

MATHEMATICS APPLICATIONS

YEAR 12 UNIT 3

TEST 1 - BIVARIATE DATA and SEQUENCES

2022



PART A - CALCULATOR FREE

TIME: 25 mins

MARKS: 25 marks

STUDENT'S NAME: _____

CIRCLE YOUR TEACHER'S NAME:

Mr Galbraith

Mr Ismail

Mrs Kalotay

Mr Lee

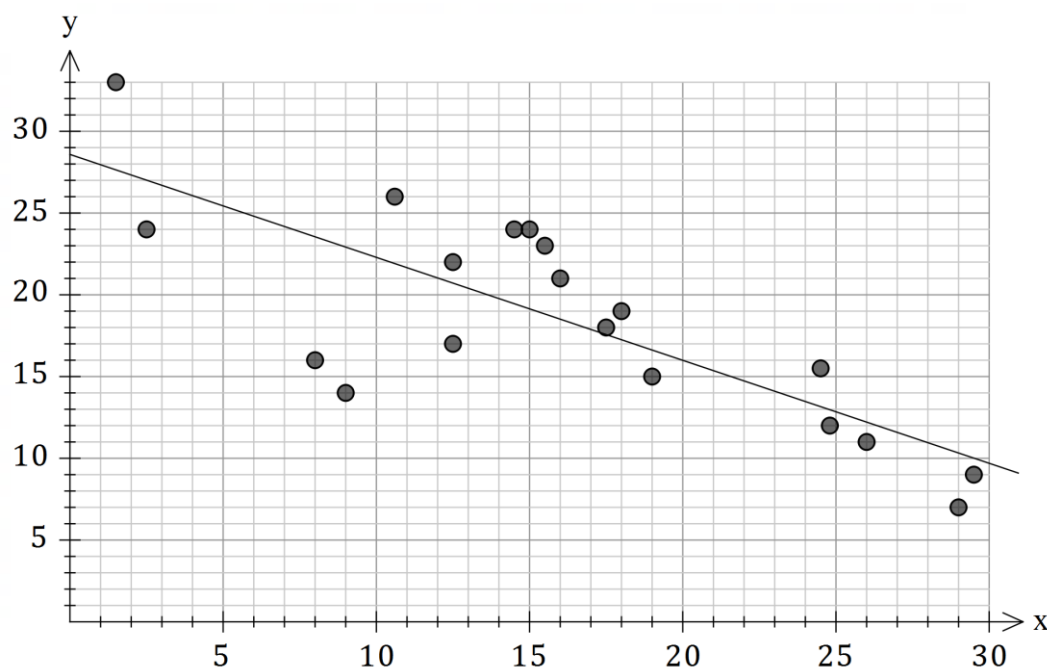
Ms Smirke

Ms Thompson

MATERIALS SUPPLIED: Formula Sheet

1) [6 marks]

A least squares line with the equation $y = 28.5 - 0.62x$ has been fitted to the scatterplot below.



a) State whether the following statements are true (T) or False (F) (5)

- _____ A: It is the line for which the sum of the squares of the vertical distances from the line to each data point is a minimum.
- _____ B: the slope can be interpreted as 'for each increase of one unit in x, y increases by 0.62 units.
- _____ C: using the regression line to predict y for x = 20 is a case of interpolation.
- _____ D: the residual for the point (18, 19) will be positive.
- _____ E: the line underpredicts the value of y for the data point (16, 21.1)

b) It is realised point (5, 10) has been omitted from the scatterplot and the calculations for the least squares line. If this point is included, which one of the following will be the effect on the least squares line? (1)

- A: the gradient will increase in value, the intercept will decrease.
- B: the gradient will decrease in value, the intercept will decrease.
- C: the gradient and intercept will remain the same.
- D: the gradient will increase in value, the intercept will increase.
- E: the gradient will decrease in value, the intercept will increase.

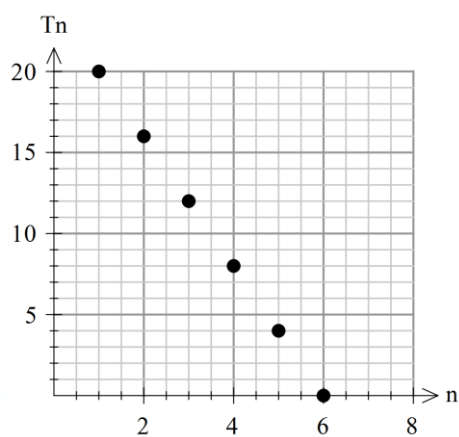
2) [7 marks]

Each of the following below defines a sequence. For each:

i. State whether the sequence is arithmetic, geometric or neither. (3)

ii. Determine the recursive rule. (4)

