

High School Mathematics Test 2015

Year 10

Bivariate Data

Non Calculator

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)

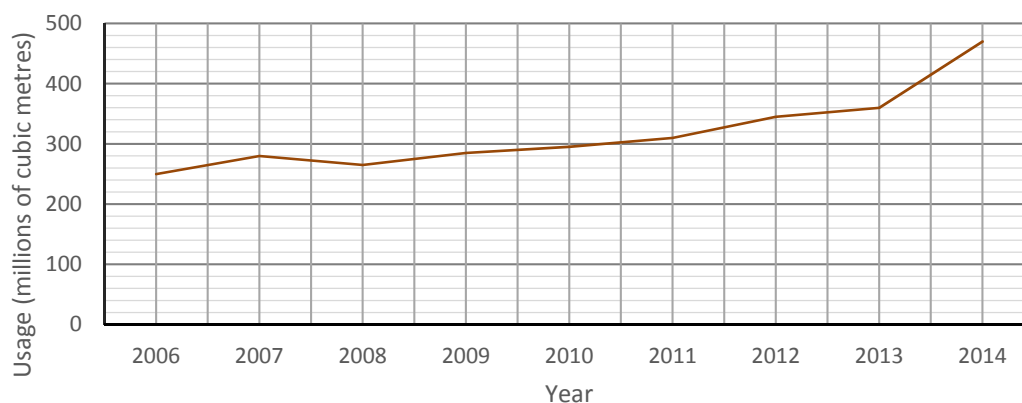
Name _____

Section 1 Short Answer Section

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

Questions 1 – 3 refer to the line graph below.

Natural Gas Consumption in Mayborough



1. What was the consumption in 2013?

.....

2. Which year had a decrease compared to the previous year?

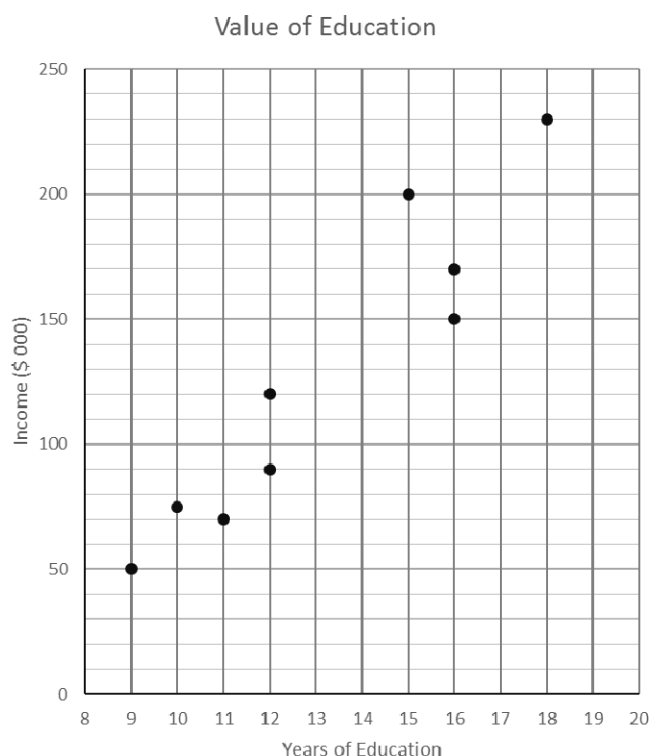
.....

3. What was the average annual increase between 2006 and 2014?

.....

Questions 4 – 7 refer to the table and graph below.

Years of Education	Income (\$,000)
10	75
16	170
12	90
18	230
11	70
9	50
12	120
15	200
16	150
14	170
18	220
19	160
10	70
11	90
17	160
13	130



Lewis conducted a survey on people's education and income and recorded the results in the table. The first nine data pairs (shaded) have been drawn onto the scatter plot.

4. Plot the remaining seven data pairs on the scatter plot.

5. How many people in the survey had less than 13 years of education?

.....

