Greenwood College
Year 12 Applications
Test 2 2019
Resource-Free

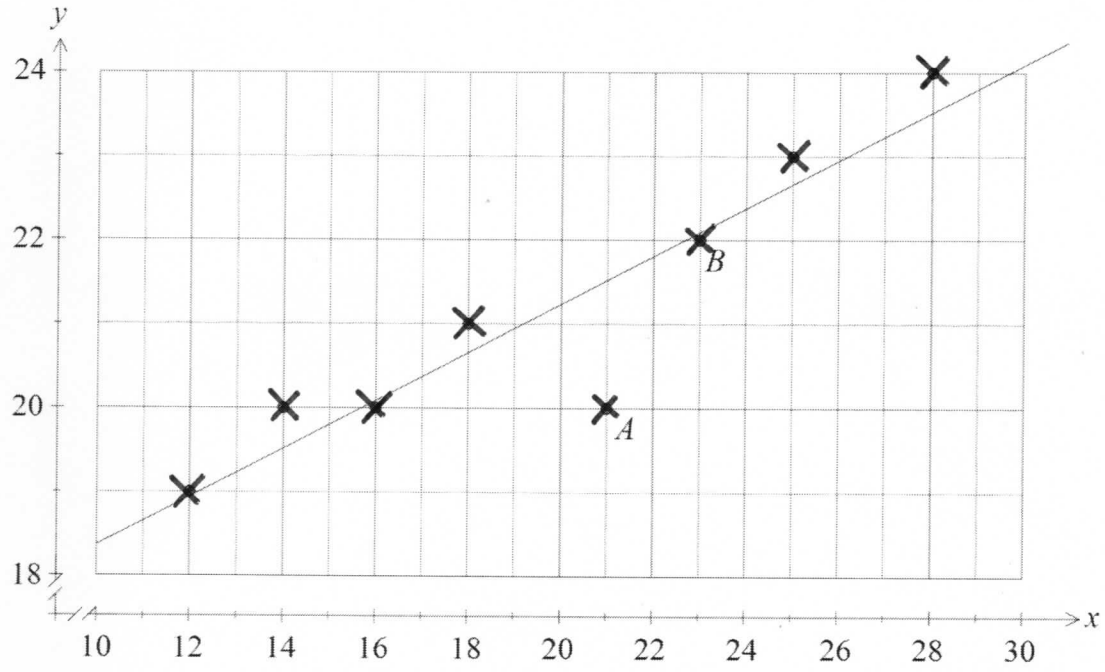
Name..... Marking key ..... 10 Mar 2019 151

No calculators nor notes allowed.
28 mark total.

Formula sheet allowed.
30 minute time limit.

Question 1 **[8 marks: 2, 1, 1, 3, 1]**

The scatterplot below, with least-squares line displayed, shows the relationship between two numerical variables, x and y. The correlation coefficient between the variables is 0.92.



(a) Describe the association between x and y in terms of direction and strength.

States positive direction. ✓

States moderate to strong strength. ✓

2

(b) Describe the effect on the correlation coefficient if

(i) the point labelled *A* was removed from the dataset. ✓

Coefficient would increase.

