School Name
Mathematics Test 2017

Year 10

Further Single Variable Analysis

Calculator Allowed

Skills and Knowledge Assessed:

- Determine quartiles and interquartile range (ACMSP248)
- Construct and interpret box plots and use them to compare data sets (ACMSP249)
- Compare shapes of box plots to corresponding histograms and dot plots (ACMSP250)
- Evaluate statistical reports in the media and other places by linking claims to displays, statistics and representative data (ACMSP253)
- 10A Calculate and interpret the mean and standard deviation of data and use these to compare data sets (ACMSP278)

Name_____

Section 1 Short Answer Section

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

1.	What is the range of these scores? 15, 12, 28, 22, 35, 42, 50, 65 ……
2.	Find the median of these scores. 2, 8, 15, 7, 6, 14, 7, 12, 20, 5, 9 ……
	Questions 3 – 5 refer to the following: Joey counted the number of kangaroos in the top paddock each day for ten days. The results were: 12, 25, 3, 15, 32, 24, 14, 8, 22, 16.
3.	What is the median number of kangaroos? ……
4.	What is the upper quartile of the data? ……
5.	What is the interquartile range of the data? ……... ……

6. Find the lower quartile of the following scores:

10, 11, 12, 12, 14, 16, 18, 20, 25, 29, 9, 30, 8, 26

……....

…….

Questions 7 – 10 refer to the stem and leaf plot below.

Stem	Leaves					
0	2	6	7	8	9	9
1	0	1	2	4	8	
2	2	5	7	8		
3	0	6				
4	2	5				
5	2					

The stem and leaf plot gives the number of walkers passing a checkpoint each minute during a twenty-minute period of a race.

7. What is the median of the data?

……....

…….

8. What term describes the shape of this distribution?

……....

…….

9. What is the upper quartile of the data?

……....

…….

10. What is the interquartile range of the data?

……....

…….

Questions 11 – 15 refer to the frequency distribution table below.

Number of Days (x)	Frequency (f)	Cumulative Frequency
3	4	4
4	7	11
5	9	20
6	11	31
7	8	39
8	3	42

The table shows the number of days that different advertisements continued to appear on a website.

11. What is the median number of days?

……....

…….

12. What is the upper quartile of the data?

……....

…….

13. What is the interquartile range?

……....

…….

14. What is the mean of the data?

……....

…….

15. What is the standard deviation of the data?

……....

…….

Questions 16 – 17 refer to the following:
Some statistical measures are listed below for a set of data.

Mean	21	Median	20
Highest score	30	Mode	22
Lowest Score	8	Range	22
Upper quartile	24	Lower quartile	12

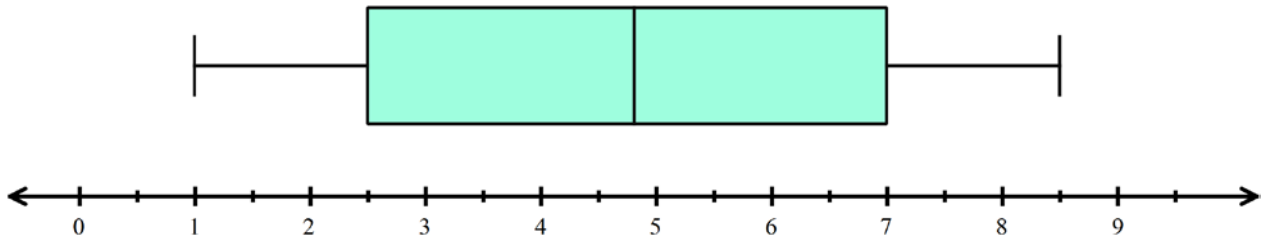
16. Write a five-number summary for the data.

……

17. What is the interquartile range of the data?

……

Questions 18 – 20 refer to the box plot below.



18. What is the range of the scores in the box plot?

……

19. What is the interquartile range of the scores in the box plot?

……....