6. Describe the relationship between the two variables.

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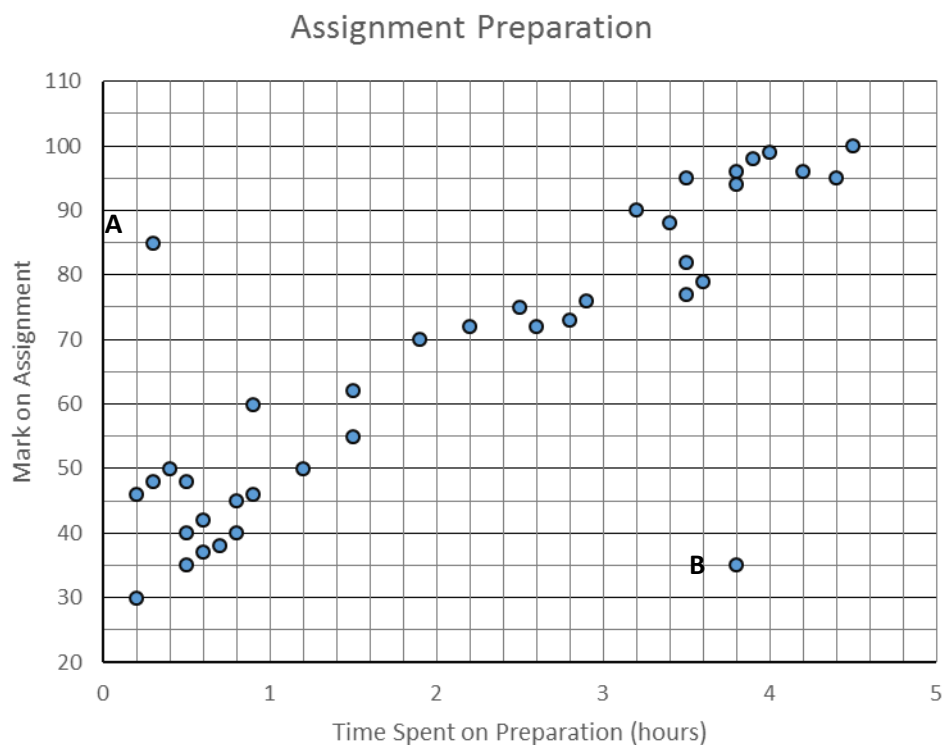
7. What percentage of those surveyed had an income over \$100 000?

.....

.....

Questions 8 – 11 refer to the following.

Ethan surveyed students on the number of hours they spent in preparing an assignment for submission and the mark they received for the assignment and plotted the results on the scatter plot.



8. What was the highest mark recorded in the survey?

.....

9. How many students spent less than an hour in preparation?

.....

10. How are the two points labelled **A** and **B** different from the other points?

.....

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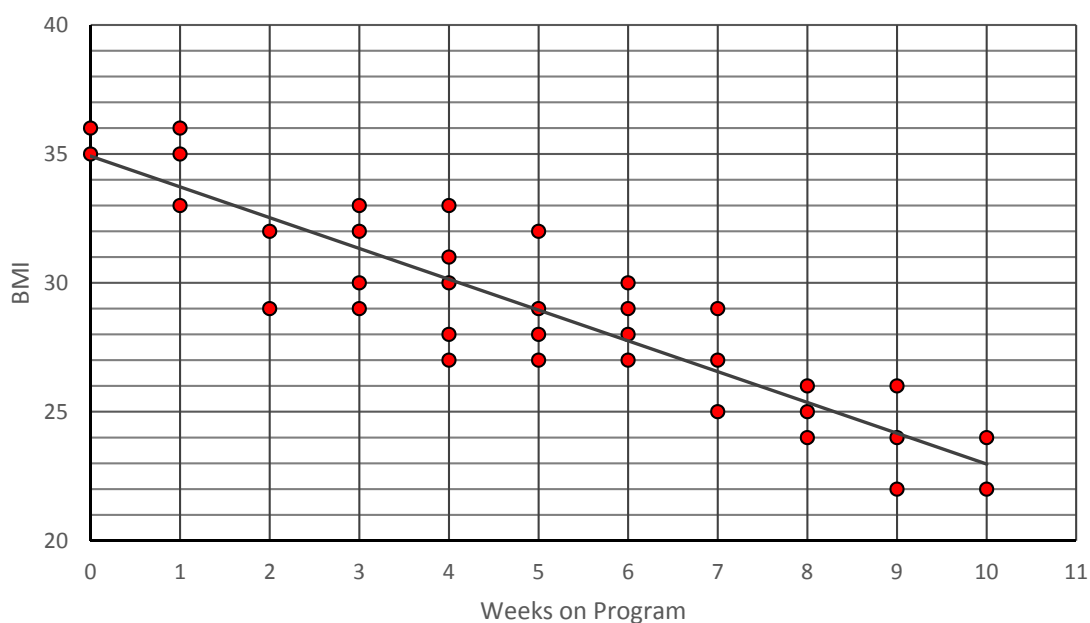
11. Describe the apparent relationship between amount of preparation and the mark received.

.....

.....

Questions 12 – 15 refer to the following.

10 Week Fitness Challenge program



The scatterplot above was used to evaluate the effectiveness of the 10 week fitness challenge for people who were classified as obese based on their BMI at the start of the program.

12. What type of relationship is indicated by the points on the scatterplot?

.....
.....

13. A line of best fit has been drawn on the scatterplot.
What is the gradient of the line?

.....
.....

