

Section Two: Calculator-assumed

65% (98 Marks)

This section has **eleven (11)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 100 minutes.

Question 8

(6 marks)

The weight, W_n kg, of flour produced by a mill that needs to be sent to the packing department is given by $W_{n+1} = W_n + 1.25$, $W_0 = 7.5$, where n is the number of minutes after 5 am.

(a) Complete the table below.

(2 marks)

	5am	5.01am	5.02am	5.03am	5.04am	5.05am
n	0	1	2	3	4	5
W_n	7.5	8.75	10	11.25	12.5	13.75

(b) Calculate the weight of flour at 6 am.

(2 marks)

$$W_{60} = 8.75 + (n-1)(1.25)$$

$$W_{60} = 8.75 + (60-1)(1.25)$$

$$6am = 82.5 \text{ kg flour}$$

(c) At what time will the weight of flour reach 150 kg?

(2 marks)

$$150 = 8.75 + (n-1)(1.25)$$

$$n = 114$$

$$\therefore 1 \text{ hour and } 54 \frac{1}{2} \text{ minutes after 5am}$$

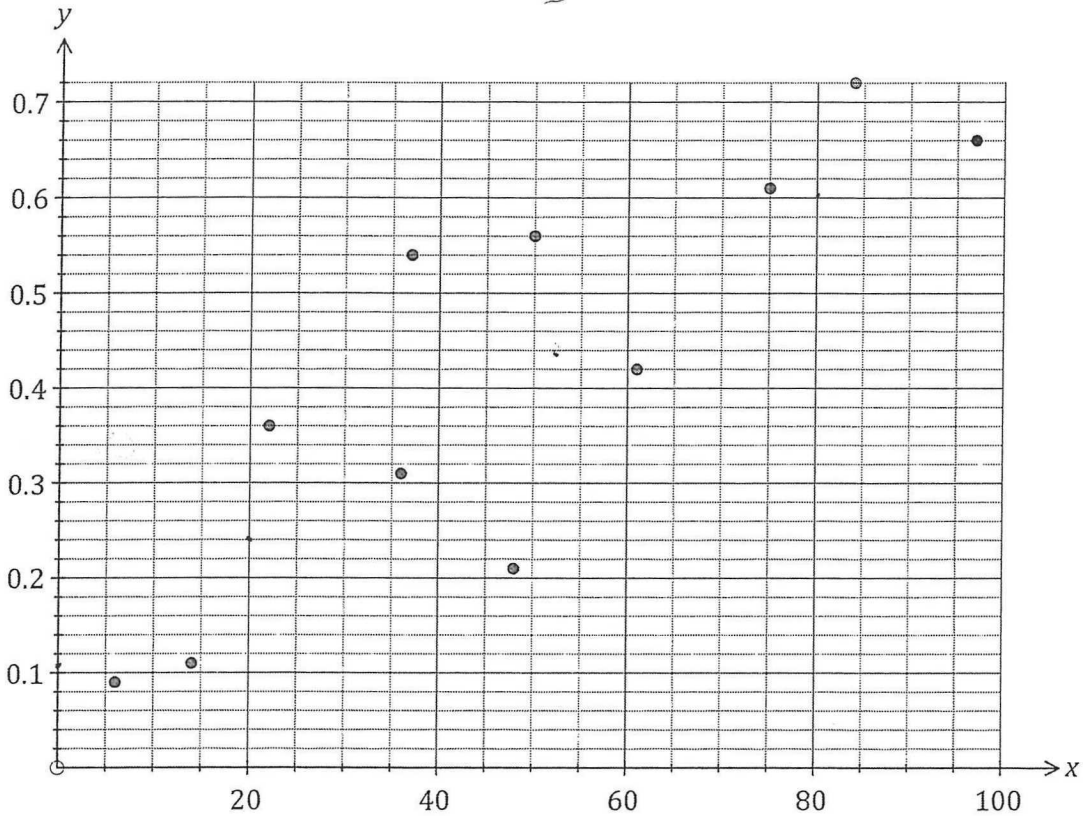
$$\therefore 6.54am$$

Question 9

(12 marks)

Agricultural researchers collected data on the amount of rainfall (x mm) and the yield of cucumbers (y kg per square metre) over several seasons at a farm. Some of their data is shown in the table and scatterplot below.

