



IB DIPLOMA PROGRAMME

Mathematics Standard Level SL

Test on Straight Lines, Surds, Data and Sampling and Statistics

October 2019

NO GDC

35 minutes

Instructions to candidates:

- Write down your name in the space provided.
- Do not open this examination paper until instructed to do so.
- A graphic display calculator is **not allowed** for this test
- Answer all the questions
- Write your answers in the spaces provided.
- You are advised to show all working, where possible. Where an answer is wrong, some marks may be given for correct method, provided this is shown by written working.
- Unless otherwise stated in the question, all numerical **answers** must be given **exactly**

Points: _____/

Grade:

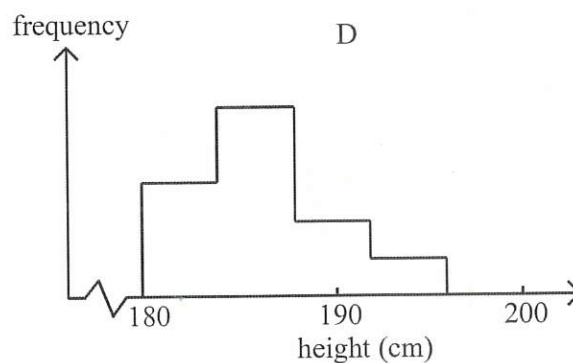
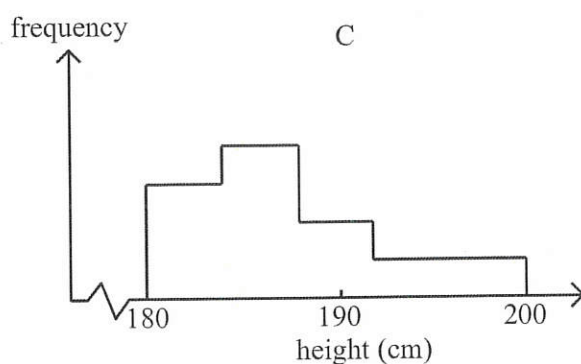
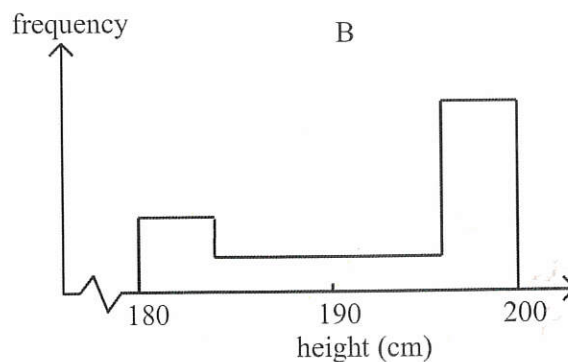
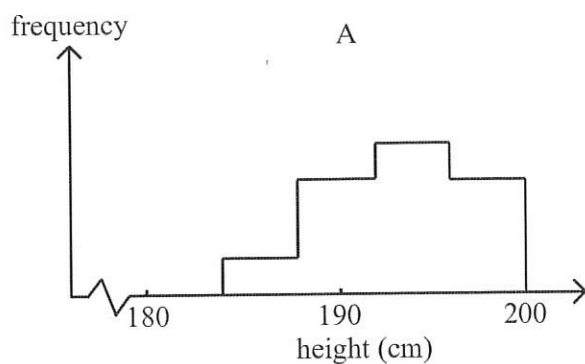
Please circle your chosen Mathematical Subject:

Analysis and Approaches (AA) or Applications and Interpretation (AI)

Name: Mark scheme

Teacher: (AA, ARC or ANU) _____

1. The heights in cm of the members of 4 volleyball teams A, B, C and D were taken and represented in the frequency histograms given below.



The mean \bar{x} and standard deviation σ of each team are shown in the following table.

	I	II	III	IV
\bar{x}	194	189	188	195
σ	6.50	4.91	3.90	3.74

← How wide the spread is

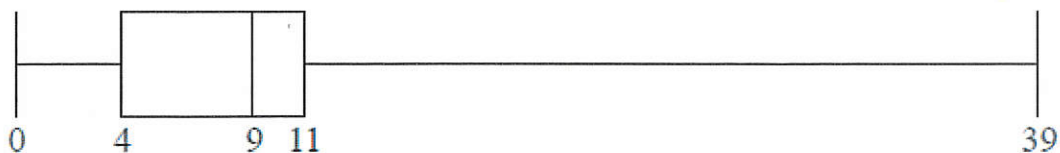
Match each pair of \bar{x} and σ (I, II, III, or IV) to the correct team (A, B, C or D).

\bar{x} and σ	Team
I	B
II	C
III	A D
IV	A

4 correct 6 marks
3 correct 4 marks
2 correct 3 marks
1 correct 1 mark

(Total 6 marks)

2. The following box-and-whisker plot shows the number of text messages sent by students in a school on a particular day.



