent working.

1 mark for correctly selecting the appropriate future value annuity rule.

1 mark for determining the future value of the annuity after one year.

Note: This mark may be implied by subsequent working.

1 mark for determining the compound interest earned on the first year of payments for the next four years.

1 mark for correctly determining the i and n values for the second to fifth year.
Note: This mark may be implied by subsequent working
1 mark for determining the future value of the annuity after four years.
Note: This mark may be implied by subsequent working.
1 mark for determining the total amount in the account.
1 mark for determining that Anna can afford her holiday and provides reasoning.