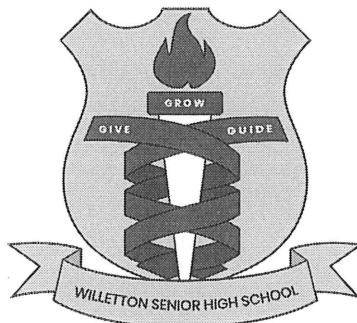


MATHEMATICS APPLICATIONS

YEAR 11 UNIT 2

TEST 3

2022



PART A

CALCULATOR FREE

TIME: 30 mins

MARKS: 32 marks

STUDENT'S NAME:

SOLUTIONS

CIRCLE YOUR

TEACHER'S NAME: Mr Galbraith      Mr Stillitano      Mr Riemer

Dr Duan      Miss Colquhoun      Mrs Regi

MATERIALS SUPPLIED: Formula Sheet

**Question 1****[4 marks]**

Classify each of the following variables described below, by entering its letter A to L in the most appropriate column in the table.

Numerical and discrete	Numerical and continuous	Categorical and nominal	Categorical and ordinal
B, D, F ✓	E, H, L ✓	C, G, I ✓	A, J, K ✓

(-1 for each letter incorrectly placed)

A: The finishing position in a 100m race.

B: Number of left-hand students in a classroom

C: The blood group of a person

D: The number of teeth with fillings

E: The length of a swimming pool.

F: The number of people attending a football match

G: Favourite food

H: Weight of a fish

I: The hair colour of Irish females

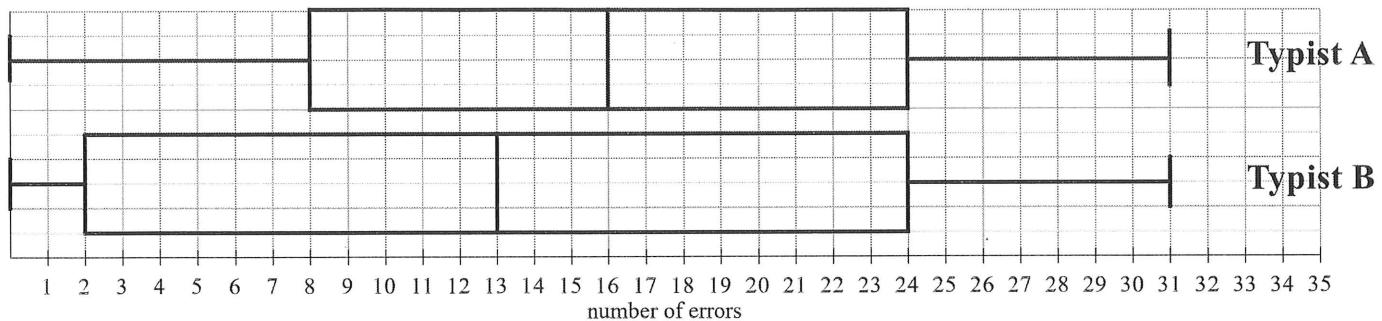
J: Income level as high, medium, or low

K: Academic letter grades

L: Heights

**Question 2****[4 marks]**

The parallel box plots below show the distribution of the number of errors made by typist A and typist B.



- a) State one major difference in the number of errors made by these two typists and explain in context what this difference means?

- Typist B had a larger IQR (The median or lower quartile is smaller for B.) ✓ (2)
- Typist B makes fewer errors on average than typist A ✓

- b) Which typist would be expected to have the greater mean number of errors? Justify.

