# Extended Mathematics
# Topic :Statistics
# Year :May 2013 -May 2023
# Paper -4
# Answers

Question 1

| | | | | |
|---|---|---|---|---|
| **(a)** | **(i)** | 14 | 1 | |
| | **(ii)** | 8 | 1 | |
| | **(iii)** | 30 – *their* (ii) | 1FT | |
| **(b)** | | $\frac{11}{80}$ | 2 | **SC1** for $\frac{69}{80}$ |
| **(c)** | | 16, 4 | 2 | **B1** for each correct value |
| **(d)** | | 18.0625 rot to 3sf or better or 18.1 www | 3 | **M1** for $\Sigma mf$ for $m$ as mid values of 5, 12.5, 22.5, 35 and 45 (= 1445)<br>**and M1 dep** for $\Sigma mf \div 80$, dep on **M1** earned |
| **(e)** | | Correct widths with no gaps<br>2nd block w = 5, fd = 2.4<br>3rd block w = 15 fd = 1.2<br>4th block w = 10 and fd = 1.6<br>5th block w = 10 and fd = 0.4 | 1<br>1<br>1<br>1FT<br>1FT | <br><br><br>**Strict FT** from *their* (c)<br>**Strict FT** from *their* (c)<br>After **0** scored for blocks, **SC1** for 4 correct fds soi by correct heights |

Question 2

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|---|---|---|---|
| **(a)** | 171.25 (or 171 or 171.2 or 171.3)<br><br>www | **3** | **M1** for $5 \times 155 + 9 \times 162.5 + 18 \times 172.5 + 10 \times 185$ [= 7192.5]<br>and<br>**M1** (dep on **M1**) for *their* $\Sigma fx \div 42$ |
| **(b)** | $160 < x \leq 165$ oe | **1** | |
| **(c)** | Blocks with heights of 1.8, 1.2, 1, with correct interval widths and no gaps | **4** | **B3** for 2 correct blocks<br>or<br>**B2** for 1 correct block<br>or<br>**B1** for 3 correct frequency densities or heights or 3 correct widths |

Question 3

| | | | | |
|---|---|---|---|---|
| **(a)** | **(i)** | 3.2 | **1** | |
| | **(ii)** | 4.2 | **1** | |
| | **(iii)** | 4.6 | **1** | |
| | **(iv)** | 196 | **1** | |
| **(b)** | **(i)** | 100, 46, 12 | **2** | **B1** for 2 correct |
| | **(ii)** | 4 | **2** | **M1** for frequency of 60 or 140 seen in workspace |

Question 4

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|---|---|---|---|
| **(i)** | 3.81 or 3.812 to 3.813 or 3h 49min nfww | **4** | **M1** for midpoints soi (condone 1 error or omission)<br>and<br>**M1** for use of $\sum fx$ with $x$ in correct interval including both boundaries (condone 1 further error or omission)<br>and<br>**M1** (**dep** on 2nd M1) for $\sum fx \div 80$ $(305 \div 80)$ |
| **(ii)** | Correct histogram | **4** | **B1** for each correct block<br>and<br>**B1** for correct widths |

Question 5

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|---|---|---|---|---|
| **(a)** | 24.7 or 24.66 to 24.67 | | **4** | **M1** for midpoints soi<br>(condone 1 error or omission)<br>(5, 15, 25, 35, 45, 55)<br>**and**<br>**M1** for use of $\sum fx$ with $x$ in correct interval including both boundaries (condone 1 further error or omission)<br>**and**<br>**M1** (dependent on second **M**) for $\sum fx \div 120$ |
| **(b)** | **(i)** | 50, 90, 114 | **2** | **B1** for 2 correct |
| | **(ii)** | Correct curve<br>or ruled polygon | **3** | Ignore section to left of $t = 10$<br>**B1** for 6 correct horizontal plots<br>**and B1FT** for 6 correct vertical plots<br>If 0 scored **SC1** for 5 out of 6 correct plots<br>**and** |

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| | | | | **and**<br>**B1FT** for curve or polygon through at least 5 of *their* points dep on an increasing curve/polygon that reaches 120 vertically |
| | **(iii)** | 21.5 to 23<br>15 to 16.5<br>24 to 26 | **4** | **B1**<br>**B1**<br>**B2** or **B1** for 72 or 72.6 seen |
| **(c)** | **(i)** | 50, 30 | **2** | **B1** each |
| | **(ii)** | Correct histogram | **3FT** | **B1** for blocks of widths 0 – 20, 30 – 60 (no gaps)<br>**B1FT** for block of height 2.5 or *their* 50 ÷ 20<br>**and B1FT** for block of height 1 or *their* 30 ÷ 30 |