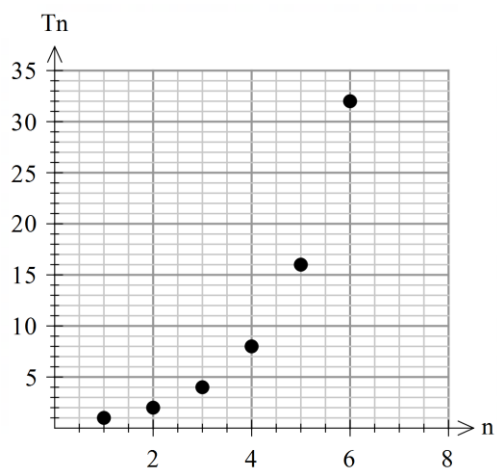
a)



i. _____

ii. _____

b)



i. _____

ii. _____

c) 5, -15, 45, -135, 405

i. _____

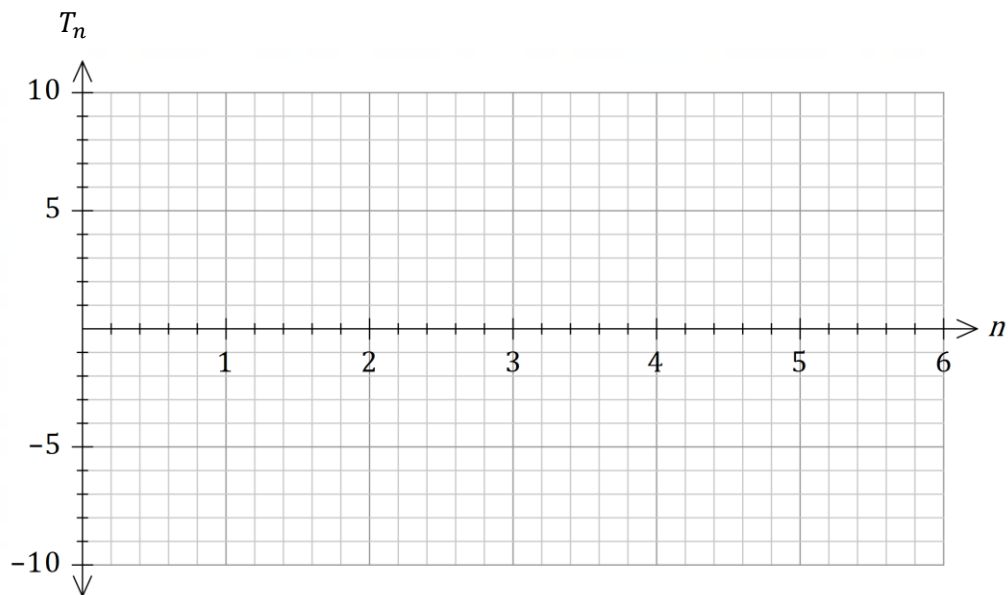
ii. _____

3) [4 marks]

Consider the following recurrence relation

$$T_{n+1} = T_n - 3, T_3 = 2$$

- a) Display the first five terms of this sequence on the axes below. (2)



- b) Determine:

i. T_0 (1)

ii. T_{10} (1)

4) [8 marks]

A group of high school students were asked the question 'Does constant revision throughout the year lead to an improved examination result?'

The results are summarised below.

	Agree	Disagree	Undecided
Under 13	14	42	14
13-16	56	16	8
Over 16	42	5	3

- a) State the explanatory variable for these data. (1)

The incomplete table below shows row percentages.

	Percentages		
	Agree	Disagree	Undecided
Under 13		60	
13-16	70	20	
Over 16	84		

- b) Show how the value of 20% was calculated. (1)
- c) Complete the table. (3)
- d) Determine whether there is any association between the variables. If so, describe the association and justify. (3)

END OF PART A

MATHEMATICS APPLICATIONS

YEAR 12 UNIT 3

TEST 1

BIVARIATE DATA and SEQUENCES

2022



PART B - CALCULATOR ASSUMED

TIME: 25 mins

MARKS: 32 marks

STUDENT'S NAME: _____

CIRCLE YOUR TEACHER'S NAME:

Mr Galbraith

Mr Ismail

Mrs Kalotay

Mr Lee

Ms Smirke

Ms Thompson

MATERIALS SUPPLIED: Formula Sheet

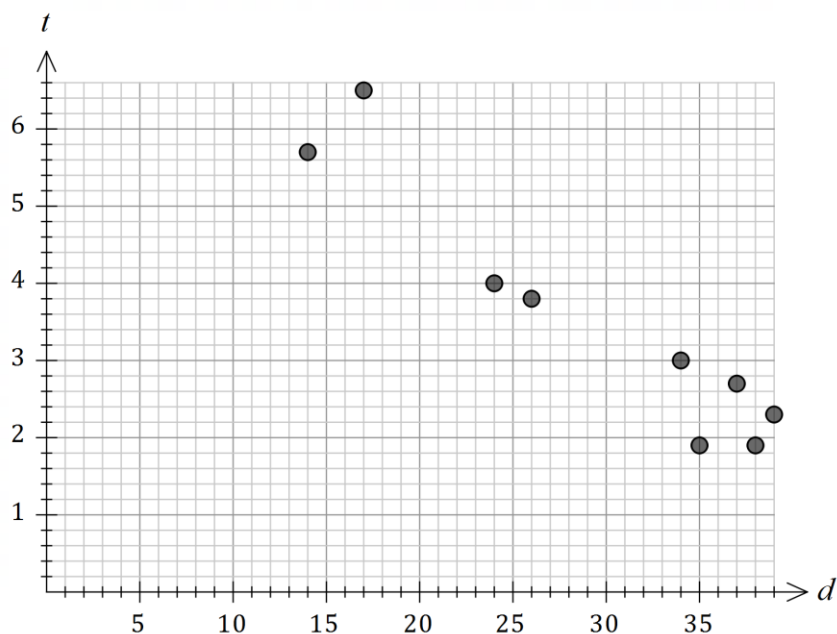
MATERIALS RECOMMENDED: Up to three approved calculators
One A4 single sided unfolded page of notes