(ii) the point labelled *B* was removed from the dataset. ✓

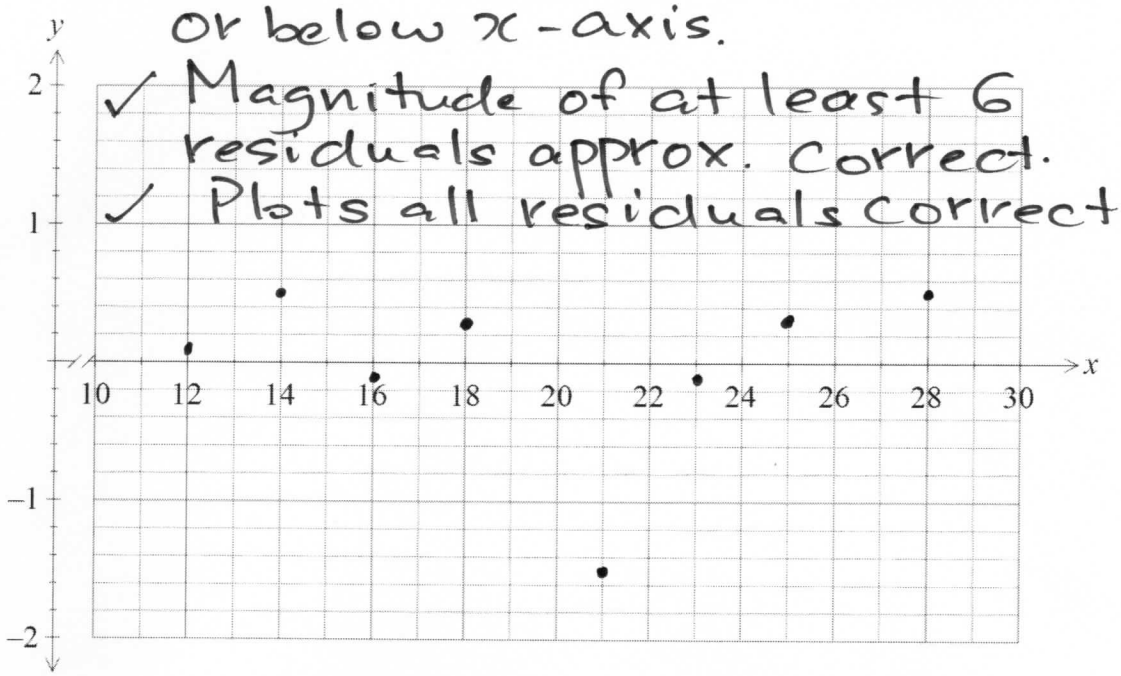
Co-efficient would decrease.

(c) Sketch a residual plot for the eight paired values on the axes below.

✓ Plots at least 6 residuals above or below x-axis.

✓ Magnitude of at least 6 residuals approx. correct.

✓ Plots all residuals correctly.



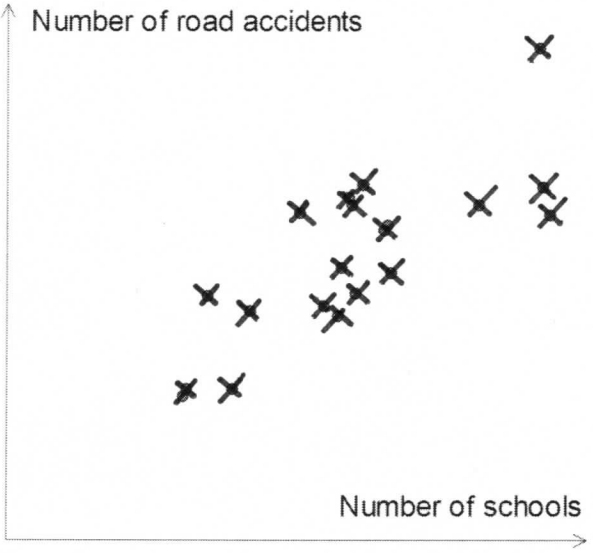
(d) Comment, with reasons, on the appropriateness of fitting a linear model to this dataset.

Linear model is appropriate because no pattern is evident in the residuals. ✓

6

Question 2 **[5 marks: 2, 1, 2]**

The scatterplot below shows data from a sample of towns in a region.



(a) Which of the numbers 1, -1, 0.75, -0.75, 0.5, -0.5, 0.25, -0.25 and 0 is closest to the correlation coefficient between the two variables? Explain your choice.

0.75 ✓

The association is moderate to strong and positive. ✓

(b) A politician saw the graph and claimed the data supported his plan to merge small schools and hence reduce the number of schools in individual towns. Identify a reason the politician might have had to make such a claim.

The scatter plot shows that towns with fewer schools ✓ have fewer road accidents.

3

✓ States town size, or other plausible confounding variable. 4

✓ Explains confounding due to common response to 3rd variable.

Question 2 cont.

(c) Identify and explain a possible non-causal explanation for the observed association between the number of schools and the number of road accidents in this sample of towns.