Question 6

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|---|---|---|---|
| **(a)** | $10 < x \leq 25$ $25 < x \leq 30$<br>$30 < x \leq 35$ $35 < x \leq 50$<br>$50 < x \leq 60$ | **2** | 5 correct<br>**B1** for 3 or 4 correct<br>**or SC1** for all correct but in the form 10 to 25 or 10 – 25 |
| | 13 33 19 [4] 15 6 | **3** | **B2** for 4 correct<br>**or B1** for 3 correct |
| **(b)** | 25.1[0] or 25.13 to 25.14 nfww | **4** | **M1** for mid-values soi, condone one error or omission<br>5 17.5 27.5 32.5 42.5 55 soi |

Question 7

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|---|---|---|---|---|
| **(a)** | **(i)** | (100 – 70) × 0.4 [= 12] or better | **1** | Accept $\frac{24}{78} \times 39$ oe |
| | **(ii)** | 60.9 or 60.89… nfww | **5** | **B1** for 3 or 4 correct extra frequencies 3, 6, 10, 8 soi<br>**M1** for at least 4 of mid-interval values 15, 40, 55, 65, 85 soi<br>**M1** for $\Sigma fx$ where $x$ is any value in each interval allow *their* frequencies provided integers and they must be shown<br>[3 × 15 + 6 × 40 + 10 × 55 + 8 × 65 + 12 × 85] [2375] |
| | | | | **M1 (dependent on second M1)** for ÷ 39<br>**or** ÷ (3 + 6 + 10 + 8 +12) |
| **(b)** | | 60.5 | **3** | **M2** for 20 × 70 – 19 × 70.5 oe<br>**or M1** for either 20 × 70 or 19 × 70.5 |

Question 8

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|---|---|---|---|---|
| **(a)** | **(i)** | 37.5 to 38.5 | **1** | |
| | **(ii)** | 19.5 to 20.5 nfww | **2** | **B1** for [LQ =] 23.5 to 24<br>or [UQ =] 43.5 to 44 |
| | **(iii)** | 43 | **2** | **B1** for 56 seen or horizontal line drawn at cf = 56 |
| **(b)** | **(i)** | 31.8[4…] nfww | **4** | **M1** for midpoints soi (condone 1 error or omission)<br>and<br>**M1** for use of $\sum ft$ with $t$ in correct interval including both boundaries (condone 1 further error or omission)<br>and<br>**M1** (**dep** on 2nd M1) for $\sum ft \div 80$ ($2547.5 \div 80$) |
| | **(ii)** | Correct histogram | **4** | **B1** for each correct block with correct width and height<br>If **B0** then **SC1** for four correct f.d.s or four correct widths |

Question 9

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|---|---|---|---|
| **(i)** | 7 | **4** | **M2** for $\frac{16\times11+17\times10+18p+19\times4+20\times8}{11+10+4+8+p}=17.7$ or better<br>or<br>**M1** for sum of two correct products or better or for [total =] $11 + 10 + 4 + 8 + p$<br>and<br>**B1** for $582 + 18p = 17.7\ (33 + p)$ |
| **(ii)** | 17 | **1FT** | **STRICT FT** median for *their p* if integer |

Question 10

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|---|---|---|---|
| **(a)** | $35 < t \leqslant 40$ | **1** | |
| **(b)** | 22.5, 27.5, 32.5, 37.5, 42.5, 47.5 | **M1** | At least 4 correct mid-values soi |
| | $(2 \times 22.5 + 6 \times 27.5 + 7 \times 32.5 + 19 \times 37.5 + 9 \times 42.5 + 7 \times 47.5)$ | **M1** | $\sum fx$ where $x$ is in the correct interval allow one further slip<br>[45 + 165 + 227.5 + 712.5 + 382.5 + 332.5 = 1865] |

