Year 1 Applied Chapter 3 – Exam Questions Representation of Data (60mins)

1. M1

Width	1	1	4	2	3	5	3	12
Freq. Density	6	7	2	6	5.5	2	1.5	0.5

0.5×12 or 6 A1

Total area is $(1 \times 6) + (1 \times 7) + (4 \times 2) + ..., = 70$

$(90.5 - 78.5) \times \dfrac{1}{2} \times \dfrac{140}{\text{their } 70}$ M1

                        "70 seen anywhere"   B1

Number of runners is 12   A1   5

2. (a) Time is a <u>continuous</u> variable <u>or</u> data is in a <u>grouped</u> frequency table   B1   1

(b) Area is proportional to frequency <u>or</u> $A \propto f$ or $A = kf$ B1   1

     1st B1   for one of these correct statements.
            "Area proportional to frequency density" or
            "Area = frequency" is B0

(c) $3.6 \times 2 = 0.8 \times 9$ M1
                                  dM

(d) (Total) = $\dfrac{24}{0.8}$, = **30**   M1, A1   2

3. (a) 18-25 group, area $= 7 \times 5 = 35$ B1
        25-40 group, area $= 15 \times 1 = 15$ B1   2

(b) $(25 - 20) \times 5 + (40 - 25) \times 1 = 40$ M1A1   2

(c) Mid points are 7.5, 12, 16, 21.5, 32.5   M1
        $\Sigma f = 100$ B1

$\dfrac{\sum ft}{\sum f} = \dfrac{1891}{100} = 18.91$ M1A1   4

(d) $\sigma_t = \sqrt{\dfrac{41033}{100} - \bar{t}^{\,2}}$ $\qquad \sqrt{\dfrac{n}{n-1}\left(\dfrac{41033}{100} - \bar{t}^{\,2}\right)}$ alternative OK $\qquad$ M1

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ M1

$\sigma_t = \sqrt{52.74\ldots} = 7.26$ $\qquad\qquad\qquad\qquad\qquad\qquad$ A1 $\quad$ 3

Clear attempt at $\dfrac{41033}{100} - \bar{t}^{\,2}$ or $\dfrac{n}{n-1}\left(\dfrac{41033}{100} - \bar{t}^{\,2}\right)$ alternative

for first M1.
They may use their $\bar{t}$ and gain the method mark.
Square root of above for second M1
Anything that rounds to 7.3 for A1.

(e) $Q_2 = 18$ or 18.1 if $(n + 1)$ used $\qquad\qquad\qquad\qquad\qquad$ B1

$Q_1 = 10 + \dfrac{15}{16} \times 4 = 13.75$ or 15.25 numerator gives 13.8125 $\qquad$ M1A1

$Q_3 = 18 + \dfrac{25}{35} \times 7 = 23$ or 25.75 numerator gives 23.15 $\qquad\qquad$ A1 $\quad$ 4

4. (a) Indicates max / median / min / upper quartile / lower quartile (2 or more) B1

$\qquad$ Indicates outliers (or equivalent description) $\qquad\qquad\qquad\qquad$ B1

$\qquad$ Illustrates skewness (or equivalent description e.g. shape) $\qquad\qquad$ B1 $\quad$ 3

$\qquad$ Allows comparisons

$\qquad$ Indicates range / IQR / spread
$\qquad\qquad\qquad$ *Any 3 rows*

(b) (i) $\quad$ 37 (minutes) $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ B1

$\qquad$ (ii) $\quad$ Upper quartile or Q_3 or third quartile or 75th percentage or P_{75} $\qquad$ B1 $\quad$ 2

(c) outliers

$\qquad$ How to calculate correctly

$\qquad$ 'Observation that are very different from the other observations

$\qquad$ and need to be treated with caution' $\qquad\qquad\qquad\qquad\qquad\qquad$ B1

$\qquad$ These two children probably walked / took a lot longer $\qquad\qquad\qquad$ B1 $\quad$ 2
$\qquad\qquad\qquad$ *Any 2*

(d)

Time (School B)
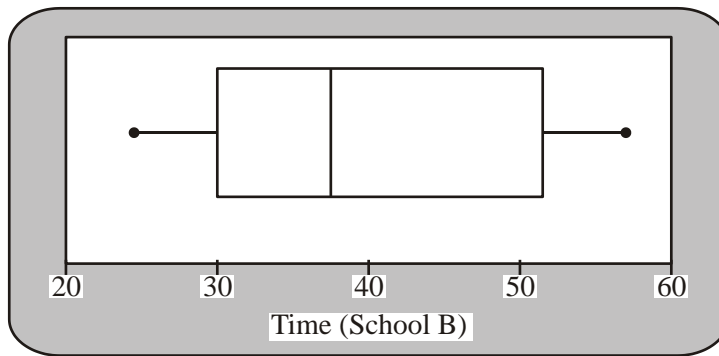
Box & median & whiskers	M1
Sensible scale	B1
30, 37, 50	B1
25, 55	B1 4