- (a) Find the value of the interquartile range.

[2 marks]

$$IQR = Q_3 - Q_1$$

$$= 11 - 4 = 7$$

M1 A1

- (b) One student sent k text messages, where $k > 11$. Given that k is an outlier, find the least value of k .

[4 marks]

outliers are $Q_3 + 1.5IQR$ or $Q_1 - 1.5IQR$

as $k > 11$

$$Q_3 + 1.5IQR$$

M1

$$= 11 + 1.5(7)$$

A1

$$= 11 + 10.5$$

$$= 21.5$$

A1

$$k = 21$$

A1

3. There are 10 items in a data set. The sum of the items is 60.

(a) Find the mean.

[2 marks]

$$\bar{x} = \frac{\sum x_i}{n} = \frac{60}{10} = 6 \quad \text{M1 A1}$$

The variance of this data set is 3. Each value in the set is multiplied by 4.

(b) (i) Find the value of the new mean.

[2 marks]

$$\text{new mean is } 6(4) = 24 \quad \text{M1 A1}$$

(ii) Find the value of the new variance.

[2 marks]

$$\text{ORIGINAL VARIANCE } 3 \quad \text{ORIGINAL SD } \sqrt{3} \quad \text{M1}$$

$$\text{NEW SD } 4\sqrt{3}$$

$$\text{NEW VARIANCE } (4\sqrt{3})^2 = 16(3) = 48 \quad \text{A1}$$

4. (a) Show that $(\sqrt{10} + 1)(\sqrt{10} - 4) = 6 - 3\sqrt{10}$.

[2 marks]

$$\begin{aligned}(\sqrt{10} + 1)(\sqrt{10} - 4) &= 10 - 4\sqrt{10} + \sqrt{10} - 4 && \text{M1 A1} \\ &= 6 - 3\sqrt{10} && \text{A0}\end{aligned}$$

(b) Simplify fully $(\sqrt{10} + 4)(\sqrt{10} - 4)$.

[2 marks]

$$\begin{aligned}\text{Use } (a+b)(a-b) &= a^2 - b^2 \\ (\sqrt{10} + 4)(\sqrt{10} - 4) &= 10 - 16 = -6 \\ &\quad \text{A1} \quad \text{A1}\end{aligned}$$

(c) Hence, rationalise the denominator and simplify $\frac{(\sqrt{10}+1)}{(\sqrt{10}+4)}$ and writing it in the form $a + b\sqrt{10}$, where $a, b \in \mathbb{Q}$.

[4 marks]

$$\begin{aligned}\frac{\sqrt{10} + 1}{\sqrt{10} + 4} &= \frac{(\sqrt{10} + 1)(\sqrt{10} - 4)}{(\sqrt{10} + 4)(\sqrt{10} - 4)} = \frac{6 - 3\sqrt{10}}{-6} = -1 + \frac{1}{2}\sqrt{10} \\ &\quad \text{M1 A1} \quad \text{A1} \quad \text{A1}\end{aligned}$$

5. The following frequency distribution of marks has mean 4.5.

Mark	1	2	3	4	5	6	7
Frequency	2	4	6	9	x	9	4

Find the value of x.

[4 marks]

$$\frac{1(2) + 2(4) + 3(6) + 4(9) + 5(x) + 6(9) + 7(4)}{2 + 4 + 6 + 9 + x + 9 + 4} = 4.5$$

M1 A1

$$\frac{2 + 8 + 18 + 36 + 5x + 54 + 28}{34 + x} = 4.5$$

$$5x + 10 + 54 + 82 = 4.5(34 + x)$$

A1

$$5x + 146 = 153 + 4.5x$$

$$5x - 4.5x = 153 - 146$$

$$0.5x = 7 \quad | \times 2$$

$$x = 14$$

A1

$$\begin{aligned} 4.5(34) &= 4(34) + \frac{1}{2}(34) \\ &= 136 + 17 \\ &= 153 \end{aligned}$$

6. The graph below shows the graph of a straight line.

(a) Write down the equation of the straight line in the form $y = mx + c$.

[2 marks]

$$y = -\frac{1}{2}x + 6$$

A1 A1

(b) On the same graph, draw the line with equation $3x - 2y - 4 = 0$.

[2 marks]

$$\begin{aligned} -2y &= -3x + 4 \quad | \div -2 \\ y &= \frac{3}{2}x - 2 \end{aligned}$$

(c) Using your graphs, or otherwise, solve the equation $\frac{3}{2}x - 2 = -\frac{1}{2}x + 6$.

[2 marks]

$$\frac{3}{2}x - 2 = -\frac{1}{2}x + 6$$

$$\frac{3}{2}x + \frac{1}{2}x = 6 + 2$$

$$2x = 8$$

$$x = 4$$

(4, 4)