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| | | ÷ 50 or their $\sum f$ | **M1dep** | **Dependent** on second method |
| | | 37.3 | **A1** | **SC2** for correct answer with no working |
| **(c)** | **(i)** | 15, 19, 16 | **1** | |
| | **(ii)** | rectangular bars of height 1, 3.8 and 1.6 | **B2FT** | **FT** their **(c)(i)**, on correct boundary lines<br>**B1FT** for 2 correct heights<br>If 0 scored for heights then **SC1** for 3 correct frequency densities soi |
| | | correct widths of 15, 5,10 and no gaps | **B1** | |

Question 11

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|---|---|---|---|
| **(a)** | $140 < h \leqslant 144$ | **1** | |
| **(b)** | 144.875 nfww | **4** | **M1** for at least 4 correct mid-values soi<br>**M1** for $\sum fx$ where $x$ is in the correct interval, allow one further error/omission<br>**M1 dep** for ÷ 40<br>dependent on second method mark |
| **(c)** | 4 correct blocks | **4** | **B3** for 3 correct blocks<br>**B2** for 2 correct blocks<br>**B1** for 1 correct block<br>or at least 3 correct frequency densities (1.4, 1, 1, 0.65 ) |

Question 12

| | | | |
|---|---|---|---|
| **(a)** | 72.5 | **3** | **M1** for $\Sigma fm$ with correct frequencies and correct mid-interval values<br>**M1** for ÷ 200 **dep** on first **M1** |
| **(b)** | Correct histogram | **4** | **B1** four correct widths – no gaps<br>**B3** for blocks of correct heights 0.5, 5, 16, 4<br>or **B2** for 3 blocks of correct heights<br>or **B1** for 2 blocks of correct heights<br>If 0 scored for the heights then **SC1** for all four frequency densities soi |

Question 13

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|---|---|---|---|---|
| **(a)** | **(i)** | 316 | **4** | **M1** for 100, 250, 325, 375, 450 soi<br><br>**M1** for $\Sigma fm$ with $m$'s in intervals including boundaries [15800]<br><br>**M1** (dep on 2nd **M1**) for *their* $\Sigma fm \div 50$ |
| | **(ii)** | Three correct blocks with heights 0.09, 0.36, 0.24 with correct widths and no gaps | **3** | **B2** for two correct blocks<br>or<br>**B1** for one correct block or three correct frequency densities soi |
| **(b)** | | Students have a greater range of estimates oe | **B1** | |
| | | [On average] adults estimated a greater mass oe | **B1** | |

Question 14

| | | | | |
|---|---|---|---|---|
| **(a)** | **(i)** | $24 < t \leqslant 30$ | **1** | |
| | **(ii)** | 30.9 or 30.875 nfww | **4** | **M1** for midpoints **soi** (condone 1 error or omission)<br>5, 17, 27, 35, 50, 65 soi<br><br>**M1** for use of $\sum fx$ with $x$ in correct interval including both boundaries<br>(condone 1 further error or omission)<br>(50, 1530, 3645, 2975, 3500, 650)<br>and<br>**M1** (dep on 2nd **M1**) for $\sum fx \div 400$ |
| **(b)** | **(i)** | [10 100] 235 320 390 [400] | **2** | **B1** for any two correct<br>**SC1** for 235, $n$, $n + 70$ $n > 235$ |
| | **(ii)** | Correct curve or polygon | **3** | **B1** for correct horizontal placement<br>**B1FT** for correct vertical placement<br><br>**B1FT dep on at least B1** for reasonable increasing curve or polygon through their 6 points<br><br>If zero scored **SC1** for 5 out of 6 points correctly plotted |

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| **(c)** | **(i)** | 27.5 to 29 | **1** | |
| | **(ii)** | 12 to 14 | **2** | **B1** for 36 to 38 or 24 seen |
| | **(iii)** | 18 to 20 | **2** | **B1** for 60 seen or marked on grid |
| | **(iv)** | 30 to 45 | **2** | **B1** for 355 to 370 seen |

Question 15

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|---|---|---|---|---|
| **(a)** | | 101.5625 or 102 or 101.5 to 101.6 nfww | **4** | **M1** for 55, 90, 110, 160 soi<br><br>**M1** for $\Sigma fm$ with frequencies and each $m$ in or on a boundary of a correct interval<br>2750, 2700, 4400, 6400<br><br>**M1 dep on 2nd M** for ÷ 160 |
| **(b)** | | Correct histogram drawn with correct widths and heights<br>1, 1.5 and 2 (no gaps) | **3** | **B1** for each correct block<br>If zero scored, **SC1** for correct heights or frequency densities |
| **(c)** | | $\frac{40}{160}$ oe | **1** | |
| **(d)** | **(i)** | $\frac{1560}{25440}$ oe | **2** | **M1** for $\frac{40}{160} \times \frac{39}{159}$ |
| | **(ii)** | $\frac{4000}{25440}$ oe | **3** | **M2** for $\frac{40}{160} \times \frac{50}{159} + \frac{50}{160} \times \frac{40}{159}$ oe<br>or<br>**M1** for one of these products soi |