……

20. What term describes the shape of this distribution?

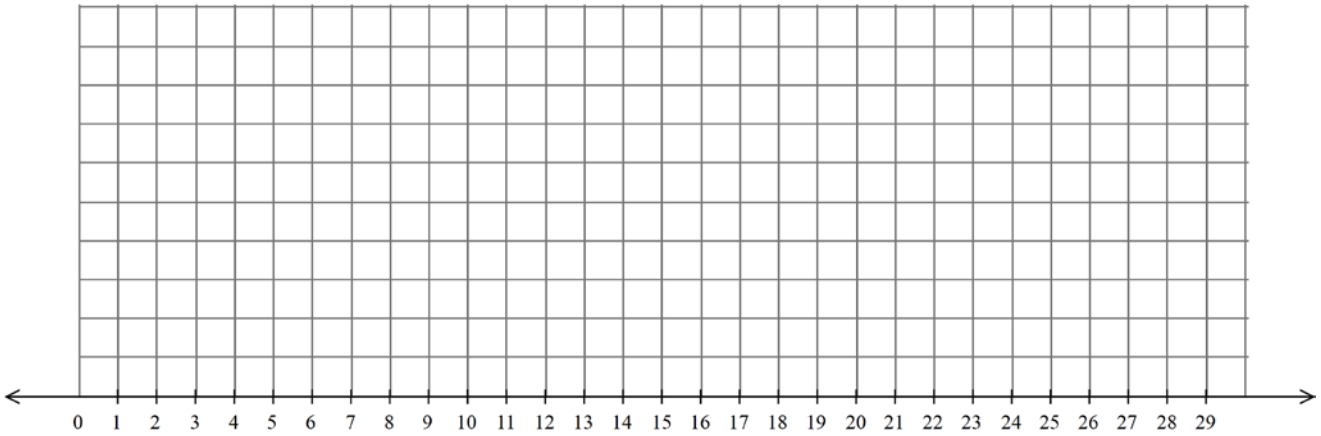
……....

……

Questions 21 – 24 refer to the five-number summary below.

4, 14, 21, 24, 26

21. Draw a box plot for the set of data.



22. **What percentage of the scores lie between 21 and 24?**

……....

……

23. What is the interquartile range of the data?

……....

……

24. What term describes the shape of this distribution?

……....

……

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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.

1. **What is the median of the scores below?**
   5, 2, 8, 6, 7, 5, 7, 9, 6

   A. 5 **B. 6** **C. 6.5** **D. 7**

2. **What is the lower quartile for the set of data below?**
   1.5, 1.7, 1.9, 2.1, 2.3, 2.4, 2.4, 2.7, 3.0

   A. 1.6 **B. 1.7** **C. 1.75** **D. 1.8**

Questions 3 and 4 refer to the following table.
The table below gives the scores by 7 competitors on two events.

Name	Round 1	Round 2
Joe	15	17
Frank	16	15
Matty	18	16
Kevin	19	19
Liam	19	21
Callum	20	20
Kynan	22	22

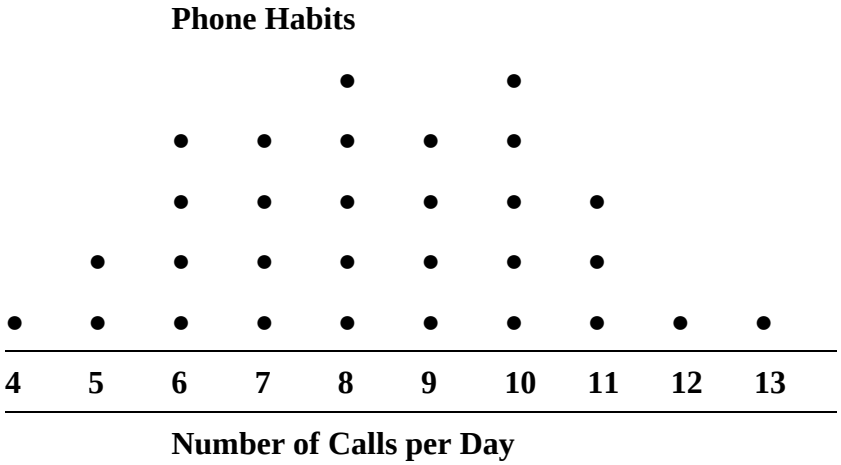
3. **What is the upper quartile of the scores on Round 1?**

   A. 19 **B. 19.5** **C. 20** **D. 21**

4. **Which player's score was on the upper quartile on round 2?**

   A. Callum **B. Kevin** **C. Kynan** **D. Liam**

Questions 5 – 7 refer to the following dot plot.



Tessa recorded the number of calls that she made each day for the month of April.

