School Name
Mathematics Test 2017

Year 10

Bivariate Data

Calculator Allowed

Skills and Knowledge Assessed:

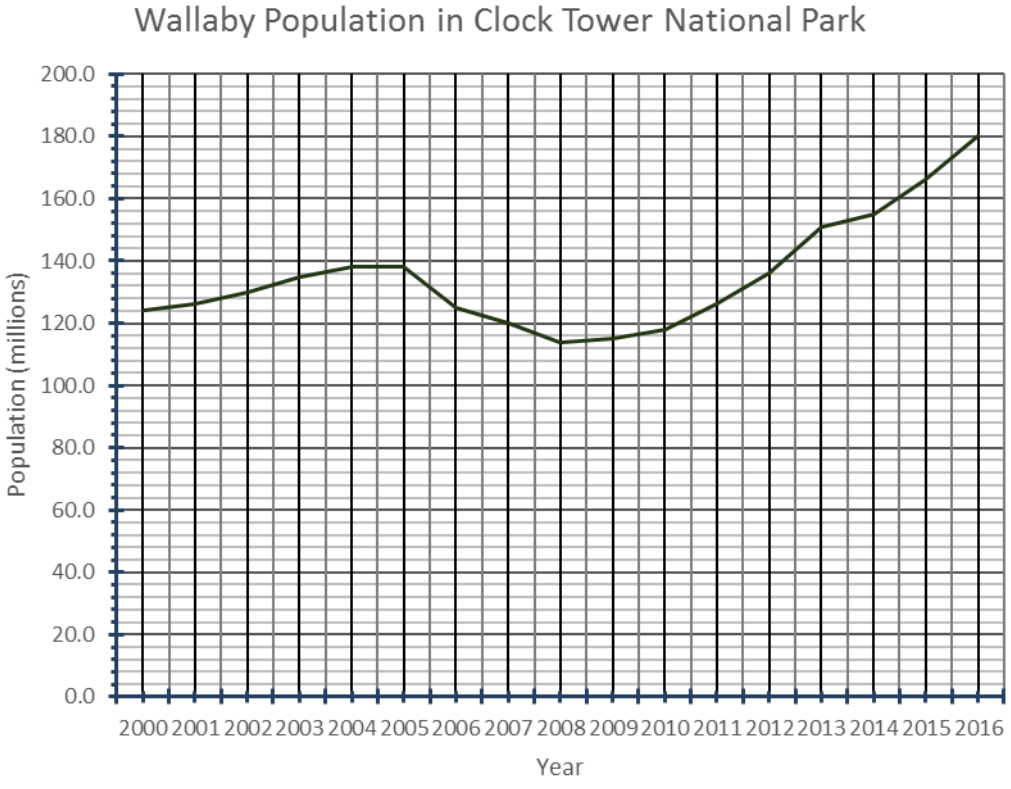
- **Use scatter plots to investigate and comment on relationships between two numerical variables (ACMSP251)**
- **Investigate and describe bivariate numerical data where the independent variable is time (ACMSP252)**
- **10A Use information technologies to investigate bivariate numerical data sets. Where appropriate use a straight line to describe the relationship allowing for variation (ACMSP279)**

Name_____

Section 1 Short Answer Section

Write all working and answers in the spaces provided on this test paper.

Questions 1 – 4 refer to the line graph below.



1. What was the population in 2012?

……

2. Between which years was there a decrease in the population?

……

3. In which year was the population 120 million?

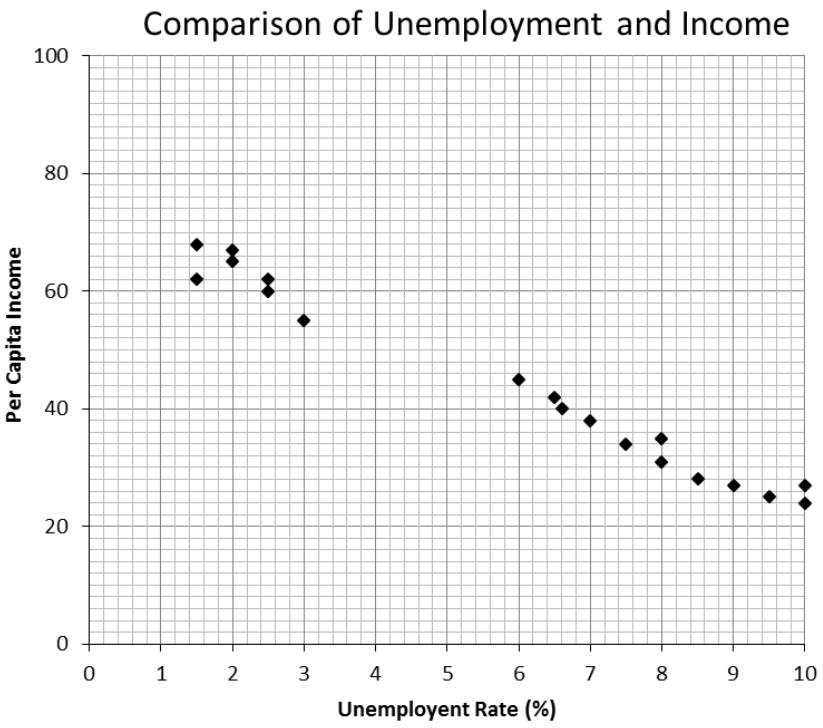
……

4. What was the increase in population between 2000 and 2016?

……

Questions 5 – 8 refer to the table and graph below.

Unemployment rate (%)	Per Capita Income ($,000)
1.5	68
2	67
1.5	62
2	65
2.5	62
2.5	60
3	55
3.5	55
3.5	52
4	54
4.5	53
5	52
5.5	50
6	45
6.5	42
6.6	40
7	38
7.5	34
8	35
8	31
8.5	28
9	27
9.5	25
10	24
10	27



The results of research on 25 countries Unemployment Rate and Average Per-Capita Income are shown on the table and scatterplot above.

The shaded data has been plotted on the graph.