Question 16

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|---|---|---|---|---|
| **(a)** | | Correct diagram | **3** | **B1** for correct vertical plots<br>and<br>**B1** for correct horizontal plots<br>and<br>**B1 dep on at least B1** for reasonable <u>increasing</u> curve or polygon through *their* 6 points<br><br>If zero scored, **SC1** for 5 out of 6 correct plots |
| **(b)** | **(i)** | 32 to 34 | **1** | |
| | **(ii)** | 120 – reading at $r = 50$ | **2FT** | **B1FT** for reading at $r = 50$ seen |

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| **(c)** | 8 18 27 | **2** | **B1** for 2 correct |
| **(d)** | 35.2 or $35\frac{1}{6}$ or 35.16 to 35.17 nfww | **4** | **M1** for mid-values soi<br>**M1 FT** for $\sum fx$ with $x$ in the correct interval including boundaries<br>**M1dep** for $\sum fx \div 120$ dependent on second **M1** earned |
| **(e)** | 1.6<br>1.35<br>0.3 | **4FT** | **FT** from **(c)** *their* $8 \div 5$ and *their* $27 \div 20$<br>**B3FT** for any 2 correct<br>or **B2FT** for first **or** second answer correct<br>or **B1** for 0.3 only |

Question 17

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|---|---|---|---|
| **(a)** | 1.35 nfww | **4** | **M1** for 0.5, 1.5, 2.5, 3.5, 4.5, 5.5 soi,<br>**M1** for $\Sigma fm$ soi by 162 where $m$ is in correct interval including boundaries<br>**M1**dep for $\Sigma fm \div 120$ or $\Sigma fm \div \Sigma f$ dependent on **second M1** earned |
| **(b) (i)** | 93, 102, 113, 118 | **2** | **SC1FT** for 1 error |
| **(ii)** | Correct diagram | **3** | **B1FT** for correct vertical plots<br>and<br>**B1** for correct horizontal plots<br>and<br>**B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 6 points<br>If zero scored, **SC1FT** for 5 out of 6 correct plots |
| **(iii) (a)** | 0.6 to 0.85 | **1** | |
| **(b)** | 1.3 to 1.7 | **2** | **B1** for UQ = 1.7 to 1.9 or LQ = 0.2 to 0.4 |
| **(c)** | 0.3 to 0.6 | **2FT** | Allow in correct range provided there is no evidence of reading at 35<br>or **FT** *their* reading at 42<br>**B1** for 42 soi |
| **(c) (i)** | 30 and 18 | **2** | **B1** for each |
| **(ii)** | 0.75 and 0.3 | **3FT** | **FT** (*their* 30) ÷ 40 and (*their* 18) ÷ 60<br>**B2FT** for either 0.75 or 0.3<br>or **M1** for *their* 30 ÷ 2 or ÷ 20<br>or for *their* 18 ÷ 3 or ÷ 20 |

Question 18

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|---|---|---|---|
| **(a) (i)** | 64 | **1** | |
| **(ii)** | 16 to 16.5 | **2** | **M1** for UQ = 71 to 71.5 or LQ =55 |
| **(iii)** | 62 | **2** | **B1** for 24 indicated |
| **(iv)** | 6 | **2** | **B1** for 54 seen |
| **(b)** | [8] 12 23 11 [4] 2 | **3** | **B2** for 1 incorrect reading FT others<br><br>**B1** for 2 correct |
| **(c)** | Blocks of height 0.6 2.3 1.1 0.4 with correct widths | **4FT** | **FT** *their* **(b)** for heights<br>**B1FT** for each correct block<br><br>If **B0, SC1** for blocks of widths 20, 10, 10, 10 or for *their* correct frequency densities |