5. **Which term could be correctly applied to this distribution?**

   A. Bi-modal
   B. Negatively skewed
   C. Positively skewed
   D. Symmetrical

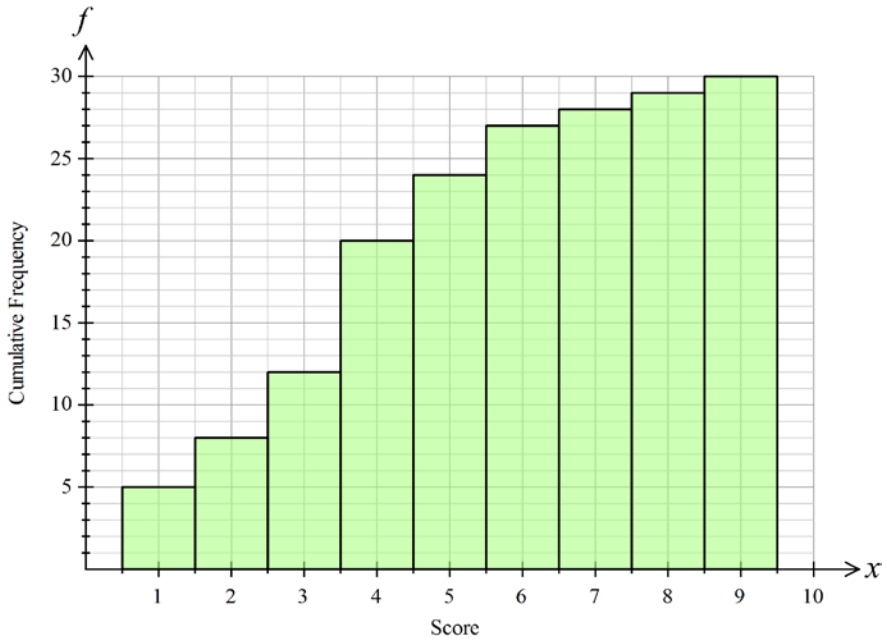
6. **What is the upper quartile for the set of data?**

   A. 8 **B. 9** **C. 9.5** **D. 10**

7. **What is the interquartile range for the data?**

   A. 2 **B. 2.5** **C. 3** **D. 3.5**

Questions 8 – 10 refer to the following cumulative frequency histogram.



The cumulative frequency histogram is drawn to illustrate the scores by 30 participants in a contest.

8. **What is the median score?**

A. 3 **B. 4** **C. 5** **D. 6**

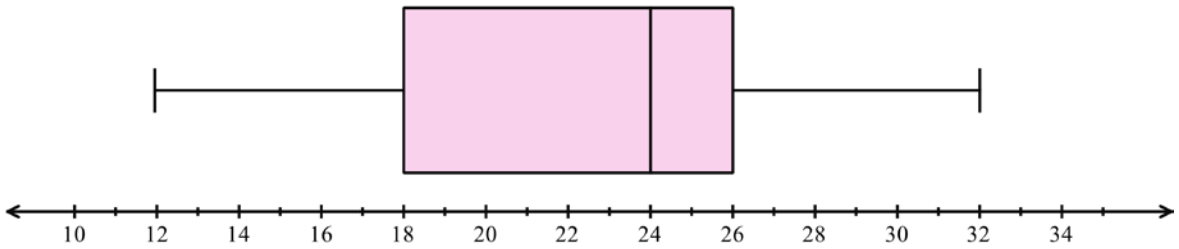
9. **What is the upper quartile?**

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

10. **What is the interquartile range?**

A. 3 **B. 4** **C. 5** **D. 6**

Questions 11 – 14 refer to the following box plot.



The box plot summarises the scores by 60 competitors in an archery competition where the maximum possible score was 40.

11. **What was the lowest score by any competitor?**

A. 12 B. 18 C. 24 D. 26

12. **What is the lower quartile?**

A. 12 B. 18 C. 24 D. 26

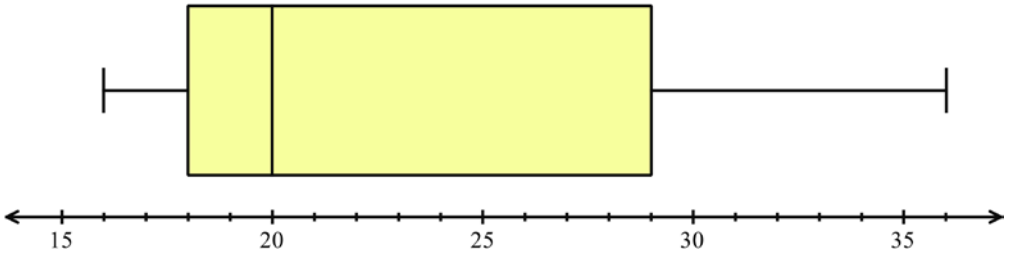
13. **What is the interquartile range?**

A. 2 B. 4 C. 6 D. 8

14. **What percentage of competitors scored between 24 and 26 inclusive?**

A. 25% B. 50% C. 75% D. 100%

Questions 15 – 17 refer to the box plot below.