14. What is the equation of the line of best fit?

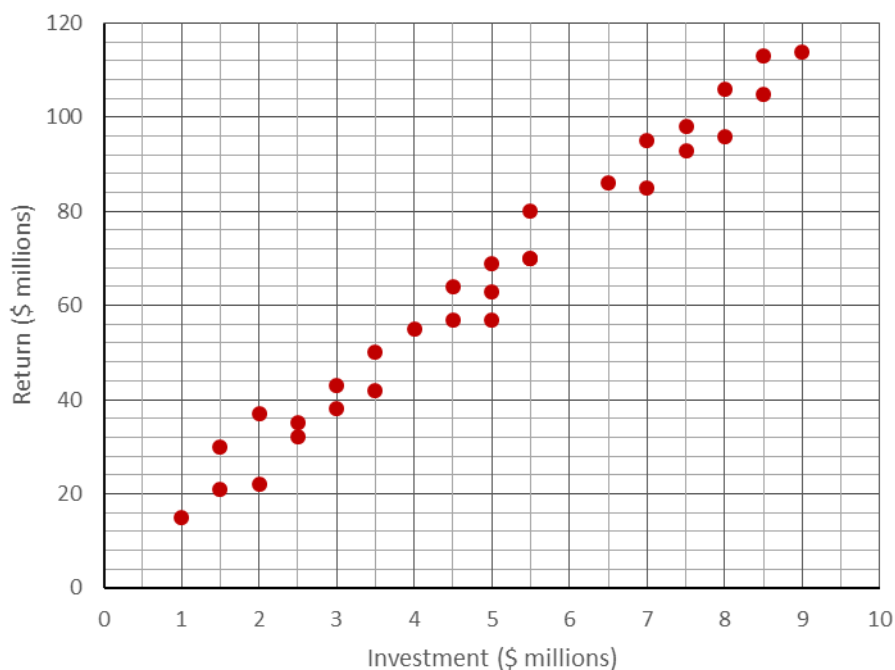
.....
.....

15. Based on the equation of the line of best fit, what BMI would be achieved if the program were extended to 15 weeks?

.....
.....

Questions 16 – 18 refer to the following.

Returns on Investments by Companies



Duane researched the investments by companies and the return, by way of increased profits. The results are shown on the scatter plot above.

16. Draw a line of best fit on the scatterplot.

17. Of the companies who invested more than \$6 million, what percentage had a return of more than \$100 million?

.....
.....

18. What is the equation of the line of best fit?

.....
.....

High School Mathematics Test 2015

Year
10

Bivariate Data

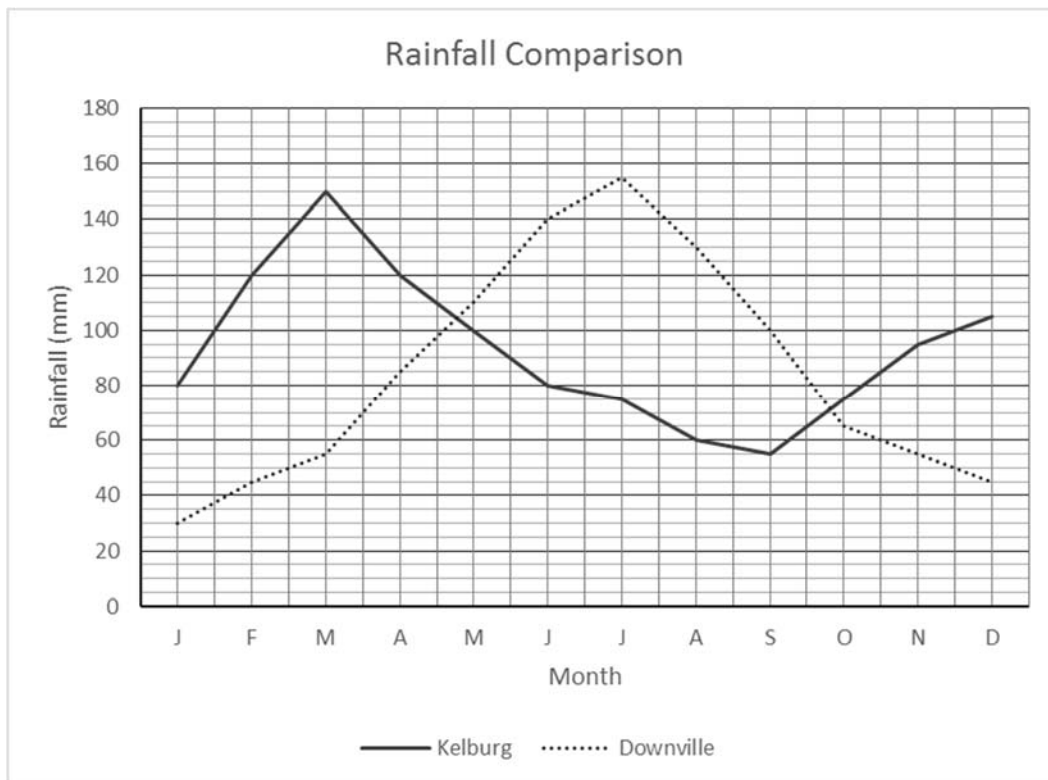
Calculator Allowed

Name _____

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.



Hillary went on the internet and found the annual rainfall records for two towns in different parts of the country and graphed the results.

1. One of the towns had rainfall of 80 mm in two different months.
How many months apart were these two recordings?
A. 5 months B. 6 months C. 10 months D. 12 months
2. What was the total rainfall in Kelburg in the winter months of June, July and August?
A. 140 mm B. 215 mm C. 255 mm D. 425 mm

3.

A Mediterranean climate has dry summers and wet winters.

A tropical climate has wet summers and dry winters.