Question 19

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|---|---|---|---|
| **(c)** | 376 nfww | **4** | **M1** for midpoints soi (condone 1 error or omission)<br>(225, 275, 325, 375, 425, 475)<br>and<br>**M1** for use of $\Sigma fx$ with $x$ in correct interval including both boundaries (condone 1 further error or omission)<br>and<br>**M1** (dependent on second M) for $\Sigma fx \div 200$ |
| **(d) (i)** | 16 | **1** | |
| **(ii)** | 33 | **2** | **M1** for $0.8 \times 50 + 0.26 \times 100$ |

Question 20

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|---|---|---|---|
| **(a) (i)** | 400 | **1** | |
| **(ii)** | 350 | **1** | |
| **(iii)** | 70 | **1** | |
| **(iv)** | 170 | **2** | **B1** for 30 seen |
| **(b) (i)** | Mid-values 40, 80, 125, 200 soi | **M1** | |
| | $\Sigma fx$ with correct frequencies and $x$'s in correct intervals or on boundaries of correct intervals | **M1** | |
| | $\div 200$ | **M1(dep)** | Dependent on second M1 |
| | 106 nfww | **A1** | **SC2** for correct answer without working |

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| **(ii)** | Correct histogram | **4** | **B1** for correct widths<br><br>**and B1** for each rectangle of correct height at 0.8, 1.6, 1.6 (up to **B3**)<br><br>After 0 scored, **SC1** for 3 correct frequency densities seen |
| **(iii)** | $\frac{10712}{39800}$ oe isw | **2** | **M1** for $\frac{104}{200}\times\frac{103}{199}$ oe |

Question 21

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|---|---|---|---|
| **(a) (i)** | 6000 [7600] 10200 4200 | **2** | **B1** for 6000 or 10200<br>If **B0** then **B1FT** for *their* (UQ – LQ) |
| **(ii)(a)** | True, median price is lower | **1** | No inclusion of other statistic |
| **(ii)(b)** | False, A's UQ < 13 600 oe | **1FT** | **FT** *their* UQ in **(a)(i)** |
| **(b)** | 11 025 | **4** | Listed values are in thousands<br>**M1** for 3, 7, 9, 11, 13, 18 soi<br><br>**M1** for $\Sigma fm$ [1323]<br><br>**M1** (dep on second **M1**) for *their* $\Sigma fm \div 120$ |
| **(c)** | 323.25 nfww | **3** | **M2** for $9948 - 0.25 \times 8760$<br>or<br>**M1** for $0.25 \times 8760$ |

Question 22

| | | | |
|---|---|---|---|
| **(a)** | 15 | **2** | **M1** for $10 \div 40$ [$\times 60$] |
| **(b)** | 49.2 nfww | **4** | **M1** for 35, 42.5, 47.5, 52.5, 57.5, 70 soi<br><br>**M1** for $\Sigma fx$<br>$8 \times 35 + 22 \times 42.5 + 95 \times 47.5 + 55 \times 52.5 + 14 \times 57.5 + 6 \times 70$<br><br>**M1 dep** for *their* $\Sigma fx \div 200$ |
| **(c)** | Fully correct histogram | **4** | **B3** for 4 correct blocks<br>or **B2** for 2 or 3 correct blocks<br>or **B1** for 1 correct block |

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| **(d)** | **(i)** | 125, 180 | **1** | |
| | **(ii)** | Correct diagram | **3** | **B1FT** *their* **(d)(i)** for 6 correct heights within correct square(including boundaries) or touching correct line if should be on a grid line<br>and<br>**B1** for 6 points at upper ends of intervals on correct vertical line<br>and<br>**B1FT** (dep on at least B1) for increasing curve or polygon through 6 points<br><br>If zero scored, **SC1FT** for 5 correct points plotted |
| | **(iii)** **(a)** | 48 to 49 | **1** | |
| | **(b)** | 55 | **1** | |
| | **(c)** | 8 to 14 | **2FT** | **B1FT** for 186 to 192 seen |

Question 23

| | | | | |
|---|---|---|---|---|
| **(a)** | **(i)** | 15 to 15.2 | **1** | |
| | **(ii)** | 10.8 to 11 | **1** | |
| | **(iii)** | 9 to 9.2 | **1FT** | **FT** 20 – *their* **(a)(ii)** |
| | **(iv)** | 10 | **1** | |
| | **(v)** | 24 | **2** | **B1** for 176 written |
| **(b)** | **(i)** | 16.75 nfww | **4** | isw attempted time conversion after correct answer<br>**M1** for 5, 12.5, 17.5, 25, 45 soi<br>**M1** for $\Sigma fx$<br><br>**M1 dep** for their $\Sigma fx \div 200$ |
| | **(ii)** | Fully correct histogram | **4** | **B1** for each correct block<br><br>If zero scored, **SC1** for frequency densities of 9.6, 12, 2.6 and 0.6 seen |