5. Plot the remaining six ordered pairs on the scatter plot.

6. How many countries in the survey had an unemployment rate greater than 9%?

……

7. Describe the relationship between the two variables.

……

……

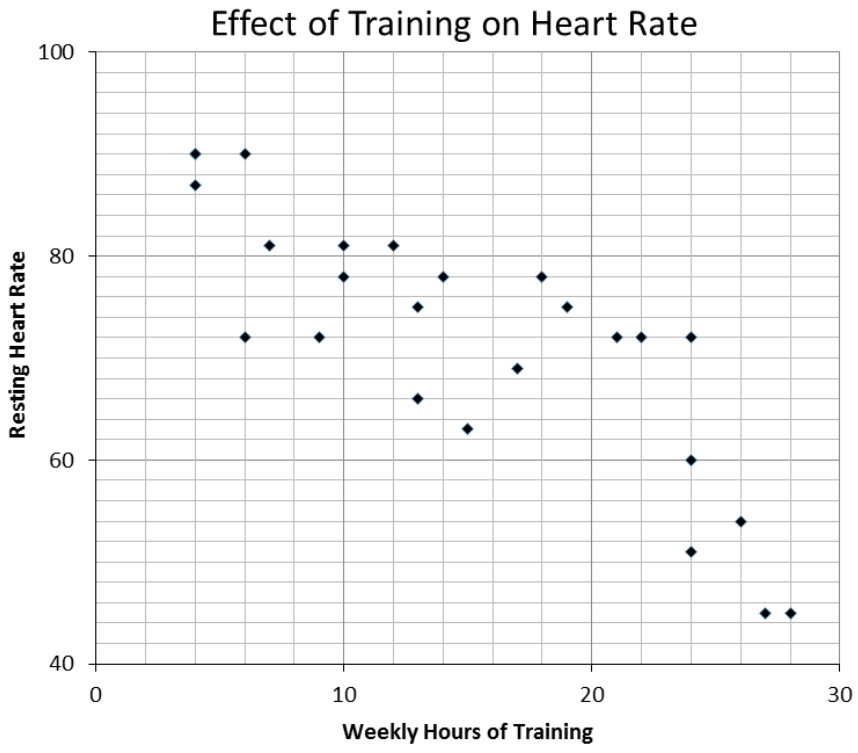
8. What percentage of the countries surveyed had a per-capita income over $60 000?

……

……

Questions 9 – 12 refer to the following.

Matthew is a personal trainer and conducts a survey of some of his clients, comparing the number of weekly hours that they spend training with their resting heart rate.
The results are shown on the Scatter plot below.



9. What was the lowest heart rate of the people included in the survey?

……

10. What fraction of his clients trained for more than 20 hours per week?

……

11. What percentage of his clients had a resting heart rate above 80?

……

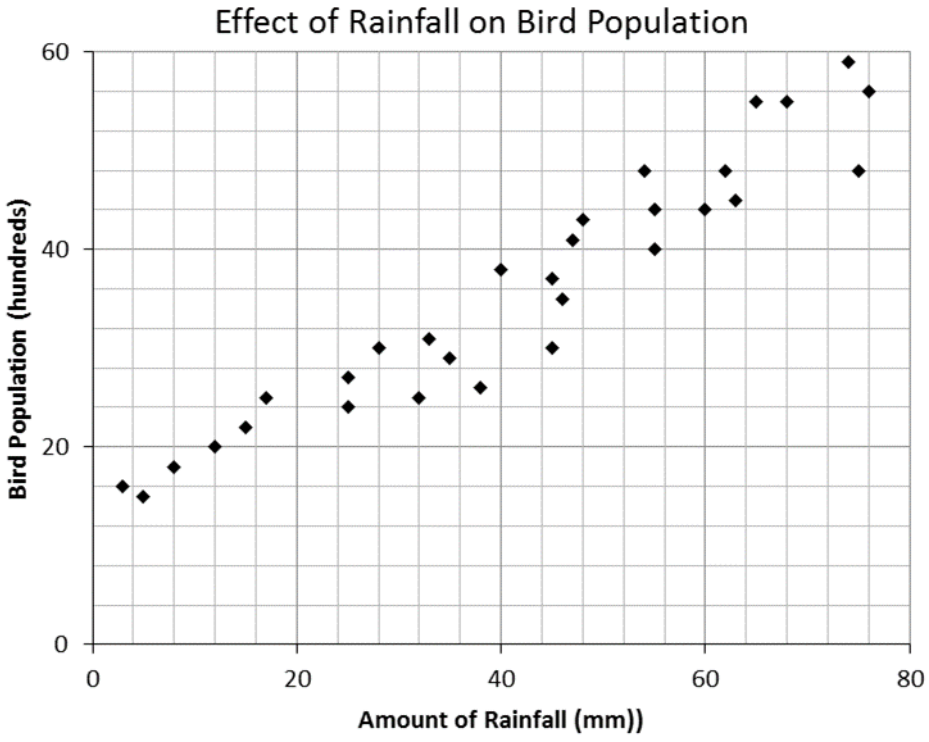
……

12. Describe how the heart rate changed as the hours of training increased.

……

……

Questions 13 – 16 refer to the following.



The scatterplot above was drawn by collecting the annual rainfall data and bird population counts over a number of years for a remote inland water system.

13.	Describe the relationship indicated by the points on the scatterplot. …….... ……
14.	Draw a line of best fit on the scatterplot.
15.	What is the gradient of the line? (Give your answer as a decimal correct to one decimal place.) …….... ……
16.	What is the equation of the line of best fit? …….... ……