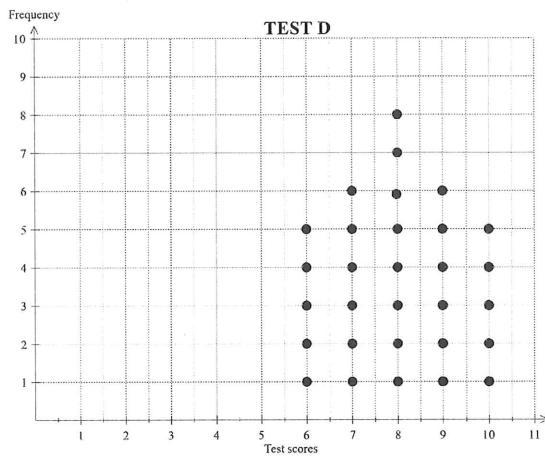
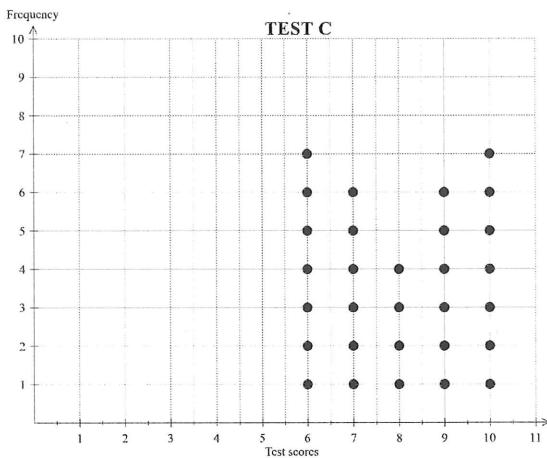
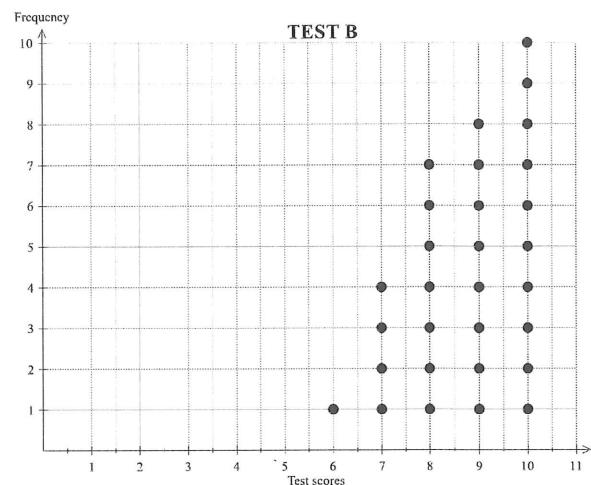
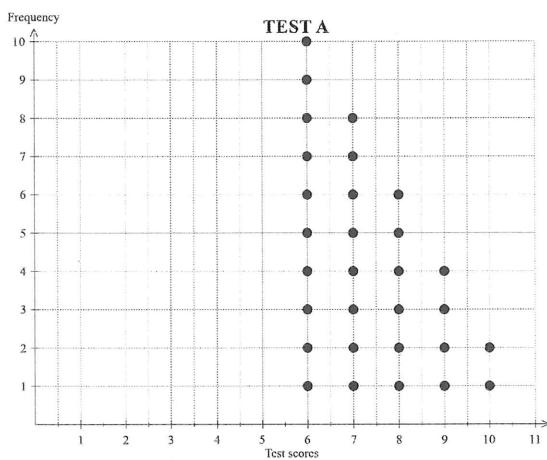
Typist A, as median is higher with a greater number of errors for the middle 50% of the total errors ✓ (1)

- c) Which typist would be expected to have the greater standard deviation of number of errors? Justify.

Typist B, as greater spread indicated by a larger IQR ✓ (1)

**Question 3****[8 marks]**

The test results for four different tests A, B, C and D for the same class of students are shown in the graphs below:



Note: Calculations are not required to answer the following questions.

- Which tests have the same mean? *C, D ✓*
- Which test has the smallest mean? *A ✓*
- Which tests have the same median? *C, D ✓*
- Which test has the largest median? *B ✓*
- Which test has the smallest mode? *A ✓*
- Which test has the smallest standard deviation? *D ✓*
- Which tests have a symmetrical distribution? *C, D ✓*
- Which test has a positive skew? *A ✓*

**Question 4**

[16 marks]

The heights of the starting five players in basketball teams A and B are shown below.

Team A	
Player	Height(cm)
1	212
2	185
3	183
4	182
5	179

Team B	
Player	Height(cm)
1	188
2	186
3	183
4	182
5	181

a) Formula:  $\text{variance} = \frac{\sum(x-\bar{x})^2}{n}$

Find the variance for team B, given that the mean for team B is 184 cm. (Show working)

$$\underline{(188-184)^2 + (186-184)^2 + (183-184)^2 + (182-184)^2 + (181-184)^2} \quad (3)$$

5

$$= \frac{16+4+1+4+9}{5} = \frac{34}{5} \quad (\text{or } 6.8) \quad \checkmark$$

(If use 2.6<sup>2</sup> from table and get 6.76) only

b) How would you find the standard deviation from the variance for team B?

$\sqrt{\frac{34}{5}}$  or  $\sqrt{6.8}$  or take sq. root of variance (1)

c) Complete the following table

(5)

	Team A(cm)	Team B(cm)
Sum of heights	941	$184 \times 5$ $= 920 \quad \checkmark$
Mean height	$\frac{941}{5} = 188.2 \quad \checkmark$	184
Median height	183 <span style="color: red;">✓</span>	183
Range in height	33	7 <span style="color: red;">✓</span>
Interquartile range	18	$187 - 181.5$ $= 5.5 \quad \checkmark$
Standard deviation (1 decimal place)	12.1	2.6

d) On average, which team has the taller players? Justify.