Rainfall, x	22	84	97	48	14	37	97	50	61	75	36	6
Yield, y	0.36	0.72	0.66	0.21	0.11	0.54	0.66	0.56	0.42	0.61	0.31	0.09



- (a) Calculate the correlation coefficient for the data, and comment on how its value is reflected in the scatterplot above. (3 marks)

$$r = 0.8575 \checkmark$$

the scattergraph shows a strong positive linear association between rainfall^(x) and yield^(y). This seen by the points showing an increasing trend.

- (b) What percentage of the variation in the yield can be explained by the variation in the rainfall? (2 marks)

$$r^2 = 0.7353$$

73.53%

- (c) Determine the equation for the least-squares line that models the data. Give your answer correct to 4 decimal places. (2 marks)

$$\hat{y} = 0.0061x + 0.1194$$

- (d) Draw the least-squares regression line on the scatterplot by first calculating two points that lie on the line. Clearly indicate the coordinates of these points below. (3 marks)

Point 1: (,) e.g. (20, 0.2412)

Point 2: (,) e.g. (40, 0.363)

e.g. (0, 0.1194) e.g. (60, 0.4847)

(52.25, 0.4375) e.g. (80, 0.6064)

e.g. (100, 0.7281)

- (e) Estimate the cucumber yield in a season that has 64 mm of rainfall and comment on the reliability of this value. (2 marks)

$$\hat{y} = 0.0061(64) + 0.1194$$

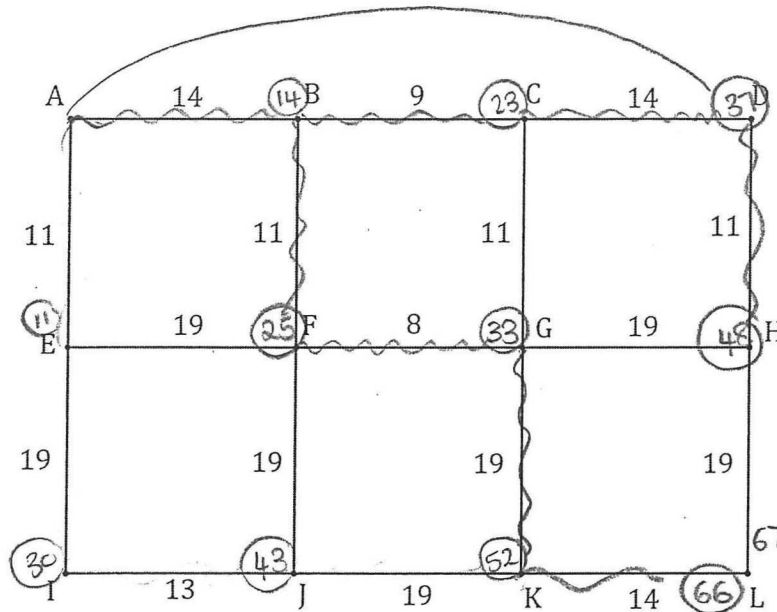
$$\hat{y} = 0.509 \quad \therefore \sim 0.51 \text{ kg per square metre}$$

reliable due to interpolation
and a strong correlation

Question 10

(8 marks)

The weighted graph below represents the footpaths connecting 12 buildings in the grounds of a defence force training facility. The number on each edge is the time required to walk along each footpath in minutes.



- (a) Determine the minimum time to walk from C to J and state the corresponding route.

(2 marks)

C G E J

38 minutes

- (b) Determine the minimum time to walk from A to L and state the corresponding route.

(3 marks)

A-B-F-G-K-L ✓

66 minutes ✓

working out
 ABCDHL = 67
 AEIJKL = 76

- (c) A new footpath is being planned between A and D so that the minimum time to walk from A to L is reduced by 5 minutes. How long should the walk between A and D take to achieve this? Justify your answer.

(3 marks)

ATM ABCDHL is 67 ∴ minimum time was

66 min ∴ 66 - 5 = 61 minutes. (∴ need ABCDHL to be 6 min shorter)

Hence if AD is 37 then 37 - 6 = 31 minutes.

Question 11

(9 marks)

The value of a machine used in a factory is recorded at the start of each year.