The size of individual towns is likely to be a confounding variable. The 2 variables are both likely to have a casual association with town size, but not with each other.

Question 3 **[8 marks: 2, 1, 1, 2, 2]**

(a) Describe a suitable method to organise and display data when investigating the existence of an association between two categorical variables.

A 2-way frequency table, with either row or column %s. Might also choose to construct a segmented/stacked column graph.

✓ States freq. table.

✓ Mentions row/column %s.

(b) A class was set a task to investigate whether an association exists between the distance a student lived from school and the number of times they were late in a term.

(i) What **type** of graph/s would be appropriate to display data collected?

A scatterplot. ✓

(ii) What statistical measure would be useful to calculate in order to determine whether an association existed?

Correlation coefficient ✓

Question 3 cont.

(iii) One student designed the questionnaire shown below. Comment on the appropriateness of their design for this investigation.

Name:

Tick one box	Distance less than 2 km	Distance more than 2 km
Late less than 3 times		
Late more than 3 times		

Not very appropriate or useful.
- Better to record exact distances and number of lates for each person.
- Late group boundary does not allow for 3 lates, ...

✓ Comments that form not good.
✓ Supplies reasons.

(iv) A student carried out the investigation, found that a moderate negative association existed, and concluded that frequent lateness was caused by living close to the school. Comment on their conclusion.

Conclusion implies that one causes the other, which may not be true. All that can be concluded is that an association exists between the variables.

✓ Disagrees with conclusion.
✓ States causation implied.

4

Question 4 **[5 marks: 1, 2, 2**

A group of university students was asked the question "Does full attendance at school lead to an improved examination result?"

The results are summarised below.

Resp.

Exp.

	Agree	Disagree	Undecided
Under 20	14	42	14
20-25	56	16	8
Over 25	42	5	3

(a) State the explanatory variable for these data.

Age ✓

(b) The results are now presented as row percentages.

	Agree	Disagree	Undecided	
Under 20	20%	60%	20%	100%
20-25	70%	**20%**	10%	100%
Over 25	84%	10%	6%	100%

Show how the 20% (highlighted in **bold**) was calculated from the first table.

$$\frac{16}{(56+16+8)} \times 100\% \quad ✓✓$$

(c) Use the data to determine one association between the variables. Describe the association and explain your reasoning.

✓✓ As age ↑, % agree ↑.

OR As age ↑, % disagree ↓.

OR As age ↑, % undecided ↓.

Question 5 **[2 marks]**

Given a correlation co-efficient of 0.8, determine what percentage of the variation in response variable can be explained by the variation in the explanatory variable.

$0.8 \times 0.8 = 0.64$

$= 64\%$ ✓✓

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Resource-Allowed

Name...

Formula sheet, one A4 page single-sided of notes and calculators allowed.