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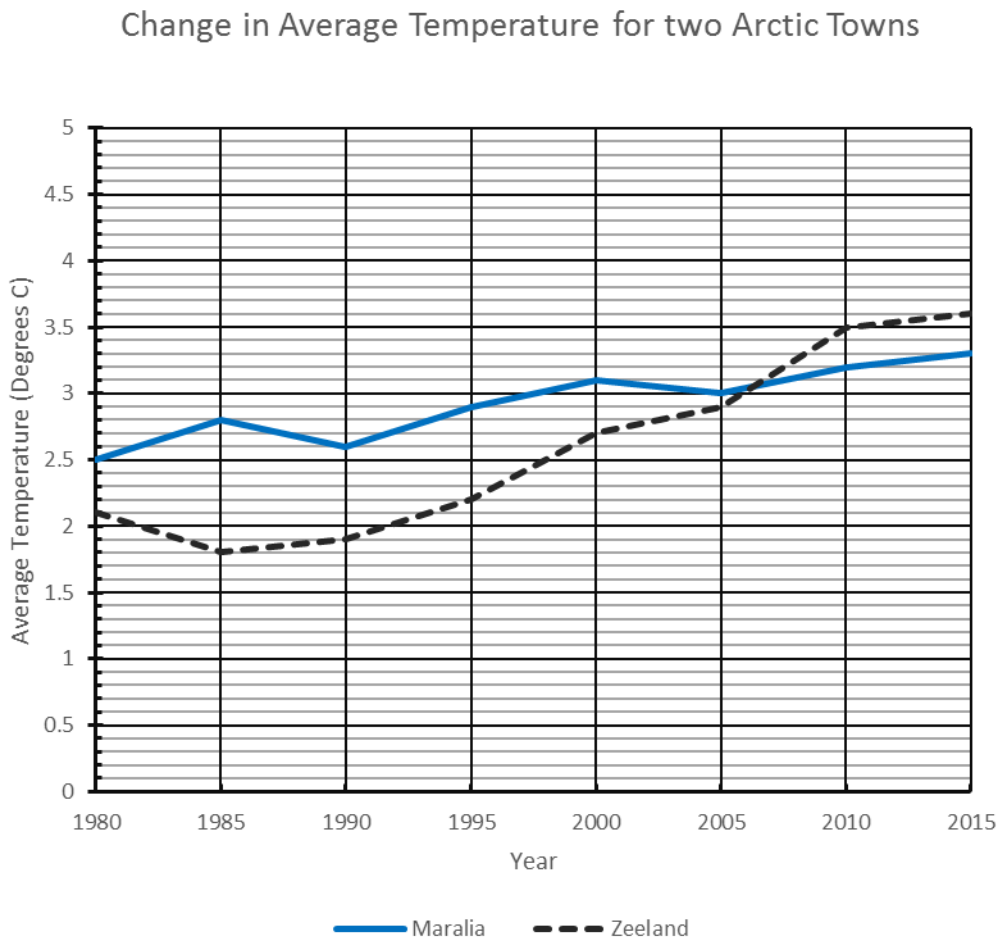
Section 2 Multiple Choice Section

Mark all your answers on the accompanying multiple choice answer sheet, not on this test paper. You may do any working out on this test paper. Calculators are allowed for this section.

Questions 1 – 3 refer to the line graph below.



Amelia graphed the average annual temperatures for two towns near the Arctic Circle over the past 35 years.

1. What was the lowest annual temperature recorded by either of the towns?

   A. 1.7^o C B. 1.8^o C C. 2.1^o C D. 2.2^o C

2. What is the difference between the highest and lowest temperatures recorded in Maralia?

   A. 0.7^o C B. 0.8^o C C. 1.0^o C D. 1.8^o C

3. A scientist is looking for evidence that the earth is warming.

   Which town's data shows a trend of increasing temperatures that could help provide the evidence he needs?

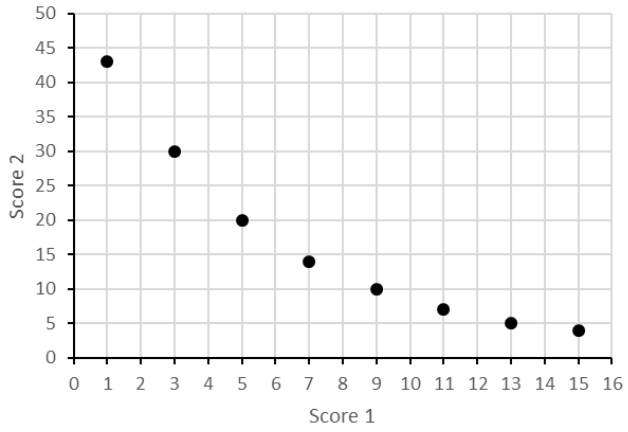
   A. Both towns data could be used as evidence.

   B. Neither towns data could be used as evidence.

   C. Only Maralia's data could be used as evidence.

   D. Only Zeeland's data could be used as evidence.

4. How could the relation shown on the scatterplot below be described?



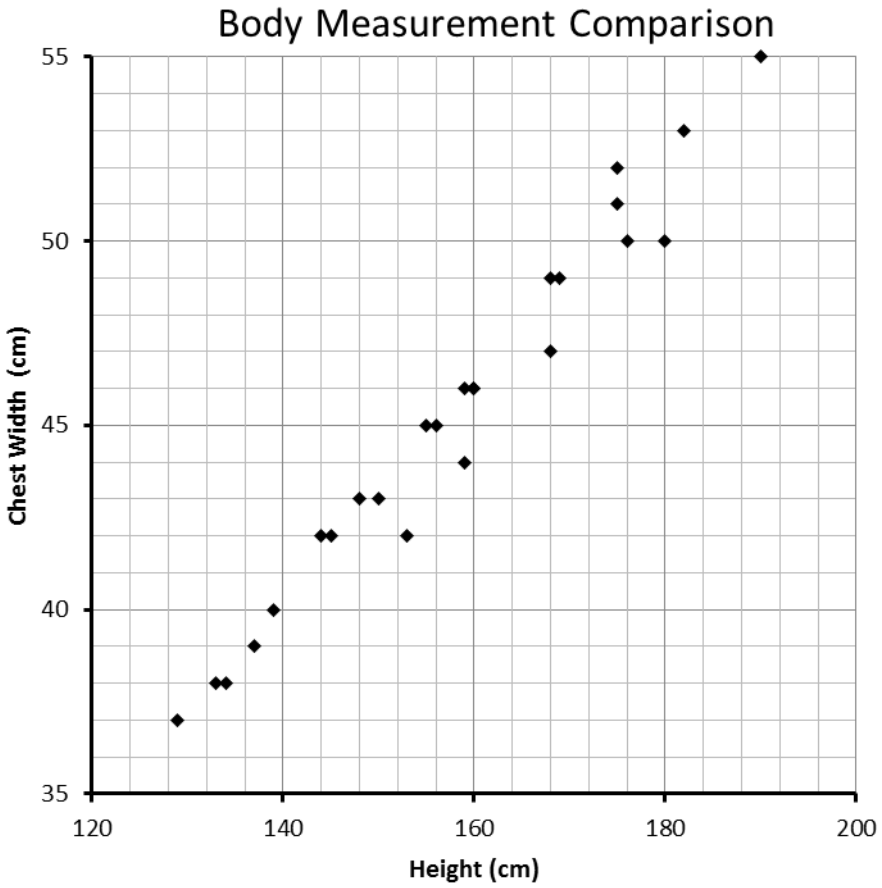
   A. A strong non - linear relationship.