5) [20 marks]

A group of Math Application students investigated the association between the tread depth, t mm, of a car tyre and the number of kilometres travelled, d (thousand km). They chose a sample of 12 tyres which were all the same brand. The results are shown below.

Kilometers Travelled (d thousand km)	15	24	20	26	14	17	24	34	35	37	38	39
Tread depth (t mm)	6	5.5	4.7	3.8	5.7	6.5	4.0	3.0	1.9	2.7	1.9	2.3

- a) The first three points from the table are missing from the scatterplot below. Plot these three points. (3)

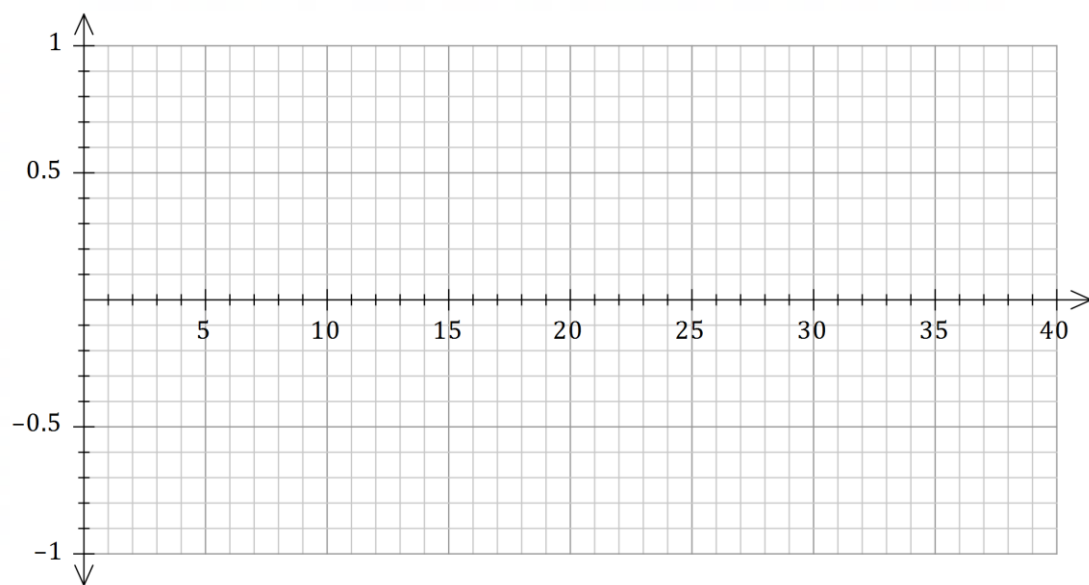


- b) Determine the equation of the least squares line and graph it on the above scatterplot. (3)
- c) State the correlation coefficient for the data and comment on your answer with respect to the scatterplot above. (3)
- d) Predict the amount of tread left on a tyre after it has done 30000 km, and state the reliability of your prediction, justifying why. (3)

e) What percentage of the variation in the tread depth can be explained by the variation in the distance travelled? (1)

f) Calculate the residual for a tyre that has travelled 15 000km. (1)

g) Draw the residual plot for the data set on the axes below, labelling the axes. (4)



h) State, with justification, whether a linear model is a good fit for the data given. (2)

6) [6 marks]

Data was collected to determine whether the age of a driver affects the distance at which they can clearly read a road sign while driving.

The following regression equation results from comparing the maximum distance (***d metres***) from the road sign at which the sign is clearly visible, to the age (***a years***) of the driver of the vehicle approaching it.

$$\text{Maximum sign legibility distance } (d) = 175.9 - 0.91 \times \text{Age of driver } (a)$$

The coefficient of determination for the data is 0.81.

- a) Interpret, in context, the gradient. (2)
- b) Determine the correlation coefficient. (2)
- c) State a lurking variable and the reasons for your choice. (2)

7) [6 marks]

- a) If the 6th term of an arithmetic sequence is 22 and the 13th term is 50, write the recursive relation that describes the sequence. (2)
- b) Given the second term of a geometric sequence is -6 and the fifth term is 48:
 - i. Calculate the common ratio. (2)
 - ii. Write down the first three terms of the sequence (2)