Question 24

| | | | | |
|---|---|---|---|---|
| **(a)** | | 72.7 or 72.70 to 72.71 nfww | **4** | **M1** for midpoints **soi** (condone 1 error or omission)<br>(47.5, 55, 65, 80, 95, 110)<br><br>**M1** for use of $\sum fx$ with $x$ in correct interval including both boundaries (condone 1 further error or omission)<br>(1092.5, 3520, 7930, 10880, 2470, 3190)<br><br>**M1** (dep on 2nd M1) for $\sum fx \div 400$ |
| **(b)** | **(i)** | [23] 87 209 345 371 [400] | **2** | **B1** for 2 or 3 correct |
| | **(ii)** | Correct graph | **3** | **B1FT** *their* **(b)(i)** for 6 correct heights<br>**B1** for 6 points at upper ends of intervals on correct vertical line<br>**B1FT** (dep on at least B1) for increasing curve or polygon through 6 points<br><br>After 0 scored, **SC1FT** *their* **(b)(i)** for 5 correct points plotted |
| | **(iii)** **(a)** | 69 to 70 | **1** | |
| | **(b)** | 20 to 23 | **2FT** | **FT** *their* cumulative freq curve<br>**M1** for correct UQ or LQ for *their* cumulative freq curve |
| | **(c)** | 72 to 75 | **2** | **M1** for 240 soi |

Question 25

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|---|---|---|---|
| (a)(i) | 4 points correctly plotted | **2** | **B1** for 2 or 3 points correctly plotted |
| (a)(ii) | Positive | **1** | |
| (b) | mean 3.1 | **3** | **M2** for $\frac{\text{sum of products}}{30}$<br><br>or **M1** for at least 4 correct products soi |
| | median 3 | **2** | **M1** for 15.5 oe indicated |
| | mode 5 | **1** | |
| | range 5 | **1** | |
| (c) | 24 nfww | **3** | **M1** for $\frac{x\times 52+45\times 75+11\times 91}{x+45+11}$ [= 70.3]<br>**M1** for clearing *their* fraction |

Question 26

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|---|---|---|---|
| (a)(i) | 80 33 20 | **1, 1, 1** | |
| (a)(ii) | 17.3 nfww | **4** | **M1** for 5, 15, 22.5, 27.5, 40 soi<br>**M1** for $\sum fx$ with *their f* 's and $x$ in correct interval including both boundaries<br>**M1** (dep on 2nd **M1**) for $\sum fx \div 200$ |
| (b)(i) | $\frac{30}{210}$ oe | **2** | **M1** for $\frac{6}{15}\times\frac{5}{14}$<br>If zero scored, **SC1** for answer $\frac{36}{225}$ oe |
| (b)(ii) | $\frac{108}{210}$ oe | **3** | **M2** for $\frac{6}{15}\times\frac{9}{14}+\frac{9}{15}\times\frac{6}{14}$ oe<br>or $1-\frac{9}{15}\times\frac{8}{14}-\frac{6}{15}\times\frac{5}{14}$<br>or **M1** for $\frac{6}{15}\times\frac{9}{14}$ or $\frac{9}{15}\times\frac{6}{14}$<br>or $\frac{9}{15}\times\frac{8}{14}+\frac{6}{15}\times\frac{5}{14}$<br>If zero scored, **SC1** for answer $\frac{108}{225}$ oe |
| (c) | 150 | **1** | |

Question 27

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|---|---|---|---|
| (a)(i) | 175.5 nfww | **4** | **M1** for at least four of<br>50, 125, 175, 225, 325 soi<br><br>**M1** for $\Sigma fx$ with $x$ inside or on boundary of each interval<br><br>**M1** (dep on second **M1**) for $\frac{\textit{their } \Sigma fx}{200}$ |
| (a)(ii) | Fully correct histogram | **4** | **B1** for each correct bar<br><br>If zero scored, **B1** for 0.2, 1.32, 0.7, 0.16 seen |
| (b)(i) | Fully correct cumulative frequency diagram | **3** | **B1** for correct horizontal plots<br>**B1** for correct vertical plots<br><br>**B1FT** dep on at least **B1** earned for points joined with smooth increasing curve or polygon<br>If zero scored, **SC1** for 4 correct plotted points |
| (b)(ii)(a) | 170 to 175 | **1** | |
| (b)(ii)(b) | 152 to 158 | **2** | **M1** for 42 to 48 written |