   B. A strong negative linear relationship.

   C. A weak negative linear relationship.

   D. A weak positive linear relationship.

Questions 5 – 7 refer to the following.



A sports scientist collected the data shown on the scatter plot above.

5. How many of the subjects had a height less than 140 cm?

A. 2 B. 3 C. 4 D. 5

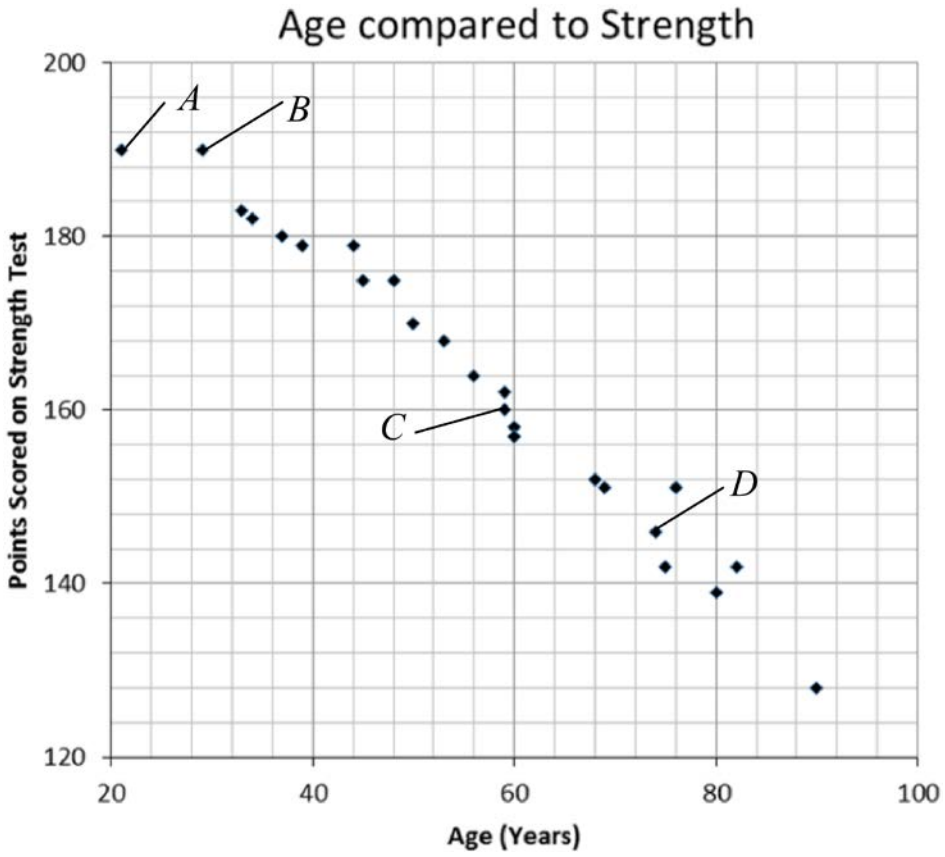
6. How many of the subjects had a chest width which was 50 cm or more?

A. 4 B. 5 C. 6 D. 7

7. What type of relationship is evident between foot length and height?

A. A strong negative linear relationship.
B. A weak negative linear relationship.
C. A strong positive linear relationship.
D. A weak positive linear relationship.

Questions 8 – 11 refer to the following



A medical researcher conducts a strength test on a group of people and compares their results with their ages on the scatter plot above. Four of the results are labelled *A* – *D*.

8. What was the highest strength score achieved by a person over 60 years of age?

A. 143 points B. 146 points C. 149 points D. 152 points

9. What type of relationship exists between the strength score and age?

A. A strong non - linear relationship.
B. A strong negative linear relationship.
C. A weak negative linear relationship.
D. A weak positive linear relationship.

10. Which is true about the people represented by the points marked *A* – *D* on the scatter plot?

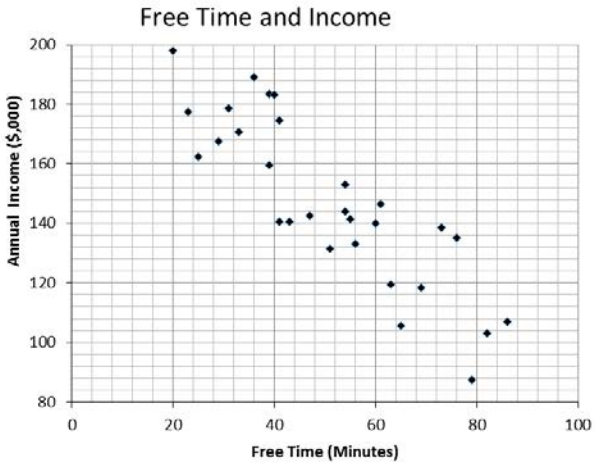
A. Person *A* is older than person *B*.
B. Person *C* is 56 years old.
C. Person *D* scored 146 points on the strength test.
D. Person *D* scored more points on the strength test than person *B*.