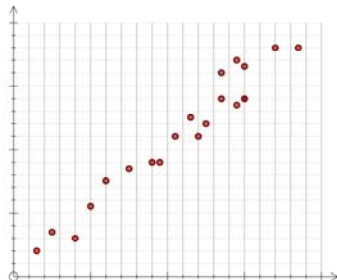
Which statement could be correct?

- A. Both towns have a Mediterranean climate.
- B. Both towns have a tropical climate.
- C. Downville has a Mediterranean climate and Kelburg has a tropical climate.
- D. Kelburg has a Mediterranean climate and Downville has a tropical climate.

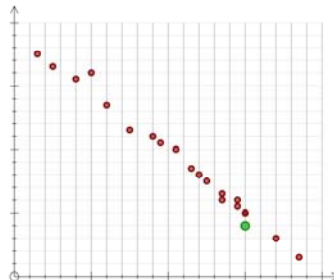
4.

Which scatter graph would indicate there is no relationship between the two variables?

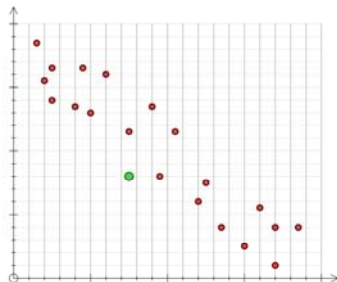
A.



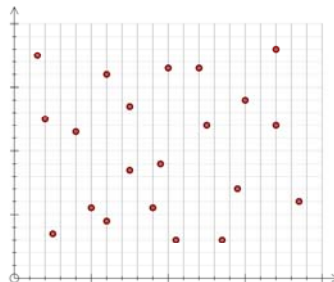
B.



C.

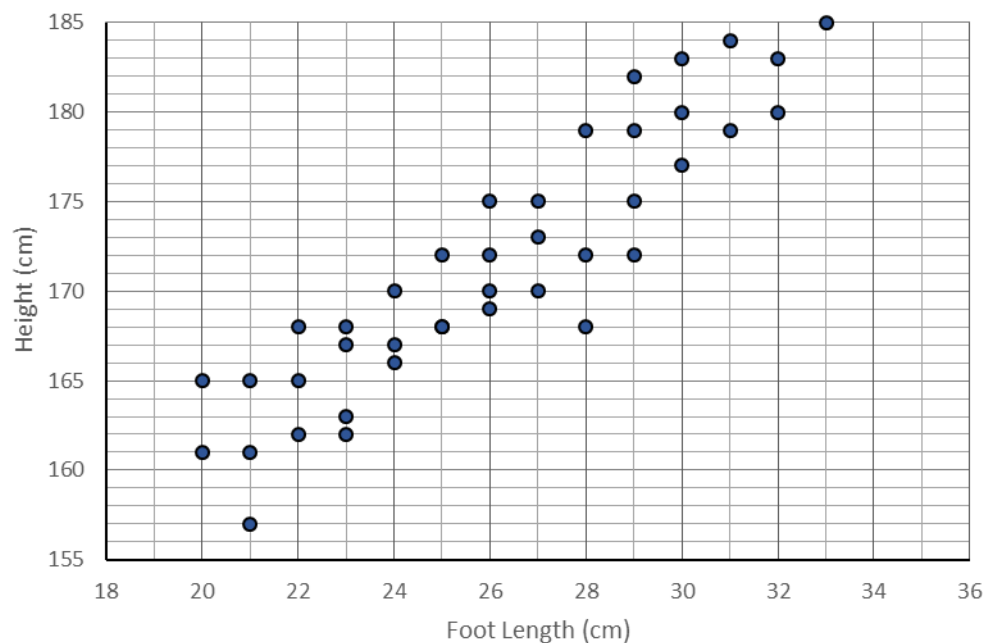


D.



Questions 5 – 7 refer to the following.