Question 28

| | | | |
|---|---|---|---|
| (a) | $71 < t \leqslant 72$ | **1** | |
| (b) | 72.3 or 72.27 to 72.28 nfww | **4** | **M1** for midpoints soi (condone 1 error or omission)<br><br>**M1** for use of $\sum fx$ with $x$ in correct interval including both boundaries<br><br>**M1** (dep on 2nd **M1**) for $\sum fx \div 90$ |
| (c)(i) | 41, 62, 80, 90 | **2** | **B1** for 2 correct values |
| (c)(ii) | Correct curve | **3** | **B1FT** *their* **(c)(i)** for 5 correct heights<br>**B1** for 5 points plotted at upper ends of intervals<br>**B1FT** (dep on at least **B1**) for increasing curve or increasing polygon through 5 points<br><br>If zero scored, **SC1FT** for 4 correct points plotted |
| (c)(iii) | 72.1 to 72.4 | **1** | |
| (c)(iv) | 1.9 to 2.2 | **2** | **M1** for UQ = 73.2 to 73.4<br>or LQ = 71.2 to 71.3 |

| | | | |
|---|---|---|---|
| (d) | 180 cao nfww | 4 | **B3** for 50 [m/s] nfww<br>OR<br>**M3** for $\frac{3725 \div 1000}{74.5 \div 3600}$<br>OR<br>**M2** for 3725 ÷ 74.5<br>or **M1** for 3725 or 74.5 seen or for (3715 to 3725) ÷ (74.5 to 75.5)<br>**M1** indep for multiply by 3.6 oe |

Question 29

| | | | |
|---|---|---|---|
| (a) | $80 < t \leqslant 100$ | 1 | |
| (b) | 86 nfww | 4 | **M1** for midpoints soi<br>**M1** for use of $\Sigma fx$ with $x$ in correct interval including both boundaries<br>**M1** (dep on 2nd **M1**) for $\Sigma fx \div 150$ |
| (c)(i) | Reference to not knowing the individual values so we do not know the highest or the lowest values | 1 | |
| (c)(ii) | 62.4 | 2 | **M1** for 26 ÷ 150 or 360 ÷ 150 soi |
| (d) | $\frac{22}{150}$ oe | 1 | |
| (e)(i) | $\frac{90}{22350}$ oe | 2 | **M1** for $\frac{10}{150} \times \frac{9}{149}$<br>After zero scored, **SC1** for answer $\frac{100}{22500}$ oe |
| (e)(ii) | $\frac{440}{22350}$ oe | 3 | **M2** for $\frac{10}{150} \times \frac{22}{149} + \frac{22}{150} \times \frac{10}{149}$ oe<br>or<br>**M1** for $\frac{10}{150} \times \frac{22}{149}$ or $\frac{22}{150} \times \frac{10}{149}$ oe<br>After zero scored, **SC1** for answer $\frac{440}{22500}$ oe |

| | | | |
|---|---|---|---|
| (f) | 13, 8.5, 7.25, 1.1 | **3** | **B2** for 3 correct<br>or<br>**B1** for 1 correct<br>or for 3 correct FD.s 5.2, 3.4, 2.9, 0.44 oe |

Question 30

| | | | |
|---|---|---|---|
| (a)(i) | 280 | **1** | |
| (a)(ii) | 320 | **1** | |
| (a)(iii) | 90 | **1** | |
| (a)(iv) | 10 | **2** | **M1** for 90 written |
| (b)(i) | 250.2 nfww cao | **4** | **M1** for at least 4 correct mid-values<br>**M1** for $\Sigma fx$<br>**M1 dep on second M1** for $\Sigma fx \div 100$ |
| (b)(ii) | Correct completion of histogram | **4** | **B1** for each correct block<br>If zero scored, then **SC1** for correct frequency densities seen |
| (c) | [22 m] further oe | **1** | |