The box plot summarises the number of music tracks that 60 people have on their phones.

15. **What percentage of people had 20 tracks or more on their phone?**

A. 25% **B. 50%** **C. 65%** **D. 75%**

16. **How many people had 29 tracks or less on their phone?**

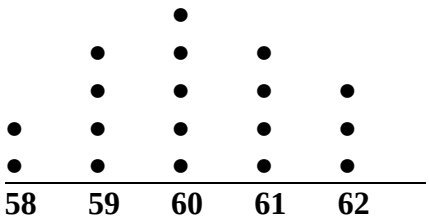
A. 25 **B. 45** **C. 50** **D. 57**

17. **Which description of the shape of the distribution can be made based on the box plot?**

A. It is a bimodal distribution.
B. It is a negatively skewed distribution.
C. It is a positively skewed distribution.
D. It is a symmetrical distribution.

Questions 18 – 20 refer to the dot plot below.

Science Marks



18. **What is the mean of the Science marks (correct to 1 decimal place)?**

A. 59.9 **B. 60.0** **C. 60.1** **D. 60.2**

19. **What is the standard deviation of the marks (correct to 2 decimal places)?**

A. 1.24 **B. 1.36** **C. 1.47** **D. 2.01**

20. **The marks on an English test have a mean of 60.2 and a standard deviation of 9.55. Which is correct?**

A. The English marks have a much higher mean than the Science marks.
B. The English marks have a much lower mean than the Science marks.
C. The English marks are much more widely spread than the Science marks.
D. The English marks are much less widely spread than the Science marks.

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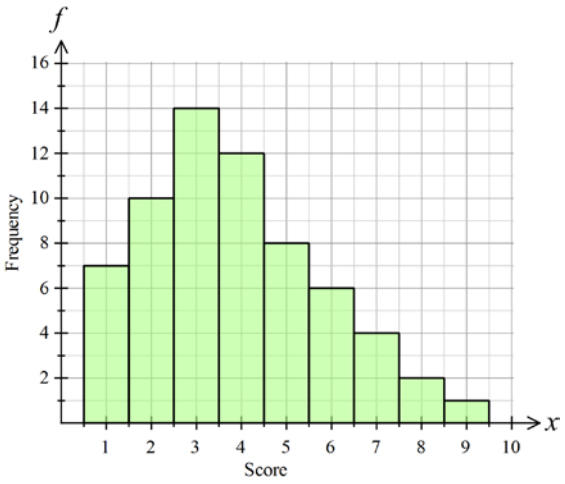
Section 3 Longer Answer Section

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

Marks

1. The frequency histogram gives the scores of 64 gymnasts on a floor routine.



Score	Frequency	Cumulative Frequency
1		
2		
3		
4		
5		
6		
7		
8		
9		

(a) Complete the frequency distribution table beside the histogram. **2**

(b) What is the median of the data? **1**

……..

(c) What is the range of the data? **1**

……..

(d) What is the lower quartile of the data? **1**

……..

(e) What is the interquartile range of the data? **1**

……..

……..

Marks

2. The stem and leaf plot below summarises the number of essays written by 19 students in Year 12.

Stem	Leaves
0	5 7 9
1	1 3 4 7
2	0 3 3 3 7
3	1 4 4 6
4	0 3 2

(a) What is the median of the data? **1**

……..

(b) What is the lower quartile of the data? **1**

……..