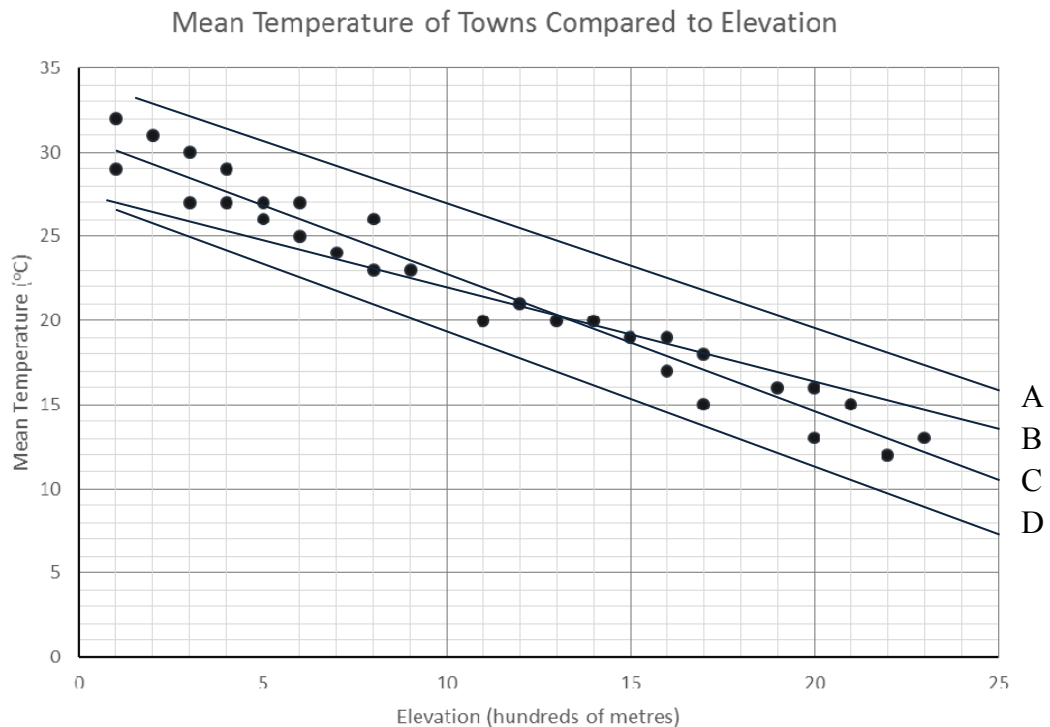
Comparison of Body Measurements



Students collected body measurements from 40 subjects as part of an assessment task, and used them to draw this scatter plot.

5. How many of the subjects had a height of 172 cm?
- A. 3 B. 4 C. 5 D. 6
6. How many of the subjects had a foot length which was 25 cm or less?
- A. 14 B. 15 C. 16 D. 17
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



Lucy while travelling recorded the mean temperature of the towns she visited and the elevation above sea level of the town and graphed the results.

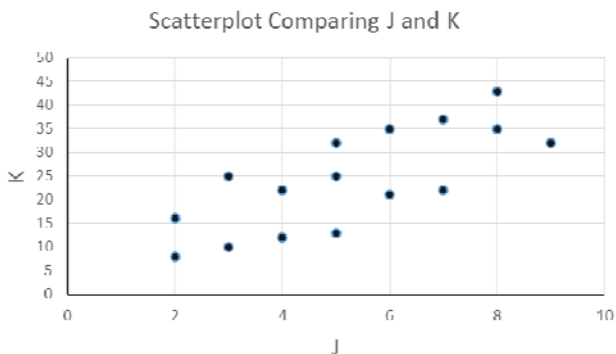
8. What was the highest mean temperature of a town which had an elevation above 1000 metres?
 - A. 18°C
 - B. 19°C
 - C. 20°C
 - D. 21°C
9. What type of relationship is evident between elevation and temperature?
 - A. A strong negative linear relationship.
 - B. A weak negative linear relationship.
 - C. A strong positive linear relationship.
 - D. A weak positive linear relationship.
10. What percentage of the towns had a mean temperature of 25°C or higher?
 - A. 12%
 - B. 40%
 - C. 45%
 - D. 48%

11. Four lines are drawn on the dot plot. Which of the lines is the line of best fit?

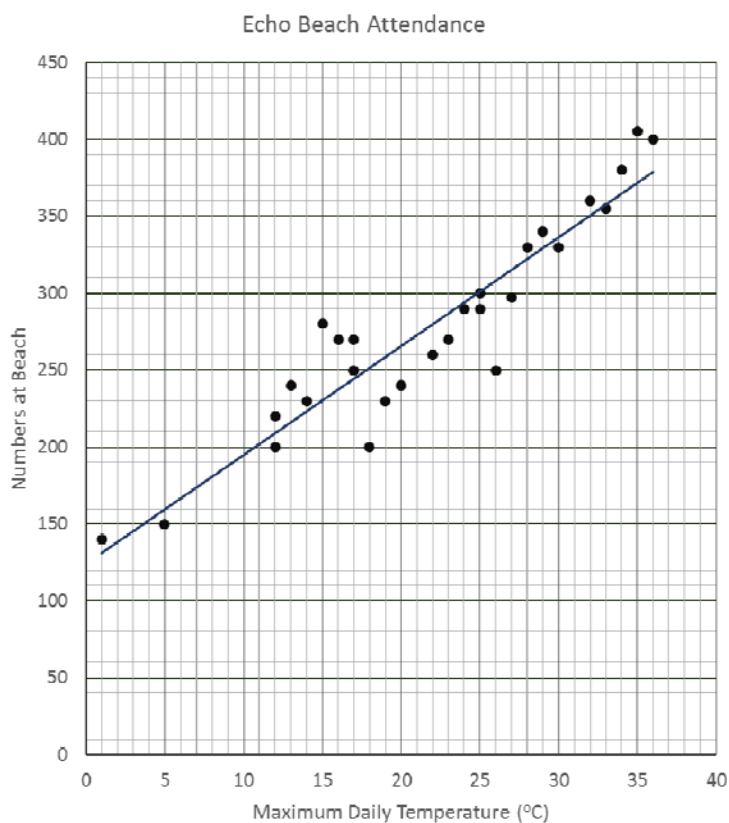
A. Line A B. Line B C. Line C D. Line D

12. What type of relationship between J and K is shown 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



The lifeguard at Echo Beach recorded the temperature and the attendance on a random sample of 30 days over a year and graphed the results.