11. When a line of best fit is drawn on the scatterplot, which of the points would not lie on the line?

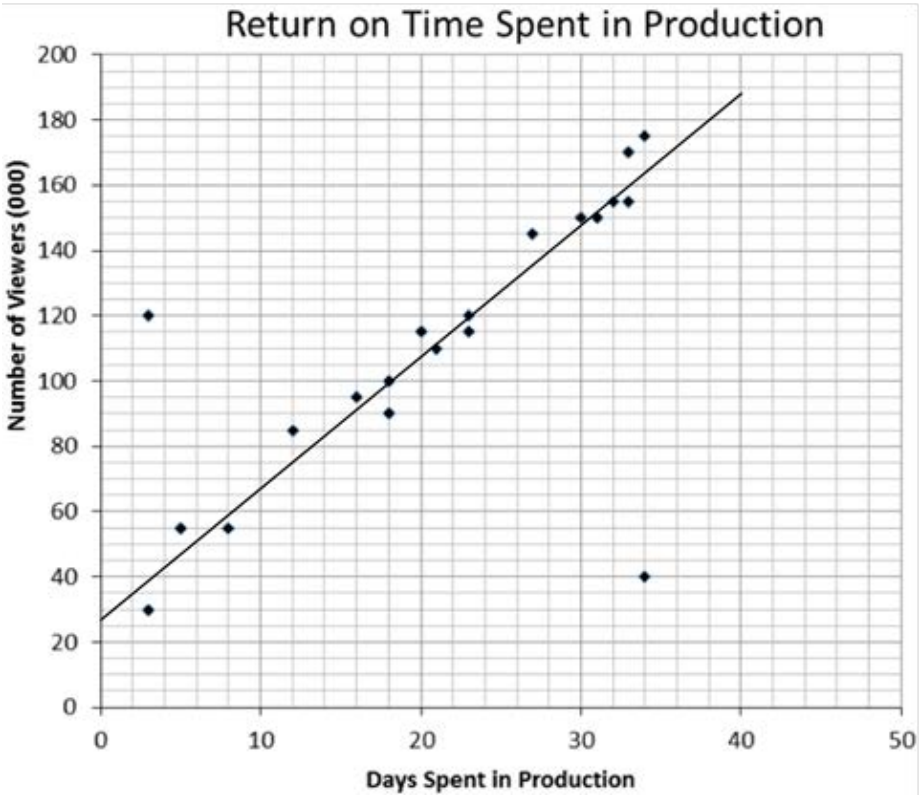
A. Point *A* B. Point *B* C. Point *C* D. Point *D*

12. What type of relationship exists between Free Time and Income on the scatter graph?

A. A strong positive linear relationship.
B. A weak positive linear relationship.
C. A strong negative linear relationship.
D. A weak negative linear relationship.



Questions 13 – 16 refer to the following



A television production company compared the number of days it spent in producing programs with the number of viewers that watched them.

13. What percentage of the programs had more than 140 000 viewers?

A. 25% B. 30% C. 35% D. 40%

14. The majority of the programs form part of a trend which is represented by the line of best fit.

How many programs could be described as outliers?

A. 1 B. 2 C. 3 D. 4

15. What is the gradient of the line of best fit drawn on the graph?

A. -4 B. 3 C. 3.5 D. 4

16. Using D for the number of days and N for the number of viewers, what is the equation of the line of best fit?

A. $N = 4D + 27$ B. $N = 3.5D + 25$

C. $N = 3D + 27$ D. $N = 4D + 20$

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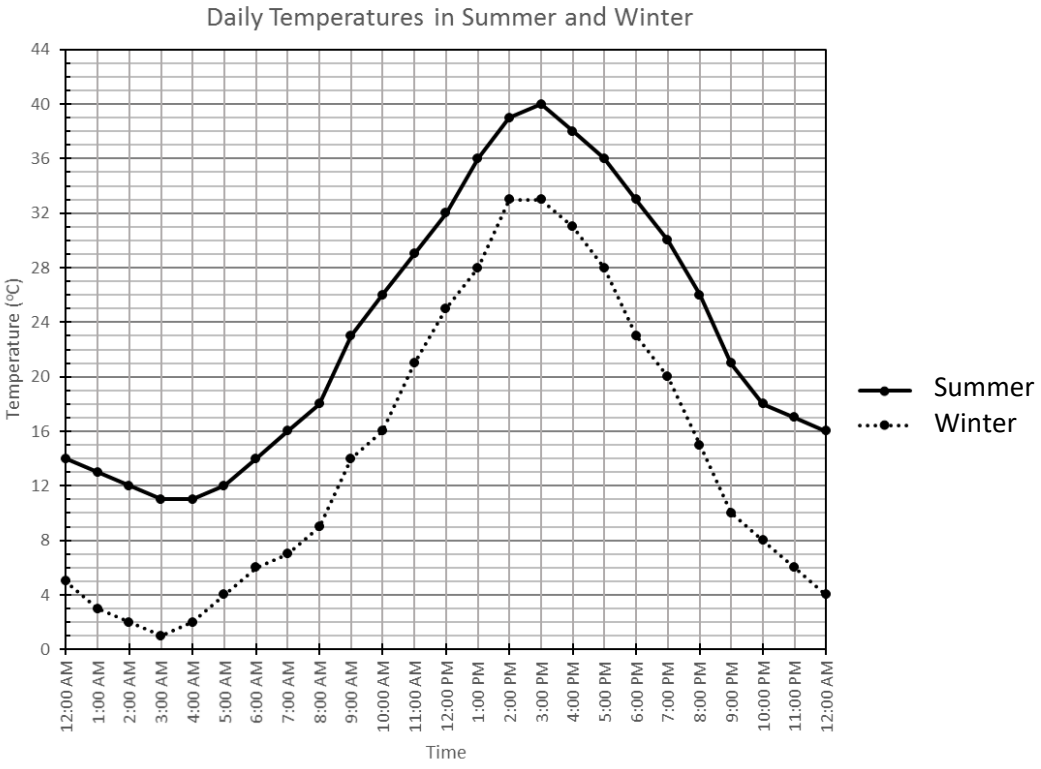
Name_____

Section 3 Longer Answer Section

Write all working and answers in the spaces provided on this test paper.

Marks

1. The graph below compares the daily temperatures during summer and winter in the town of Goorama.



Marks

(a) What was the highest summer temperature in Goorama? **1**

……..

……..

(b) What was the difference between the temperatures at 5:00 AM? **1**

……..

(c) Between what two hours of the day was there the greatest increase in temperature in summer? **1**

……..