(e)   Children from school A generally took less time   B1

50% of B ≤ 37 mins, 75% of A < 37 mins (similarly for 30)   B1

Median / Q1 / Q3 / of A < median / Q1 / Q3 / of (1 or more)   B1

A has outliers, (B does not)   B1   4

Both positive skew

IQR of A < IQR of B, range of A > range of B
         *Any **correct** 4 lines*

5.   (a) $\Sigma x = 12075$; $\Sigma x^2 = 15\ 499\ 685$

$$\therefore \bar{x} = \frac{12075}{15} = \underline{805}$$ B1

         cao

$$sd = \sqrt{\frac{15499685}{15} - 805^2} = 620.71491$$ M1

       $\sqrt{\ }$ *& correct method*

3 s.f.   621   A1   3

(NB Using $n-1$ gives 642.50125…)   (643)

(b)   99, 169, 299, 350, 475, 485, 550, 650, 689, 830,   M1
999, 1015, 1050, 2100, 2315
         Attempt to order

$\therefore Q_2 = \underline{650}$ A1
         cao 650

$\therefore IQR = Q_3 - Q_1 = 1015 - 350 = \underline{665}$

         Attempt at $Q_3 - Q_1$ M1
         cao 665   A1   4

(c) $Q_3 + 1.5(Q_3 - Q_1) = 1015 + 1.5 \times 665 = 2012.5$ M1
         Use of given outlier formula
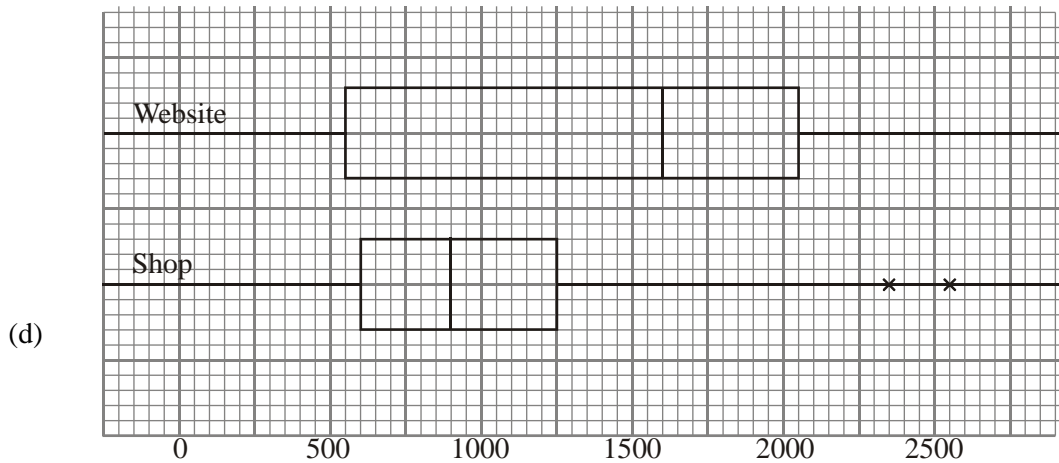
$Q_1 - 1.5(Q_3 - Q_1) = 350 - 1.5 \times 665 < 0$ M1
         Evidence both ends considered

$\therefore$ 2100 and 2315 are outliers   A1   3

(d)

	0	500	1000	1500	2000	2500

Two boxplots   B1
same scale
both labelled

Website   B1

Shop Box-plot   B1

Both outliers   B1   4

NB: For shop, right band whisker drawn to 2012.5 is acceptable.

(e)   Median website > median shop

Website negative skew; shop approx symmetrical
         Ignoring outliers

Ranges approximately equal
Shop Q_3 < Website Q_3 $\Rightarrow$ shop sales low value

Website sales more variable in value

$IQR_W \geq IQR_S$
     Any two sensible comments   B1 B1   2

6. (a)   44, 100, 134, 153, 160   1
         B1 cao

(b)   2
         B1 ft for at least 4 of 5 points plotted correctly $\pm \frac{1}{2}$ sq at end of interval
         dep on sensible table (condone 1 addition error)
         B1 ft (dep on previous B1) for points joined by curve or line segments
         provided no gradient is negative – ignore any part of graph outside
         range of their points
         (SC B1 if 4 or 5 pts plotted not at end but consistent within each interval
         and joined)

(c)   30 to 32
     15 to 18   3

     Median 30 – 32
     IQR 40 – 24
         \

(d)   2
         B2 if fully correct
         B1 for box with median or quartiles or whiskers correct

[8]