13.	What fraction of the days had a temperature of less than 10°C ? A. $\frac{1}{15}$ B. $\frac{1}{12}$ C. $\frac{1}{10}$ D. $\frac{1}{9}$
14.	A line of best fit is drawn on the graph. What is the gradient of the line (to the nearest whole number)? A. -7 B. -6 C. 6 D. 7
15.	Using T for the temperature and N for the number of people, what is the equation of the line of best fit? A. $N = -7T + 123$ B. $N = 6T + 123$ C. $N = 7T + 123$ D. $N = 7T + 133$
16.	Use the equation of the line of best fit to determine the numbers at the beach when the temperature is 8°C ? (Answer to the nearest 10 people) A. 180 B. 190 C. 200 D. 210

High School Mathematics Test 2015

Year 10

Bivariate Data

Calculator Allowed

Name _____

Section 3

Longer Answer Section

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

Marks

1.

The graph below shows the changes in the average price of a house and of a unit in the suburb of Bellavista.



(a) What was the highest average price for a unit in Bellavista?

1

.....

(b) In what year was the average price of a unit \$290 000?

1

.....

(c) Between which two years was the greatest increase in the price of a house?

1

.....

Marks

- (d) What was the smallest difference between the average price of a house and a unit in any one year?

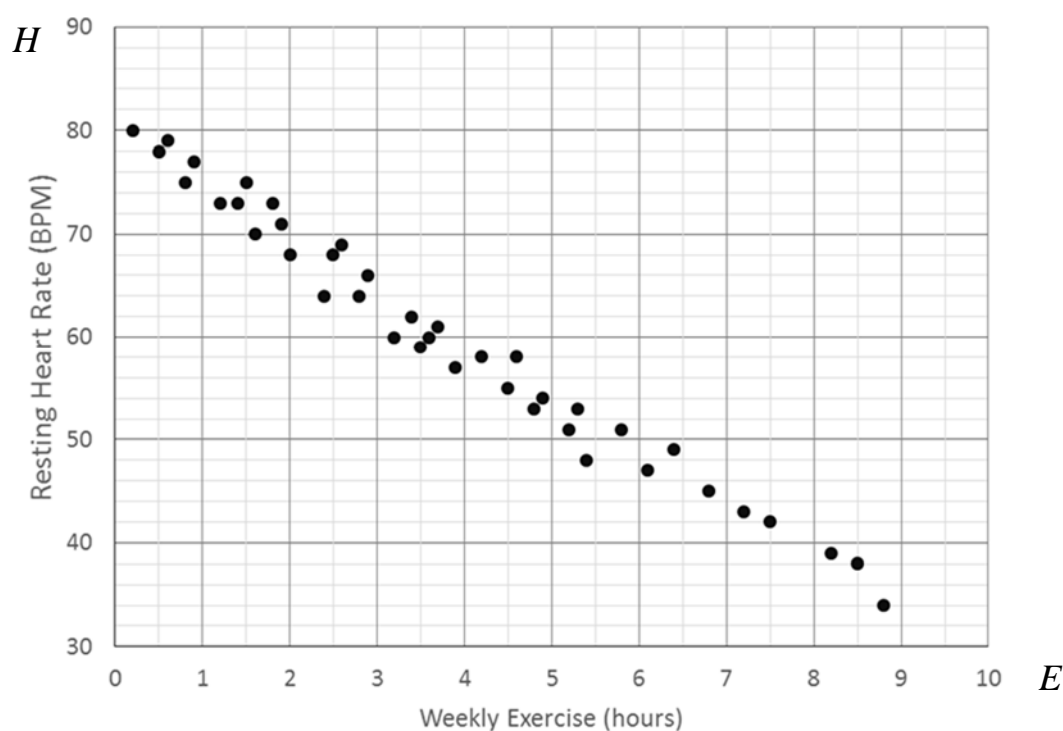
1

.....

.....

2. A gym records the number of hours exercise (E) that its members completed compared with their resting heart rate (H).

Benefits of Exercise



- (a) Describe the relationship between E and H .

1

.....

.....

- (b) What fraction of the members exercised more than 6 hours per week?

1

.....

.....

Marks

(c) Draw a line of best fit on the graph. **1**

(d) What is the gradient of the line of best fit? **1**

.....

.....

(e) What is the equation of the line of best fit? **1**

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.....

(f) Could the equation be used to find an estimate of the heart rate for someone who exercised for 20 hours per week? (explain your answer) **1**

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High School Mathematics Test 2015

Multiple Choice Answer Sheet

Bivariate Data

Name _____

Completely fill the response oval representing the most correct answer.

