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: Solutions

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

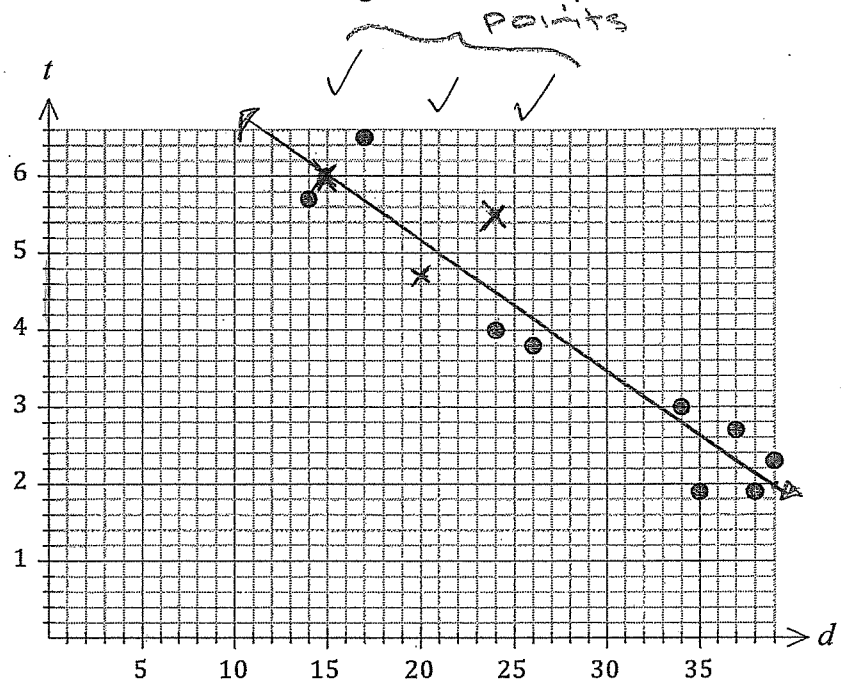
One A4 single sided unfolded page of notes

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)

$t = -0.167d + 8.508$ ✓ (* f/t with graphing)

c) State the correlation coefficient for the data and comment on your answer with respect to the scatterplot above. (3)

$r = -0.9419$ ✓

- strong, negative ✓
linear relationship

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)

(30, 3.483) ≈ 3.5mm. Reliable as interpolation & strong 'r'

✓ ✓ ✓

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

$r^2 = 0.8871$ ∴ 88.7% ✓

↑ must be a %

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

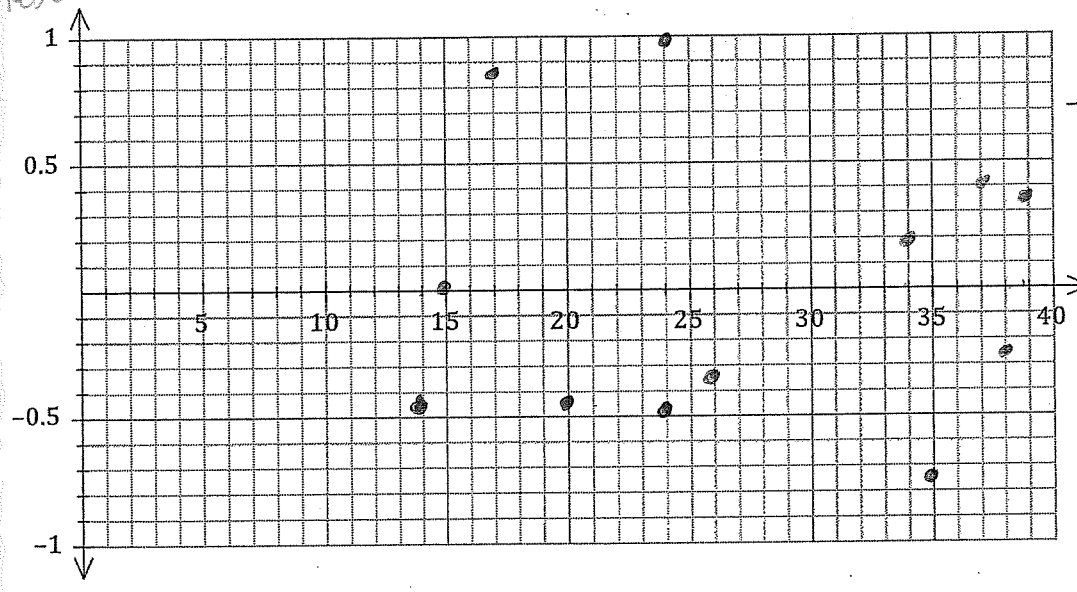
$\hat{t} = 5.9958$

≈ 6 ✓

∴ residual ≈ 0

(do not allow 4.2E-3)

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



✓ label axes

✓✓✓

−1/error omission or incorrect position

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

A linear model is a good fit as the residual plot has no pattern evident

✓ yes

✓ reason

must be both

/8

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.

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

The coefficient of determination for the data is 0.81.

a) Interpret, in context, the gradient. (2)

✓

For every year increase in age, the max distance they can see the sign decreases by 0.91m ✓

b) Determine the correlation coefficient. (2)

$r = \overset{✓}{-}0.9$ ✓

c) State a lurking variable and the reasons for your choice. (2)

any 1 ✓ { weather conditions – impacts visibility ie poor weather has reduced visibility } ✓ reason

eye sight

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)

$T_6 = 22$

$T_{13} = T_6 + 5d$

$50 = 22 + 5d$

$4 = d$

$T_{n+1} = T_n + 4, T_1 = 2$ ✓ ✓

b) Given the second term of a geometric sequence is -6 and the fifth term is 48:

i. Calculate the common ratio. (2)

$ar = -6$

$ar^4 = 48$ } ✓ working

$r^3 = -8$

$r = -2$ ✓

ii. Write down the first three terms of the sequence (2)

✓ 3 −6 12 ✓

END OF PAPER