	0	1	2
Year	2014	2015	2016
Value of machine (\$)	6 875	5 500	4 400

- (a) Explain why the three values in the table form a geometric sequence. (2 marks)

$$\frac{5500}{6875} = 0.8 \quad \frac{4400}{5500} = 0.8$$

common ratio of 0.8

- (b) What is the annual percentage rate of depreciation of the machine? (1 mark)

20%

Assume that the machine continues to depreciate at the same rate.

- (c) Determine a rule for V_n , the value of the machine n years after 2014. (2 marks)

$$V_n = 5500 \times (0.8)^{n-1}$$

$$V_n = 6875 \times (0.8)^n$$

- (d) Determine the value of the machine at the start of the year 2020. (2 marks)

$$V_6 = 6875 \times 0.8^6 \quad \text{or} \quad V_6 = 5500 \times 0.8^{6-1}$$

$$2020 = \$1802.24$$

- (e) The machine will be replaced when its value at the start of the year falls below \$500. Determine which year this will be. (2 marks)

$$500 = 6875 \times 0.8^n$$

$$n = 11.75$$

\therefore 12 years after 2014

\therefore 2026

Question 12

(11 marks)

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	37	11	8	64
	No	118	76	143	39	376
	Total	126	113	154	47	440

- (a) Complete the missing values and totals in the table above. (4 marks)

$-\frac{1}{2}$ each error

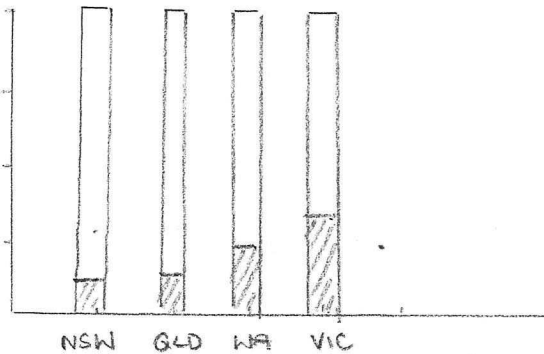
- (b) To identify the presence of an association between these two variables, explain why the state the artist worked in should be used as the explanatory variable. (2 marks)

whether work is accepted is dependent
 on the state they worked ⁱⁿ ~~on~~.
 i.e. state is ^{an} independent variable

- (c) Rounding percentages to the nearest whole number, complete the percentage two-way table below so that it may be used to identify the presence of an association between the categorical variables. (3 marks)

	State	NSW	VIC	QLD	WA
Work accepted?	Yes	6% or 7%	33%	7%	17%
	No	93%	67%	93%	83%

- (d) Comment on the presence of an association between the two variables. (2 marks)



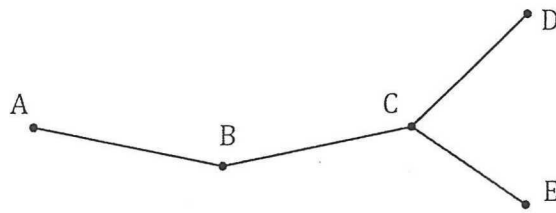
Victoria had a significantly larger proportion of work accepted compared to other states and hence artists were more likely to have work accepted in Victoria (33%) and WA (17%) in comparison to NSW (7%) and QLD (7%) whose proportions were significantly lower.

There is an association between the state they worked in and whether their work was accepted by the judges.

Question 13

(8 marks)

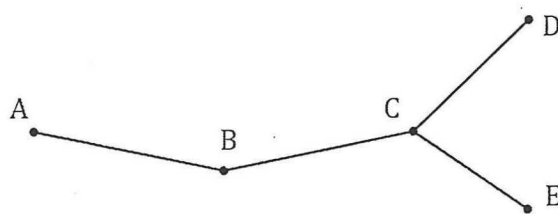
A simple connected graph is drawn below.



- (a) List, in order, the vertices of a closed walk on the graph of length 8 that visits all vertices and ends at A. (2 marks)

- (b) Explain why the walk in (a) is not a Hamiltonian cycle. (2 marks)

- (c) Add one edge and one face to the copy of the graph below, so that the new graph contains a Hamiltonian path and mark this path on the graph. (2 marks)



- (d) Add two edges and two faces to the copy of the graph below, so that the new graph does not contain a Hamiltonian path or cycle. (2 marks)