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|-----|---|-----------------------|---|-----------------------|---|-----------------------|---|-----------------------|
| 1. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
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High School Mathematics Test 2015

Year 10

Bivariate Data

Non Calculator

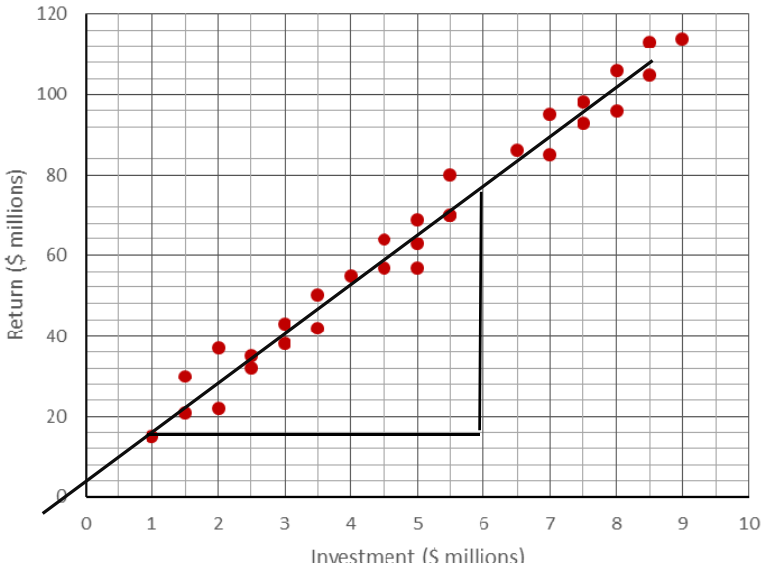
Section 1 Short Answer Section

ANSWERS

ALLOW SOME FLEXIBILITY IN ANSWERS WHEN READING FROM
GRAPHS.

No.	WORKING	ANSWER
1.	Reading from graph, in 2013, consumption is 360	360 million
2.	2008 (265) was less than 2007 (285)	2008
3.	In 2014 the consumption was 470 compared to 250 in 2006, an increase of 220 in 8 years. Average annual increase = $220 \div 8 = 27.5$ million cubic metres.	27.5 million m ³ or 27 500 000 m ³

4.	<p style="text-align: center;">Value of Education</p> <p style="text-align: center;">Income (\$ 000)</p> <p style="text-align: center;">Years of Education</p>	1 mark if majority of points plotted correctly.
5.	There 7	7
6.	There is strong positive relationship between the two variables. As one increases so does the other.	1 mark for mention of positive relationship or other words describing this.
7.	There are 10 over 100 000 out of 16 altogether. Percentage = $\frac{10}{16} \times 100 = 62.5\%$	62.5%
8.	Reading graph – 100	100
9.	Counting there are 15	15
10.	<p>Examples of answers</p> <p>A has a low preparation and high mark and B has a high preparation and low mark. They are separate from the grouping of the others along the diagonal. They are outliers from the rest of the data.</p>	Any description that indicates they are not following the trend line.
11.	As the amount of preparation increases, so does the mark received. It is a strong positive linear relationship.	Any description that indicates a strong positive linear relationship.

12.	The longer a person is on the program the lower their BMI becomes. It is a strong negative linear relationship.	Any description that indicates a strong negative linear relationship.
13.	Over 10 weeks the line goes from a BMI of 35, down to a BMI of 23, a drop of 12. $\text{Gradient} = -\frac{12}{10} = -1.2$	-1.2
14.	The line crosses the axis at 35, so using $y = mx + b$ and using B for vertical axis and W for horizontal axis, $B = -1.2W + 35$	$y = -1.2x + 35$ $B = -1.2W + 35$
15.	$B = -1.2W + 35$ and $W = 15$ $B = -1.2 \times 15 + 35$ $= -18 + 35$ $= 17$	17
16.	<p>Returns on Investments by Companies</p> 	1 mark for any line which approximates the centre of the grouping of dots.
17.	There are 10 more than \$6 million investment. Of these there are 4 which had return over \$100 million Thus there are 40%	40%
18.	$\text{Gradient} \approx \frac{60}{5} = 12$ $\text{Intercept} \approx 5$ $y = 12x + 5$ or $R = 12I + 5$	$y = 12x + 5$ or $R = 12I + 5$

High School Mathematics Test 2015

Year 10

Bivariate Data

Calculator Allowed

Section 2 Multiple Choice Section

ANSWERS

No.	WORKING	ANSWER
1.	It was in Kelburg in Jan and June which is 5 months apart.	A
2.	In Kelburg in winter the rainfall was $80+75+60=215$ mm	B
3.	Downville is wet in winter and drier in summer (Mediterranean) and Kelburg is wet in summer and drier in winter (tropical).	C
4.	The diagram where the dots tend not to make a pattern, which is the last one.	D
5.	Two lines above the 170 line which has 4 dots.	B
6.	2 had 25, 3 had 24, 4 had 23, 3 had 22, 3 had 21 and 2 had 20. $2+3+4+3+3+2=17$	D
7.	There is a strong positive linear relationship as the points are fairly close together and form a clear linear pattern where both variables increase together.	C
8.	At a height of 1200 metres the temperature was 21°C .	D
9.	There is a strong negative linear relationship as the points are fairly close together and form a clear linear pattern where one variable decreases as the other increases.	A
10.	There are 12 which are 25°C or higher, out of 30 altogether. Percentage = $\frac{12}{30} \times 100 = 40\%$	B
11.	Line C passes through the middle of the majority of the points.	C
12.	There is a weak positive linear relationship as the points are not that close together but still form a clear linear pattern where both variables increase together.	B
13.	2 had a temp less than 10°C out of 30, so fraction is $\frac{2}{30} = \frac{1}{15}$.	A
14.	The rise is 50, for a run of 7, so Gradient = $\frac{50}{7} = 7.142 = 7$ (nearest whole number)	D