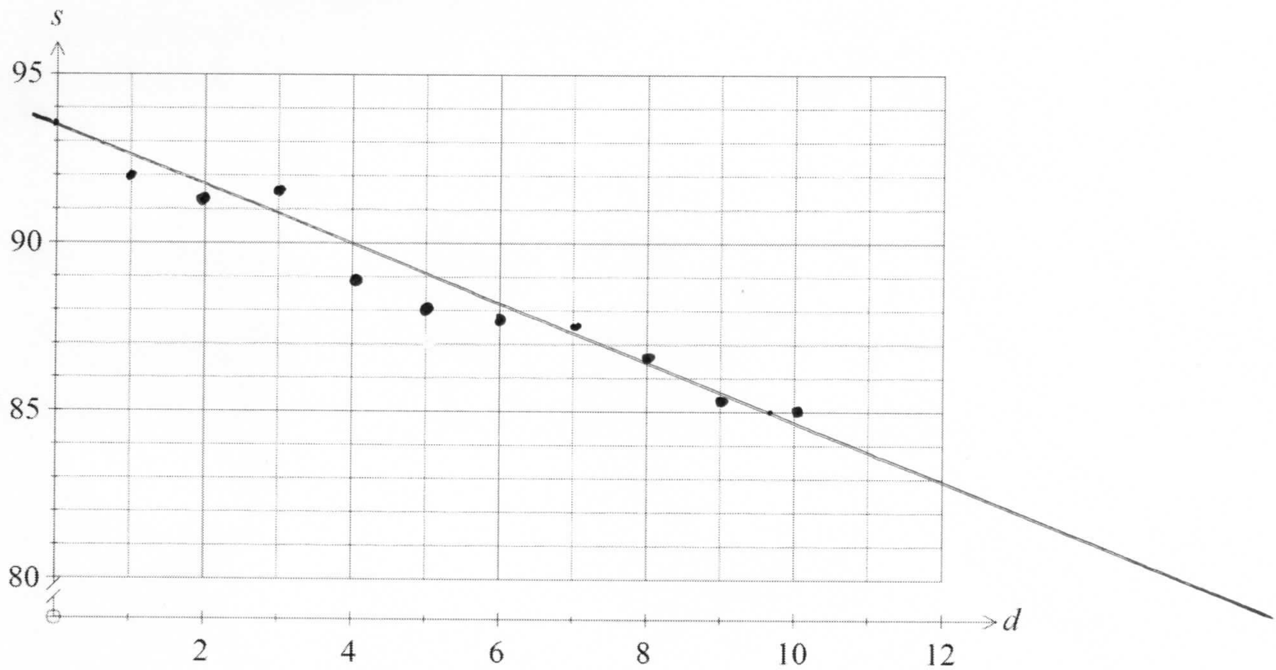
23 mark total. 25 minute time limit.

Question 6 **[12 marks: 2, 3, 2, 1, 1, 1, 2]**

The daily customer satisfaction index was measured by an online business over a period of ten consecutive days and the data collected is shown in the table below.

Day (d)	1	2	3	4	5	6	7	8	9	10
CS Index (s)	92.1	91.2	90.6	88.9	88.1	87.7	87.4	86.6	85.4	85.1

(a) Plot the above data on the axes below.



Question 6 cont.

(b) Determine the equation of the least-squares line that models the linear relationship between the day number and the customer satisfaction index. Record the correlation co-efficient.

$s = -0.779d + 92.59$ ✓✓

(c) Draw the least-squares line on the axes on the previous page. ✓✓

(d) Predict the customer satisfaction index for day 11.

$s = 84.0$ ✓

(e) Explain why a prediction for the customer satisfaction index for day 15 should be treated with caution.

Extrapolation. ✓

(f) Determine what percentage of the variation in CS Index (s) can be explained by the variation in Day (d).

$r = -0.9881$ ✓✓

$r^2 = 0.9763$

97.63%

(g) Determine the average decrease in CS Index (s) per day?

From gradient → -0.779 ✓✓

10

Question 7 **[11 marks: 4, 2, 3, 2]**

In a recent study of artists who asked for a piece of their work to be included in an exhibition, each artist was classified by the variables (i) the state they worked in and (ii) whether their piece of work was accepted by the judges.

The table below shows the number of artists in each category.

	State	NSW	VIC	QLD	WA	Total
Work accepted?	Yes	8	27	21 ✓	8	64
	No	108 ✓	86	143	39	376 ✓
	Total	116	113	164	47	440

✓ ← ✓ → ✓

(a) Complete the missing values and totals in the table above.

(b) To identify the presence of an association between these two variables, explain why the state the artist worked in should be used as the explanatory variable.

✓✓ It is possible for the "state" to affect "having work accepted", but not possible for "having work accepted" to affect "state artist works in". Hence "state" is explanatory variable and "work accepted" is response variable. 6

Question 7 cont.

(c) Rounding percentages to the nearest whole number, complete the percentaged two-way table below so that it may be used to identify the presence of an association between the categorical variables.

	State	NSW	VIC	QLD	WA
Work accepted?	Yes	7% ✓	24%	13%	17%
	No	93%	76%	87%	83%

✓ 1 column correct.
✓ All columns correct.

(d) Comment on the presence of an association between the two variables.

An association exists, as artists from VIC (24%) are much more likely to have ✓ their work chosen than an artist from NSW, QLD or WA.

5