(d) At what time of day was the smallest difference between the summer and winter temperature and what was this difference? **2**

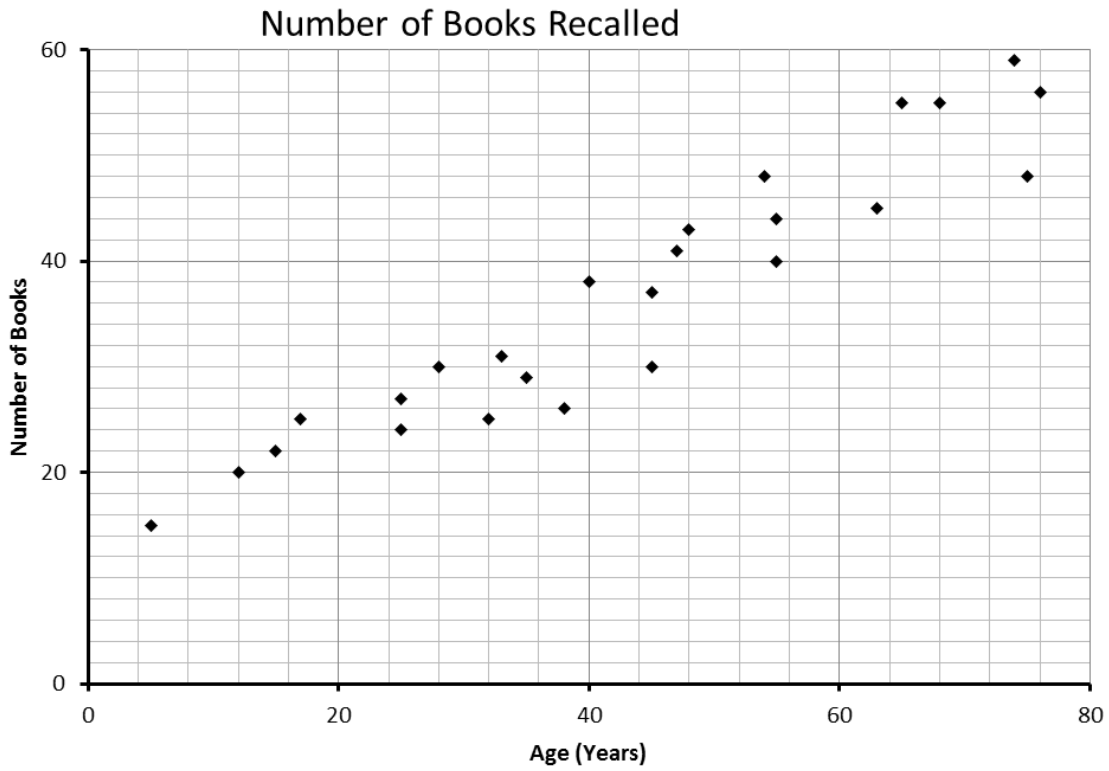
……..

……..

Marks

2. Twenty-five people were asked to list as many books as they could remember, that they had read.

The number that each recalled was then plotted against their age on the scatterplot below.



(a) Describe the relationship between age and the number of books recalled. **1**

……..

……..

(b) What percentage of the people recalled more than 40 books? **1**

……..

……..

(c) Draw a line of best fit on the graph. **2**

Marks

(d) What is the equation of the line of best fit? **2**

……..

……..

. (e) How many books would the equation predict to be recalled by someone who was 120 years old? Would this be a reliable prediction? (Explain your answer) **2**

……..

……..

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Multiple Choice Answer Sheet

Bivariate Data

Name _____

Completely fill the response oval representing the most correct answer.

1. A ⬭ B ⬭ C ⬭ D ⬭
2. A ⬭ B ⬭ C ⬭ D ⬭
3. A ⬭ B ⬭ C ⬭ D ⬭
4. A ⬭ B ⬭ C ⬭ D ⬭
5. A ⬭ B ⬭ C ⬭ D ⬭
6. A ⬭ B ⬭ C ⬭ D ⬭
7. A ⬭ B ⬭ C ⬭ D ⬭
8. A ⬭ B ⬭ C ⬭ D ⬭
9. A ⬭ B ⬭ C ⬭ D ⬭
10. A ⬭ B ⬭ C ⬭ D ⬭
11. A ⬭ B ⬭ C ⬭ D ⬭
12. A ⬭ B ⬭ C ⬭ D ⬭
13. A ⬭ B ⬭ C ⬭ D ⬭
14. A ⬭ B ⬭ C ⬭ D ⬭
15. A ⬭ B ⬭ C ⬭ D ⬭
16. A ⬭ B ⬭ C ⬭ D ⬭