15.	The intercept is approximately 123 Equation $y = 7x + 123$ $N = 7T + 123$	C
16.	$N = 7T + 123$ $= 7 \times 8 + 123$ $= 56 + 123$ $= 179$ $= 180$ (nearest 10)	A

High School Mathematics Test 2015

Multiple Choice Answer Sheet

Bivariate Data

Name ANSWERS

Completely fill the response oval representing the most correct answer.

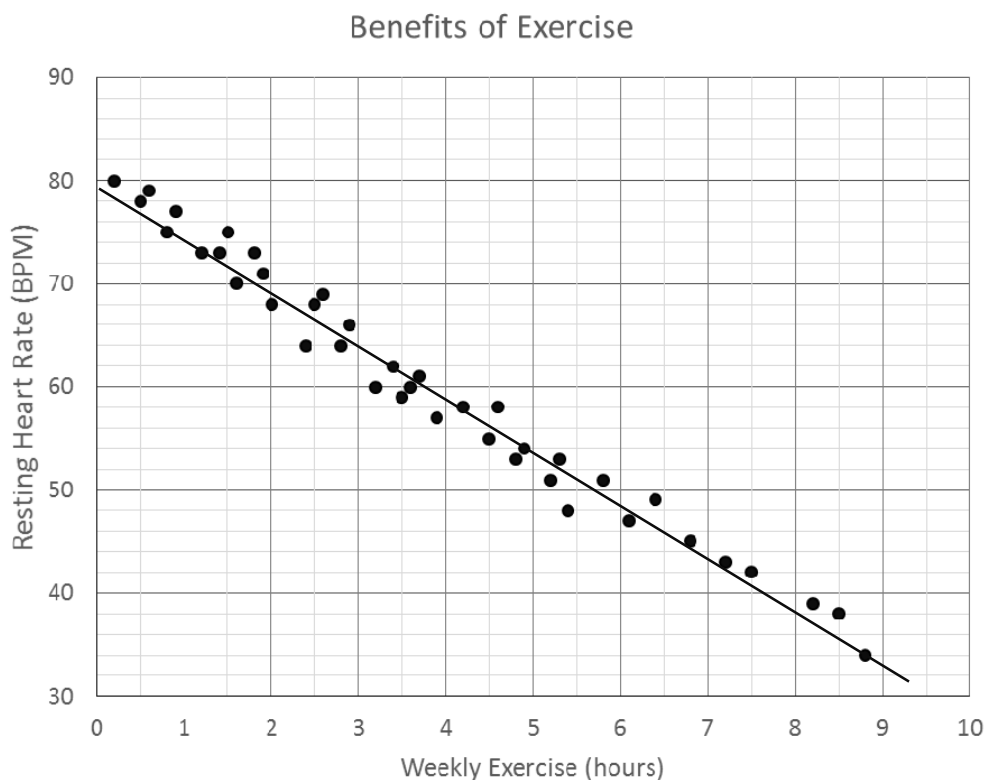
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| 10. | A | <input type="radio"/> | B | <input checked="" type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
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| 15. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input checked="" type="radio"/> | D | <input type="radio"/> |
| 16. | A | <input checked="" type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |

High School Mathematics Test 2015

Year 10	<i>Bivariate Data</i>	Calculator Allowed
Section 3 Longer Answer Section		
ANSWERS		
		Marks
1.	(a) The highest unit price was \$330 000 (in 2007).	1
	(b) It was in 2003.	1
	(c) It was between 2013 and 2014 (\$40 000)	1
	(d) The smallest difference was \$50 000 (in 2008)	1
2.	(a) It is a strong negative linear relationship.	1
	(b) There were 8 out of 40. Fraction = $\frac{8}{40} = \frac{1}{5}$.	1

(c) See graph.

1



(d) Rise = -14 and run = 2.5

1

$$\text{Gradient} = -\frac{14}{2.5} = -5.6$$

As the values are read from the graph to use in finding the gradient, allow for a range of answers around -5.6.

(e) The intercept is about 79 (accept 78 or 80)
Equation $H = -5.6E + 79$

Allow for a range of answers.

1

(f) If we try to use the formula for a time of 20 hours we get the following.

1

$$\begin{aligned} H &= -5.6E + 79 \\ H &= -5.6 \times 20 + 79 \\ &= -33 \end{aligned}$$

This is not possible, in fact as we get to the longer exercise times the linear graph is no longer appropriate.