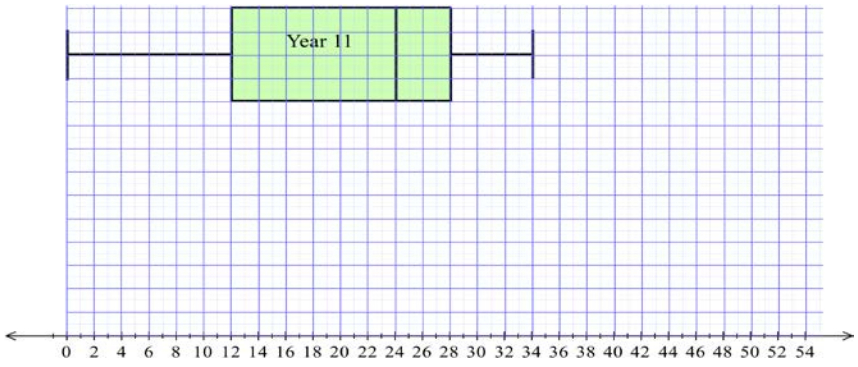
……..

(c) Find the interquartile range of the data. **2**

……..

……..

(d) A box plot showing the number of essays for 19 Year 11 students is shown below. Draw a box plot for the Year 12 data on the same grid. **2**

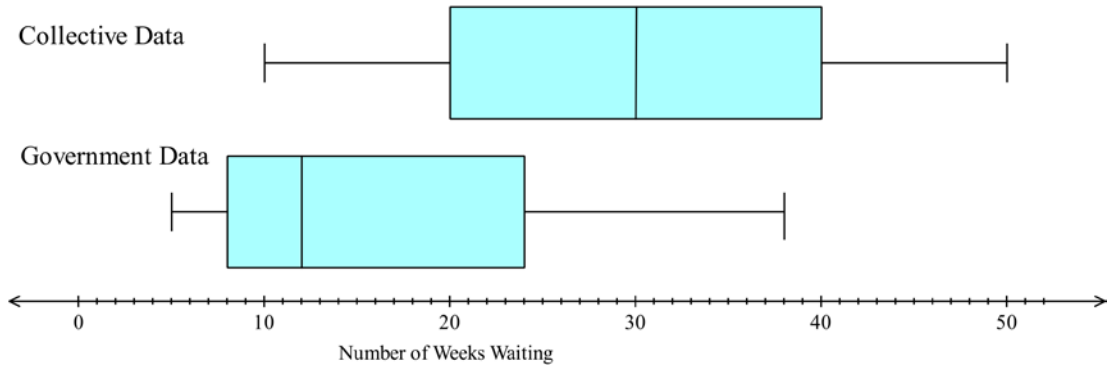


(e) Use the box plots to compare the distribution of essays for Year 11 with those of Year 12. **2**

……..

……..

3. A government department collects data on the number weeks that people spend waiting for rental accommodation.
A housing collective also collects comparable data.
The two sets of data are shown on the parallel box plots below.



(a) Compare the median values from the two sets of data. **2**

……..

……..

(b) Compare the spread of the two sets of data, using at least two different measures. **2**

……..

……..

(c) Compare the shape of the distributions of the two sets of data. **2**

……..

……..

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Multiple Choice Answer Sheet

Further Single Variable Analysis

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 ⬭
17. A ⬭ B ⬭ C ⬭ D ⬭
18. A ⬭ B ⬭ C ⬭ D ⬭
19. A ⬭ B ⬭ C ⬭ D ⬭
20. A ⬭ B ⬭ C ⬭ D ⬭

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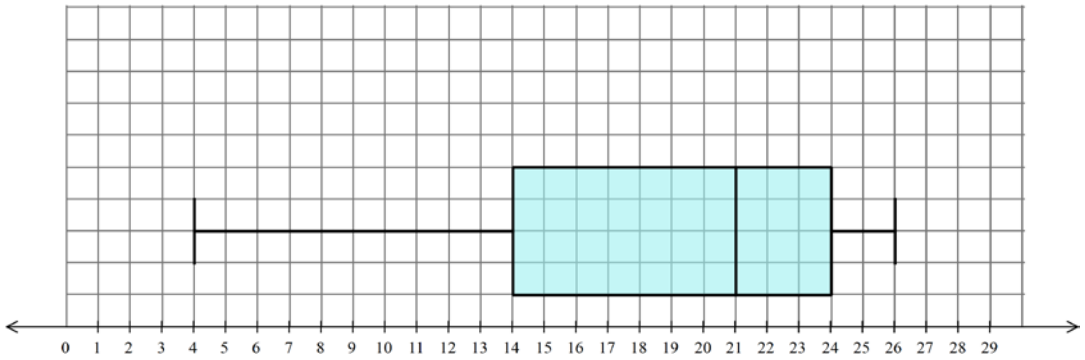
Short Answer Section