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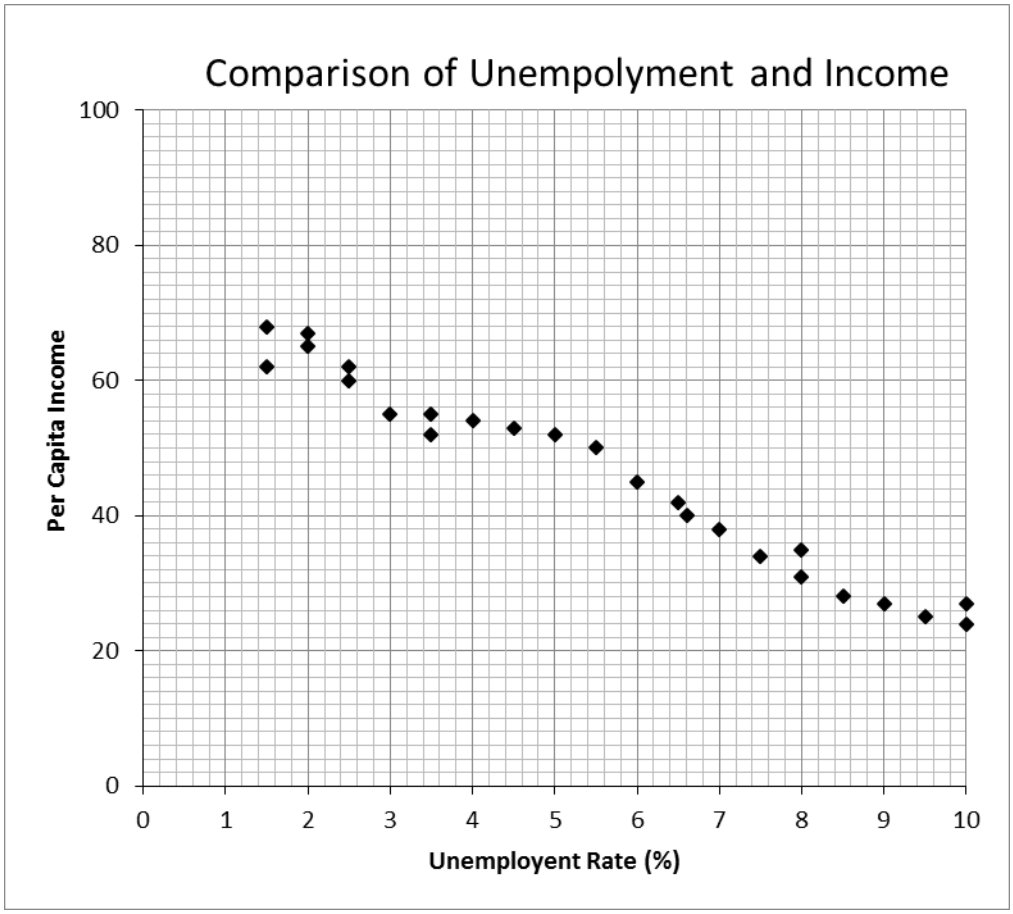
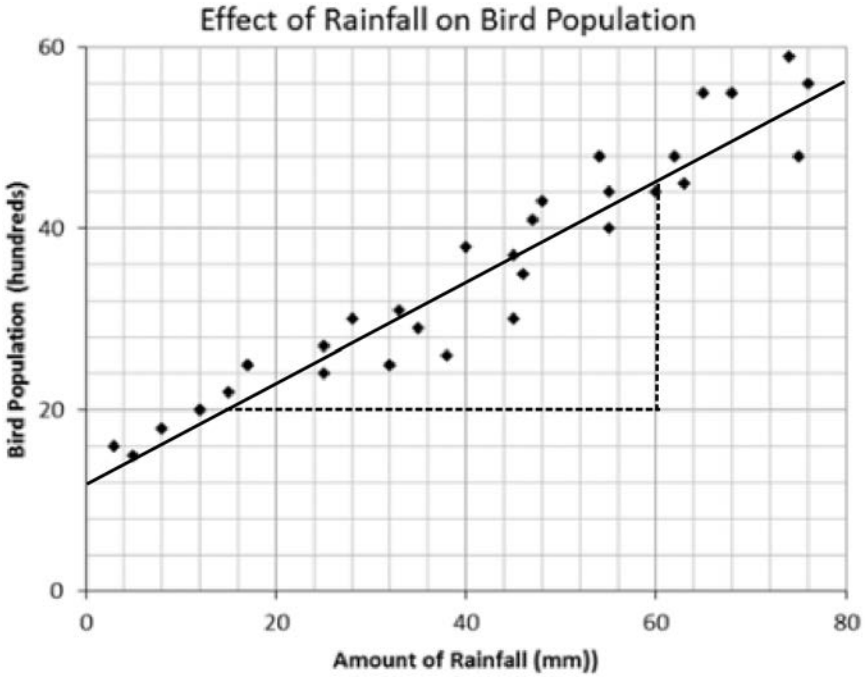
Bivariate Data

Non Calculator Section

ANSWERS

Question	Working and Answer
1.	The population in 2012 was **136** .
2.	It was between **2005 and 2008**.
3.	The population was 120 million in **2007**
4.	The increase in population between 2000 and 2016 was 180 – 124 = **56**

Question	Working and Answer
5.	
6.	**Three** are greater than 9%
7.	Either of the following or similar: **As unemployment rate increased, the per capital income decreased.** **It is a strong negative linear relationship.**
8.	There were 5 out of 25 over \$60 000 $\text{Percentage} = \frac{5}{25} \times 100 = \mathbf{20\%}$
9.	Use the vertical scale which is 1 division represents an increase of 2 in the heart rate. There are 2 people who are 2 ½ divisions above 40, so have a heart rate of **45.**
10.	There are 8 out of 24. $\text{Fraction} = \frac{8}{24} = \mathbf{\frac{1}{3}}$
11.	There are 6 out of 24. $\text{Percentage} = \frac{6}{24} \times 100 = \mathbf{25\%}$

Question	Working and Answer
12.	Either of the following or similar: **As training time increased, the resting heart rate decreased.** **It is a weak negative linear relationship.**
13.	Either of the following or similar: **As rainfall increased, the bird population also increased.** **It is a strong positive linear relationship.**
14.	Given the requirement for "a line of best fit" any line that approximated the middle of the data is acceptable. An example is shown below. 
15.	Using a triangle similar to that shown above Gradient = $\frac{25}{44}$ = 0.5682 = **0.6** Answer will vary depending on line drawn, but should be close to this value.
16.	Gradient = 0.6 y intercept = 12 Equation is $y = 0.6x + 12$ Using r for rainfall and p for population $\boldsymbol{p = 0.6r + 12}$ Answer will vary depending on line drawn.

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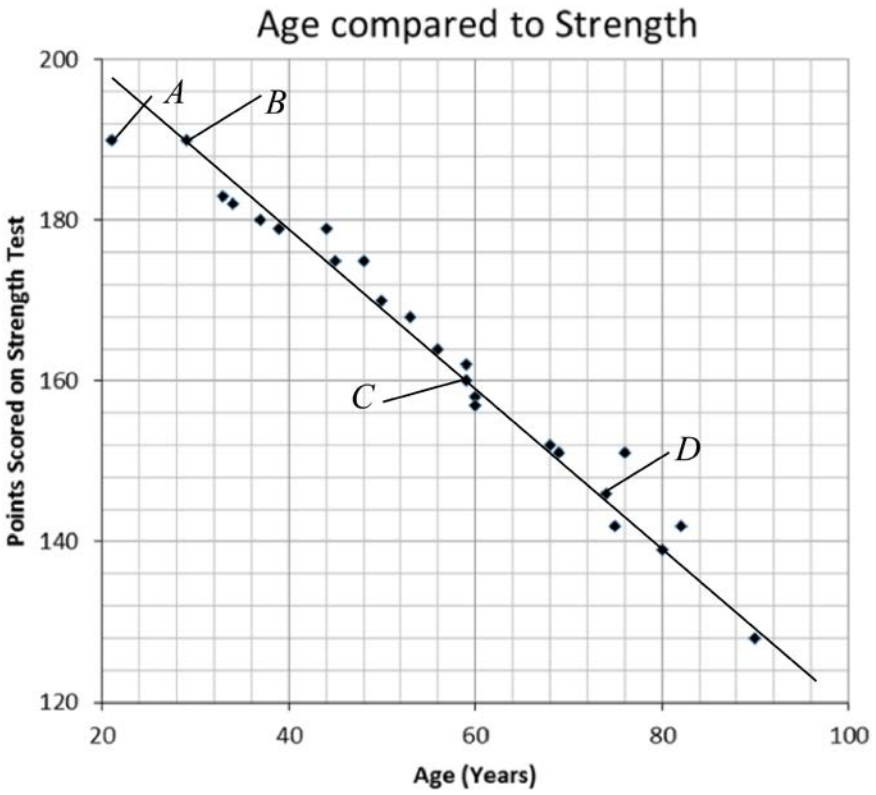
Multiple Choice
Section

