MATHEMATICS APPLICATIONS
YEAR 12 UNIT 3

TEST 1
BIVARIATE DATA and SEQUENCES

2023

PART B
CALCULATOR ASSUMED

TIME: 20 mins
MARKS: 23 marks

STUDENT'S NAME: _____

CIRCLE YOUR TEACHER'S NAME:

Mr Ismail Mrs Kalotay Ms Mack

Mrs Smirke Mrs Scoles Ms Tsen

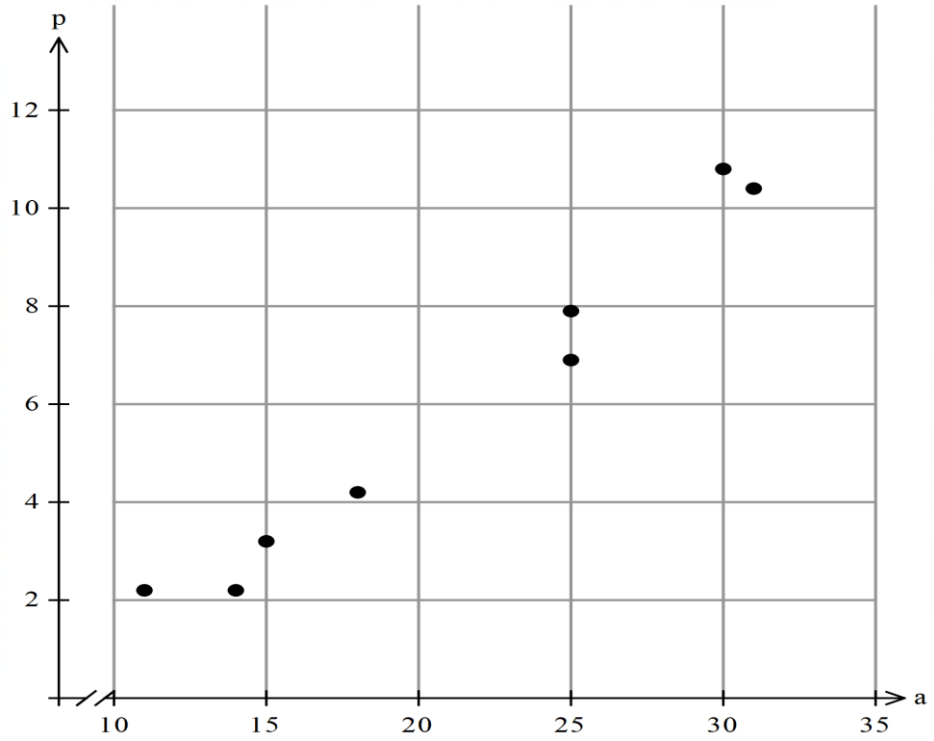
Mrs Scoles
TUTOR GROUP

Question 11 [17 marks]

Data giving the annual advertising budgets (in \$1000) and the yearly profit increases (%) of ten companies are shown below.

Annual advertising budget (in \$1000), **a**	11	14	15	18	20	25	25	27	30	31
Yearly profit increase (%), **p**	2.2	2.2	3.2	4.2	6.5	6.9	7.9	9.8	10.8	10.4

a) Complete the scatter diagram by plotting the two shaded data points in the table. [2]



b) Determine the equation of the least squares regression line that models this data (giving values correct to three decimal places) and draw this line on the scatter diagram. [4]

c) Interpret the value of the gradient in the least squares line. [2]

d) What percentage of the variation of the yearly profit increase can be explained by the variation of the annual advertising budget? [1]

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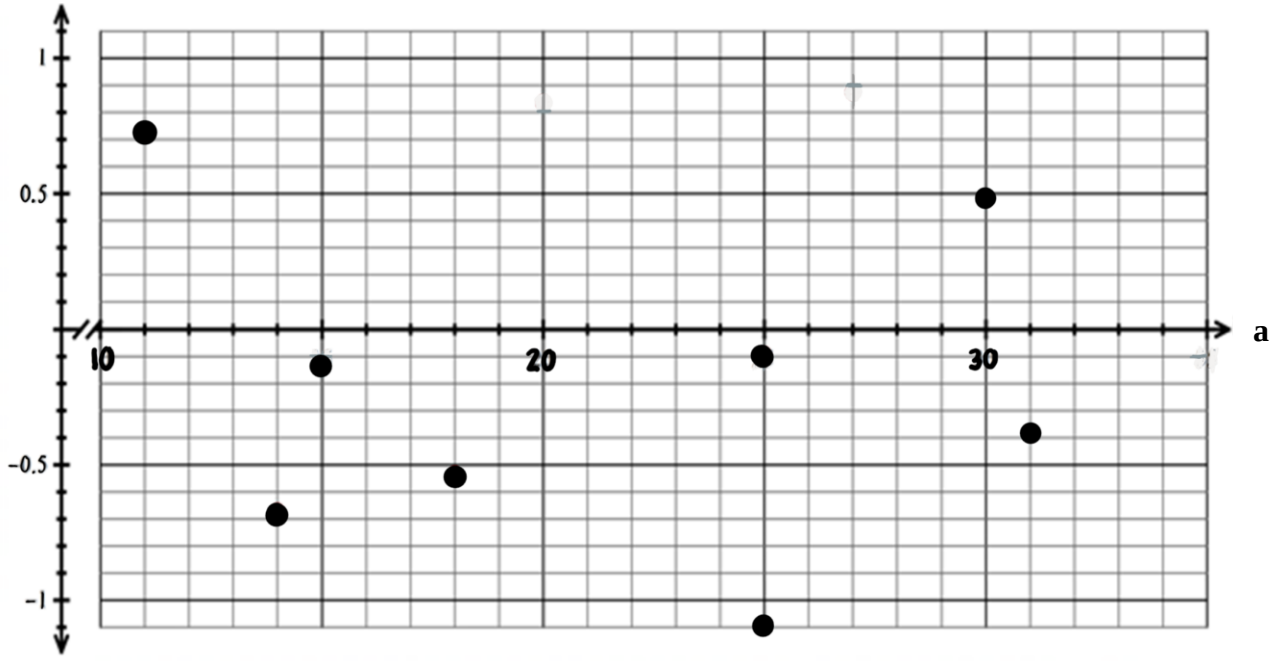
Question 11 continued:

e) Predict the yearly percentage profit increase if the annual advertising budget of a company was $35 000 and comment on its reliability. [2]

f) Is it possible to determine how much should be spent on the annual advertising budget for a company to achieve a 5% yearly profit increase?
If so, what is the value?
If not, why not and explain how you would determine it? [2]

g) Below is the residual plot for the data in the table.
The same two points in part (a) are also missing from this graph. Add their residuals. [2]

residuals



h) With reference to the residual plot, comment on whether a linear model is appropriate or not. [2]

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Question 12 [3 marks]

Every year a new housing subdivision has 40 new houses completed. If there were initially 10 houses in the subdivision:

a) Write a recursive rule to determine the number of houses in total in the subdivision each year. [2]

b) How many years will it be until there are at least 500 houses in the subdivision? [1]

Question 13 [3 marks]

A couple sell a property for $800 000 and decide to invest the money, at 4.5% p.a.
The plan is to have at least one million dollars before looking for another investment property.

a) Write a recursive rule to determine the value of the investment at the end of each year. [2]

b) How many years will it take for the investment to be worth more than one million? [1]

END OF PART B