ANSWERS

Question	Working and Answer
1.	15, 12, 28, 22, 35, 42, 50, 65 **Range = 65 – 12 = 53**
2.	Scores in order are: 2, 5, 6, 7, 7, 8, 9 12, 14, 15, 20, Middle score from 11 is the 6th which is **8**.
3.	Scores in order are: **3, 8, 12, 14, 15, 16, 22, 24, 25, 32.** **Median from 10 is between the 5th and 6th scores, so between 15 and 16 which is 15.5.**
4.	**Upper quartile is middle of upper 5 scores, so 8th score which is 24.**
5.	**Lower quartile is middle of lower 5 scores, so 3th score which is 12** **Interquartile range = 24 – 12 = 12.**
6.	**Scores are in order** 8, 9, 10, 11, 12, 12, 14, 16, 18, 20, 25, 26, 29, 30 **Median of 14 scores is between 7th and 8th so between 14 and 16, so 15** **Lower quartile is middle of lower 7 scores, so 4th score which is 11.**
7.	**Stem | Leaves** **0 | 2 6 7 8 9 9** **1 | 0 1 2 4 8** **2 | 2 5 7 8** **3 | 0 6** **4 | 2 5** **5 | 2** **Median from 20 is between the 10th and 11th scores, so between 14 and 18 which is 16.**
8.	**The data is bunched at the lower values with a tail at the top so it is positively skewed.**

<table>
<tr><td>Question</td><td>Working and Answer</td></tr>
<tr><td>9.</td><td>Upper quartile is middle of upper 10 scores, so between the 15th and 16th scores, so between 28 and 30 which is 29.</td></tr>
<tr><td>10.</td><td>Lower quartile is middle of lower 10 scores, so between the 5th and 6th scores, which are both 9's so quartile is 9.
Interquartile range = 29 – 9 = 20</td></tr>
<tr><td>11.</td><td>
<table>
<tr><td>Number of Days (x)</td><td>Frequency (f)</td><td>Cumulative Frequency</td></tr>
<tr><td>3</td><td>4</td><td>4</td></tr>
<tr><td>4</td><td>7</td><td>11</td></tr>
<tr><td>5</td><td>9</td><td>20</td></tr>
<tr><td>6</td><td>11</td><td>31</td></tr>
<tr><td>7</td><td>8</td><td>39</td></tr>
<tr><td>8</td><td>3</td><td>42</td></tr>
</table>
From 42 scores median is 21st and 22nd which are both 6's so median is 6.
</td></tr>
<tr><td>12.</td><td>Upper quartile of 42 is the middle of the upper 21 scores, so 32nd score which is 7.</td></tr>
<tr><td>13.</td><td>Lower quartile of 42 is the middle of the lower 21 scores, so 11th score which is 4.
Interquartile range = 7 – 4 = 3.</td></tr>
<tr><td>14.</td><td>$\bar{x}$ = 5.5 (from SD on calculator)</td></tr>
<tr><td>15.</td><td>σ_n = 1.4 (from SD on calculator)</td></tr>
<tr><td>16.</td><td>A five number summary lists
lower extreme, lower quartile, median, upper quartile, upper extreme
or Q_0, Q_1, Q_2, Q_3, Q_4 = 8, 12, 20, 24, 30</td></tr>
<tr><td>17.</td><td>$IQR = Q_3 - Q_1 = 24 - 12 =$ 12</td></tr>
<tr><td>18.</td><td>Range = $Q_4 - Q_0 = 8.5 - 1 =$ 7.5</td></tr>
<tr><td>19.</td><td>$IQR = Q_3 - Q_1 = 7 - 2.5 =$ 4.5</td></tr>
<tr><td>20.</td><td>The data distribution is symmetrical.</td></tr>
<tr><td>21.</td><td> 
</td></tr>
</table>

Question	Working and Answer
22.	**21 is the median and 24 is the upper quartile, so between them is 25% of the scores.**
23.	$IQR = Q_3 - Q_1 = 24 - 14 = \mathbf{10}$
24.	**The scores are bunched at the top with a tail toward the bottom, so it is negatively skewed.**