ANSWERS

Question	Working	**Answer**
1.	The lowest was at Zeeland in 1985 and it was 1.8^{o} C	**B**
2.	Lowest is 2.5 and highest is 3.3 Difference is 0.8^{o} C.	**B**
3.	Despite a couple of decreases, there is a pattern of increasing temperatures in both towns, so both could be used.	**A**
4.	The points approximate a curve, not a line so it is a strong non-linear relationship.	**A**
5.	5 are to the left of 140 on the horizontal axis	**D**
6.	2 are on 50 cm and 4 are more, so 6 are 50 cm or more.	**C**
7.	The points approximate a straight line and it has a positive gradient, so it is a strong positive linear relationship.	**C**
8.	The highest is 3 divisions above 140, each division is 4 points, so score is 140 + 12 = 152	**D**
9.	The points approximate a straight line and it has a negative gradient, so it is a strong negative linear relationship.	**B**
10.	A. Person *A* (21 yrs) is older than person *B (29 yrs)*. False B. Person *C* is (59 Years) not 56 years old. False C. Person *D* scored 146 points on the strength test. True D. Person *D* (146 Pts) scored more pts than person *B* (190 Pts). False	**C**

11.	 Point A is not on the line of best fit.	**A**
12.	The points approximate a straight line and it has a negative gradient, but they are quite widely distributed, so it is a weak negative linear relationship.	**D**
13.	$\text{Percentage} = \frac{7}{20} \times 100 = 35\%$	**C**
14.	(34, 40) and (3, 120) are outliers.	**B**
15.	$\text{Gradient} = \frac{187 - 27}{40 - 0} = \frac{160}{40} = 4$	**D**
16.	Gradient = 4 from above. y intercept = 27 Equation is $y = 4x + 27$ Inserting the appropriate pronumerals $N = 4D + 27$	**A**

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Multiple Choice Answer Sheet

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Name _____

Completely fill the response oval representing the most correct answer.

1.	A ○	B ●	C ○	D ○
2.	A ○	B ●	C ○	D ○
3.	A ●	B ○	C ○	D ○
4.	A ●	B ○	C ○	D ○
5.	A ○	B ○	C ○	D ●
6.	A ○	B ○	C ●	D ○
7.	A ○	B ○	C ●	D ○
8.	A ○	B ○	C ○	D ●
9.	A ○	B ●	C ○	D ○
10.	A ○	B ○	C ●	D ○
11.	A ●	B ○	C ○	D ○
12.	A ○	B ○	C ○	D ●
13.	A ○	B ○	C ●	D ○
14.	A ○	B ●	C ○	D ○
15.	A ○	B ○	C ○	D ●
16.	A ●	B ○	C ○	D ○

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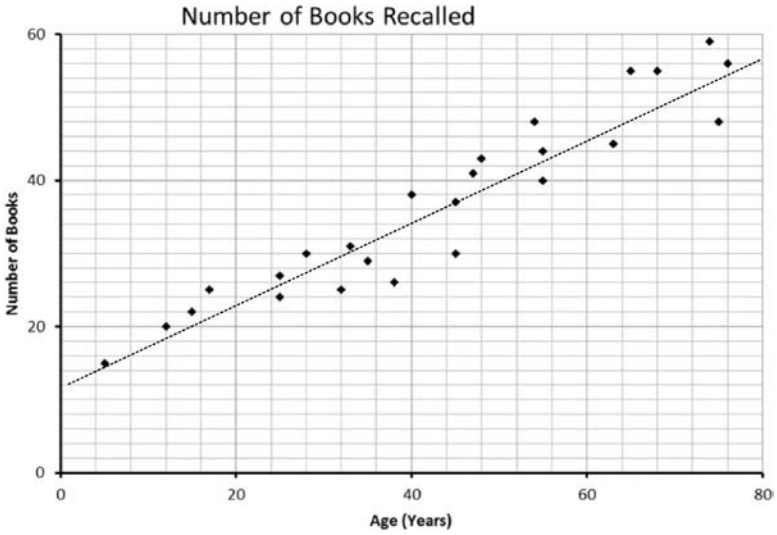
Calculator Allowed
Longer Answer Section

ANSWERS

Question		Working and Answer	Marks
1.	(a)	Using the unbroken line, the highest value is **40º C.**	**1 mark**
	(b)	Difference = 12 – 4 = **8º C.**	**1 mark**
	(c)	Increases are between 4:00 AM and 3:00PM. The greatest is 5º C between **8:00AM and 9:00 AM.**	**1 mark**
	(d)	The smallest difference is when the two graphs draw closest together in a vertical direction. This occurs at **2:00 PM** and the difference is **6º C.**	**1 mark for the time** **1 mark for the difference**
2.	(a)	Either of the following or similar: **As age increased, the number of books recalled also increased.** **It is a moderately strong positive linear relationship.**	**1 mark**
	(b)	There are 10 out of 25 $\text{Percentage} = \frac{10}{25} \times 100$ $= \mathbf{40\%}$	**1 mark**

Question	Working and Answer	Marks
(c)	Any line such as the one shown below, which has a roughly even number of points above and below and slopes with the data set.  	**2 marks for accurately drawn line with basically correct slope and position.** **1 mark for line which has obviously wrong slope or is in a position which does not evenly approximate the data.**
(d)	Gradient $= \frac{10}{20} = \frac{1}{2} = 0.5$ y intercept $= 14$ Equation $y = \frac{1}{2x} + 14$ Using a for age and n for number of books $n = \frac{1}{2}a + 14$	**2 marks for correct equation with correct gradient and intercept from line drawn in c).** **1 mark for equation with only one of gradient or intercept correct**
(e)	For a 120 year old, the equation would give $n = \frac{1}{2} \times 120 + 14$ $= 74$ books A 120 year old may recall 74 books but there are many other factors that could effect the result such as memory loss.	**1 mark for 74 books or correct answer found from incorrect equation in d)** **1 mark for reasonable explanation**