(1)

team A, as mean greater ✓

e) Which team had the greater variation of heights? Justify.

(1)

team A, as standard deviation greater ✓

f) Justify mathematically whether the height of 212 cm for team A is an outlier.

(3)

$$\begin{aligned} & Q_3 + 1.5 \times IQR \\ &= \frac{185+212}{2} + 1.5 \times 18 \checkmark \\ &= 198.5 + 27 \\ &= 225.5 \checkmark \end{aligned}$$

As the height of 212 cm is not greater than 225.5, the 212cm height is not an outlier ✓

g) Give one limitation of the mean as a statistical measure.

(1)

- Affected by extreme scores or outliers
- Might not be of same order as data
- Might not be a data value

(✓)

Give one reason

h) Explain why the standard deviation is a better measure of dispersion than the range.

(1)

- Uses all values, not only just 2 like the range.
- Not affected by outliers as much as range

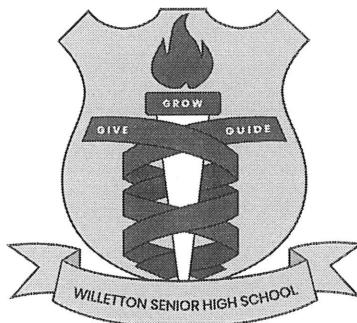
(✓)

MATHEMATICS APPLICATIONS

YEAR 11 UNIT 2

TEST 3

2022



PART B

CALCULATOR ASSUMED

TIME: 25 mins

MARKS: 26 marks

STUDENT'S NAME:

SOLUTIONS

CIRCLE YOUR

TEACHER'S NAME: Mr Galbraith      Mr Stillitano      Mr Riemer

Dr Duan      Miss Colquhoun      Ms Regi

MATERIALS SUPPLIED: Formula Sheet

MATERIALS RECOMMENDED: Up to three approved calculators  
One A4 single sided unfolded page of notes

**Question 5**

[17 marks]

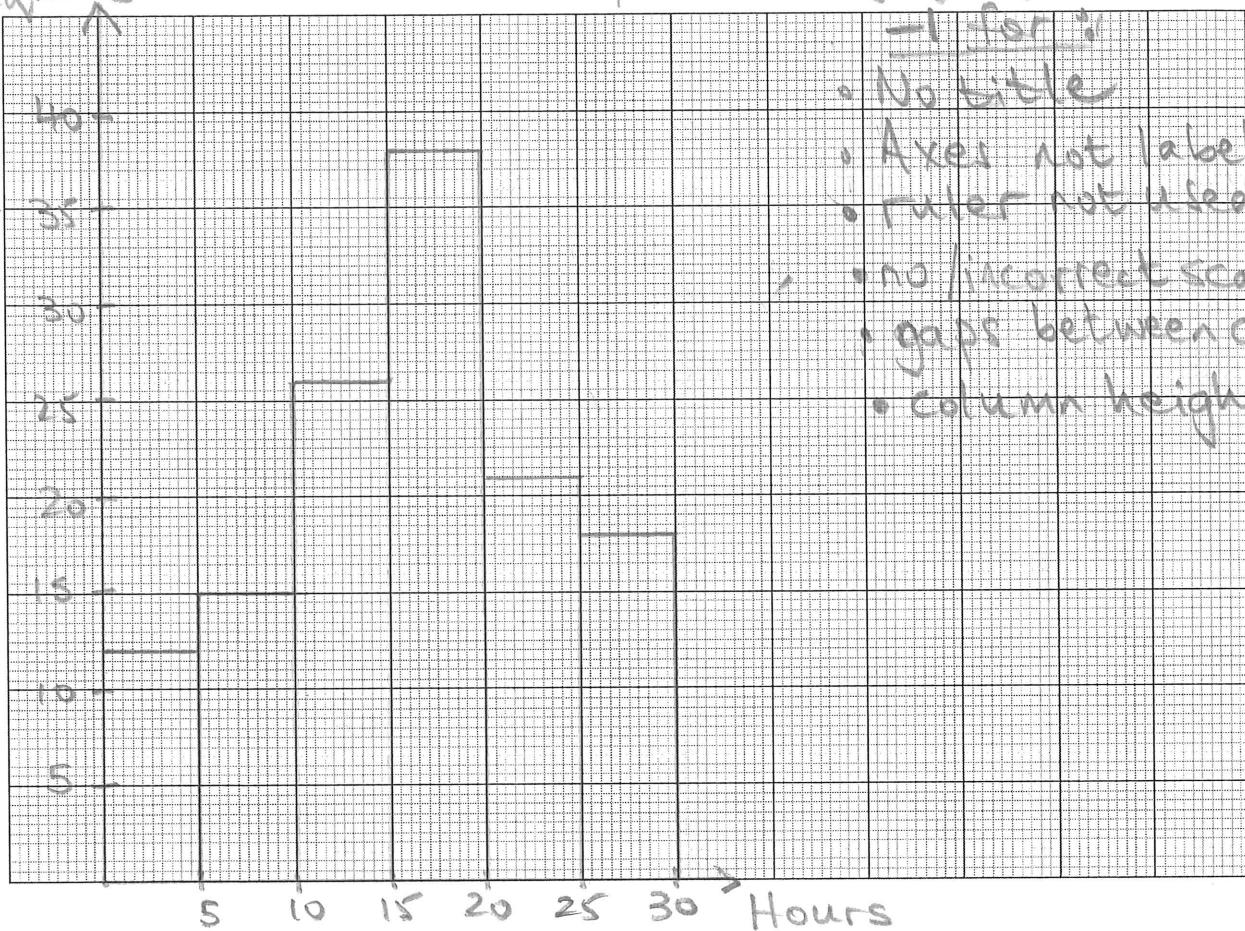
Several year 11 students were surveyed regarding the number of hours they spent studying in the week before the Semester One Examinations. The results are tabled below.