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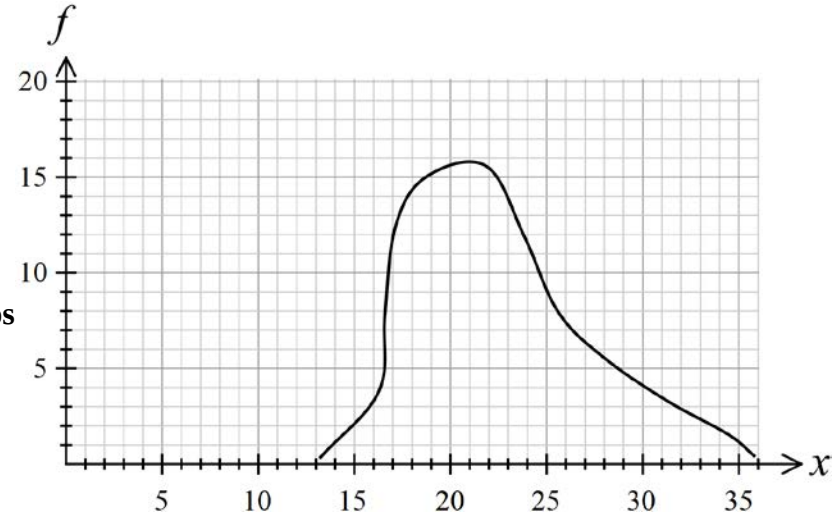
Calculator Allowed
Multiple Choice
Section

ANSWERS

Question	Working	Answer
1.	**Scores in order:** **2, 5, 5, 6, 6, 7, 7, 8, 9** Median = 6	**B**
2.	**1.5, 1.7, 1.9, 2.1, 2.3, 2.4, 2.4, 2.7, 3.0** Lower Q = average of 1.7 and 1.9 = 1.8	**D**
3.	**Round 1** **15** **16** — **Lower Q** **18** **19** — **Median** **19** **20** — **Upper Q** **22**	**C**
4.	**Name** / **Round 2** **Frank** 15 **Matty** 16 — **Lower Q** **Joe** 17 **Kevin** 19 — **Median** **Callum** 20 **Liam** 21 — **Upper Q** **Kynan** 22	**D**
5.	**Has two scores which are equally most popular, so it is Bi-modal.**	**A**
6.	**For 30 scores, median is 15th and 16th and upper Q is the 23rd score which is 10**	**D**
7.	**Lower Q = 8th score which is 7** **Interquartile range = 10 – 7 = 3**	**C**

8.	**The median from 30 is between the 15th and 16th which are both 4's, so median = 4.**	**B**
9.	**The upper quartile is the middle of the upper 15 scores, so the 23rd score which is 5.**	**D**
10.	**The lower quartile is the middle of the lower 15 scores, so the 8th score which is 2.** **Interquartile range = 5 – 2 = 3**	**A**
11.	**Lowest score = end of bottom whisker = 12**	**A**
12.	**Lower quartile = bottom of box = 18**	**B**
13.	**IQR = 26 – 18 = 8**	**D**
14.	**24 and 26 are the median and upper quartile, so the 50% and 75% marks, so 25% lie between them.**	**A**
15.	**20 is the median, so 50% had 20 or more.**	**B**
16.	**29 tracks is the upper quartile, so ¾ are less than or equal to 29.** $\frac{3}{4}$ of 60 = 45 people	**B**
17.	**The lower extreme, lower Q and the median are close together, and the upper quartile and upper extreme are more spread out. So there is a cluster at the lower end and a long tail at the top.** **It is pos** 	**C**
18.	$\bar{x}$ = 60.1111 = 60.1 (Correct to 1 *d p* using *SD* on calculator)	**C**
19.	σ_n = 1.24226 = 1.24 (correct to 2 *d p* using *SD* on calculator)	**A**
20.	<table><tr><th></th><th>Mean</th><th>SD</th></tr><tr><td>Science</td><td>60.1</td><td>1.24</td></tr><tr><td>English</td><td>60.2</td><td>9.55</td></tr></table>**The means are almost the same, but English marks have a greater SD, so are much more widely spread.**	**C**

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Multiple Choice Answer Sheet

Further Single Variable Analysis

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 ○
17.	A	○	B	○	C	●	D ○
18.	A	○	B	○	C	●	D ○
19.	A	●	B	○	C	○	D ○
20.	A	○	B	○	C	●	D ○