Number of hours( $x$ )	$0 \leq x < 5$	$5 \leq x < 10$	$10 \leq x < 15$	$15 \leq x < 20$	$20 \leq x < 25$	$25 \leq x < 30$
Number of students	12	15	26	38	21	18

- a) Construct a frequency histogram for the given data below.

Frequency Time in hours spent studying by Yr 11s

(5)



- 1 for 1
- No title
- Axes not labelled
- Ruler not used
- No incorrect scale on axes
- Gaps between columns
- Column heights incorrect

- b) Complete the table below to show the statistics for the number of hours studied by these year 11 students.

(6)

Number of students	130	✓
Estimated mean	16.2 h	✓
Modal class	$15 \leq x \leq 20$ h	✓
Median class	$15 \leq x \leq 20$ h	✓
Estimated range	$30 - 0 = 30$ h	✓
Estimated Standard deviation	7.3 h	✓

- c) Describe the distribution of the times spent by this group of year 11 students engaged in study.

(Location, spread, shape, other → in context) (4)

- 130 students surveyed
- no apparent outliers
- students studied between 15 to 20 hours on average (median class was 15 to 20 hours) with a mean of approximately 16 h ( $\text{mean} = 16.2$ )
- most students studied between 15 to 20 h (modal class was 15 to 20 h)
- All students studied between 0 to 30 h with a std. dev. of approx. 7 h, indicating almost all study times were within 2 std. dev. of the mean
- The shape of the distribution was approximately symmetrical.

- d) One year 11 student, claiming to have studied 39 hours per week before the exams, was added to this group.

State with justification how and by how much the inclusion of this student's hours will affect the standard deviation of the original group of year 11 students.

Standard deviation increases substantially from 7.3 h to 11.5 h - an increase of 4.2 h ✓ (2)

**Question 6****[9 marks]**

A major road runs through suburbs A and B. Both suburbs are of similar size and density with a speed limit of 70 km/h along the major road. The speeds of cars in suburb A and suburb B have been recorded on a split stem back-to-back stemplot below.

**Speed of cars(km/h)**

<b>Suburb A</b>	<b>Suburb B</b>
	5H 6 8
4 2 1 0 0	6L 0 2 3 3 4 4 4
8 7 6 5 5 5	6H 5 5 6 6 6 7 8 8 9
4 4 3 2 2 0	7L 0 0 0 2 2 3 3 4
8 8 6 5 5 5	7H 5 5 5 6 7 8 8
4 2 1 0 0	8L 2
8 7 6 6 5 5	8H
0	9L

Key: 5|6 means 56 km/h

H means high

L means low

- a) Describe the shape of the distribution for suburb A.

uniform (symmetrical) ✓

(1)

- b) Complete the following table for suburb B.

	Speeds in suburb A(km/h)	Speeds in suburb B(km/h)
Mean	74.5	68.9 ✓
Median	75	68.5 ✓
Interquartile range	16	10 ✓
Standard deviation	8.8	6.1 ✓

(4)

- c) Which suburb is it safer to drive in? Provide mathematical justification.

(must justify suburb choice to get mark)

(4)

- Slower speeds are associated with less accidents, making a suburb safer if speeds less. ✓
- Suburb B safer as mean and median speed are lower. ✓
- Suburb B safer as variations in speed are less (smaller std. dev.). Thus speeds are clustered closer to a smaller mean. ✓