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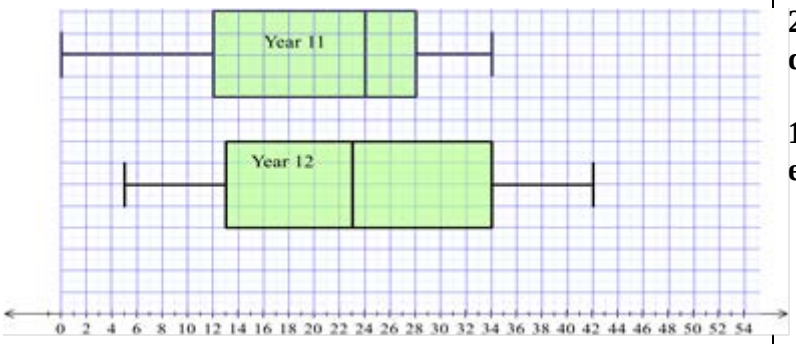
Longer Answer Section

ANSWERS

<table>
<tr><th>Question</th><th>Working and Answer</th><th>Marks</th></tr>
<tr><td>1.</td><td>(a)
<table>
<tr><th>Score</th><th>Frequency</th><th>Cumulative Frequency</th></tr>
<tr><td>1</td><td>7</td><td>7</td></tr>
<tr><td>2</td><td>10</td><td>17</td></tr>
<tr><td>3</td><td>14</td><td>31</td></tr>
<tr><td>4</td><td>12</td><td>43</td></tr>
<tr><td>5</td><td>8</td><td>51</td></tr>
<tr><td>6</td><td>6</td><td>57</td></tr>
<tr><td>7</td><td>4</td><td>61</td></tr>
<tr><td>8</td><td>2</td><td>63</td></tr>
<tr><td>9</td><td>1</td><td>64</td></tr>
</table></td><td>1 mark for correctly completed frequency column and 1 mark for correct CF column</td></tr>
<tr><td></td><td>(b) Median = between 32nd and 33rd scores
= between two scores of 4
Median = 4</td><td>1 mark for correct answer</td></tr>
<tr><td></td><td>(c) Range = 9 – 1 =8</td><td>1 mark for correct answer</td></tr>
<tr><td></td><td>(d) Lower Quartile = between 16th and 17th scores
= between 2 scores of 2
Lower Q = 2</td><td>1 mark for correct answer</td></tr>
<tr><td></td><td>(e) Upper Quartile = between 48th and 49th scores
= between 2 scores of 5
Lower Q = 5
IQR = 5 – 2 = 3</td><td>1 mark for correct answer</td></tr>
</table>

Question	Working and Answer	Marks
2.	**(a)** Stem | Leaves 0 | 5 7 9 1 | 1 3 4 7 2 | 0 3 3 3 7 3 | 1 4 4 6 4 | 0 3 2 **From 19 scores median = 10th score** **Median = 23**	**1 mark for correct answer**
	(b) Lowers Q = 5th score **=13**	**1 mark for correct answer**
	(c) Upper Q = 15th score = 34 **IOR = 34 – 13 = 21**	**2 marks for upper Q and interquartile range.** **1 mark if found incorrectly, or if only upper Q given**
	(d) 	**2 marks for correctly drawn box plot** **1 mark if a minor error in drawing plot**
	(e) The plots show that - **The medians are almost the same, with Year 11 just slightly higher than Year 12** - **Year 12 has a wider spread than Year 11,** - **Year 12 is symmetrical while Year 11 is negatively skewed.**	**2 marks for correct comparisons including at least 2 of these (or other valid) features** **1 mark for correct comparison mentioning at least one feature**
3.	**(a) Housing Collective Median = 30** **Government Median = 12** **The Housing Collective median is higher by 18 so middle of the data is considerably higher**	**2 marks for values for both and a valid comment** **1 mark for error or not providing both values, or invalid comment**

Question	Working and Answer	Marks
	(b) Housing Collective Range = 50 – 10 = 40 **IQR = 40 – 20 = 20** **Government Range = 38 – 5 = 33** **IQR = 24 – 8 = 16** **Housing Collective range and IQR are both larger (by 7 and 4 respectively)** **The Housing Collective data is more widely spread, both in overall spread and in the spread of the centre 50%.**	**2 marks for values for both sets and a valid comment** **1 mark for error or not providing all values, or invalid comment**
	(c) The Housing Collective data is symmetric, while that for the Government is positively skewed.	**2 marks for correct descriptions for both sets of data** **1 mark for correct descriptions of one set**