Question 31

| | | | |
|---|---|---|---|
| (a)(i) | $\frac{9}{160}$ oe | **1** | |
| (a)(ii) | 58.125 nfww | **4** | **M1** for mid-points soi<br><br>**M1** for use of $\Sigma fx$ with $x$ in correct interval including both boundaries<br><br>**M1** (dep on 2nd M1) for $\Sigma fx \div 160$ |
| (c) | correct curve | **3** | **B1FT** *their* **(b)** for 6 correct heights<br>**B1** for 6 points at upper ends of intervals on correct vertical line<br>**B1FT dep on at least B1** for increasing curve through *their* 6 points<br><br>After 0 scored, **SC1** for *their* 5 correct points plotted |
| (b) | [3 42] 85 140 151 160 | **2** | **B1** for 1 error **FT** other values |

| | | | |
|---|---|---|---|
| (d)(i) | 57 to 59 | **1** | |
| (d)(ii) | 36 to 42 | **2** | **B1** for UQ = 76 to 80 or LQ = 38 to 40 soi |
| (d)(iii) | 92 to 94 | **2** | **B1** for 144 seen |
| (d)(iv) | 130 to 137 | **2** | **B1** for 23 to 30 seen |

Question 32

| | | | |
|---|---|---|---|
| (a)(i) | Positive | **1** | Ignore strong, weak, etc. |
| (a)(ii) | Correct ruled line | **1** | |
| (a)(iii) | 2 | **1** | |
| (b) | [mode = ] 0<br><br>[median = ] 1<br><br>[mean = ] 1.04 or 1.041 to 1.042 | **5** | **B1**<br><br>**B1**<br><br>**B3**<br>or **M2** for<br>([10 × 0] + 8 × 1 + 3 × 2 + 2 × 3 + [0 × 4] + 1 × 5) ÷ 24 oe<br><br>or **M1** for<br>[10 × 0] + 8 × 1 + 3 × 2 + 2 × 3 + [0 × 4] + 1 × 5 oe |
| (c)(i) | 60.9 or 60.91... nfww | **4** | **M1** for 49, 57, 71 correct<br><br>**M1** for use of $\Sigma fx$ with $x$ in the correct interval including both boundaries<br><br>**M1** (dep on 2nd **M1**) for *their*<br>(78 × 49 + 180 × 57 + 162 × 71) ÷ (78 + 180 + 162) |
| (c)(ii) | Correct histogram | **4** | **B1** for correct widths in correct position<br>**B1** height 13<br>**B1** height 18<br>**B1** height 9<br><br>If 0 scored **B1** for 13, 18 and 9 seen |

Question 33

| | | | |
|---|---|---|---|
| (a)(i) | 20 [$< t \leqslant$] 25 | **1** | |
| (a)(ii) | 25 [$< t \leqslant$] 30 | **1** | |
| (a)(iii) | 28.3 or 28.33.. | **4** | **M1** for 22.5, 27.5, 32.5, 37.5, 42.5 soi<br>**M1** for $\sum fx$ where $x$ is in the correct interval including boundaries<br><br>**M1**dep for $\sum fx \div 120$ or<br>$\sum fx \div (44 + 32 + 28 + 12 + 4)$ |
| (a)(iv) | $\frac{4}{120}$ oe isw | **1** | |
| (b)(i) | 76, 104, 116, 120 | **2** | **B1** for one error FT other values or for 3 correct |
| (b)(ii) | Correct curve | **3** | **B1** for correct horizontal placement for 6 plots<br>**B1FT** for correct vertical placement for 6 plots<br>**B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 6 points<br><br>If 0 scored **SC1FT** for 5 out of 6 points correctly plotted |
| (b)(iii) | 27 to 27.5 | **1** | |
| (b)(iv) | 8.5 to 9.5 | **2** | **B1** for [UQ=] 32 to 32.5 or<br>[LQ=] 23 to 23.5 |
| (b)(v) | 8, 9, 10, 11 or 12 | **2** | **B1** for 108 to 112 seen or **B1FT** *their* graph reading at 37 mins seen |

Question 34

| | | | |
|---|---|---|---|
| (a)(i) | 42.8 or 42.79 … nfww | **4** | **M1** for mid-values soi<br><br>**M1** for $\Sigma fm$ where $m$ is any value in interval including boundaries<br><br>**M1** (dep on second **M1**) for *their* $\Sigma fm \div 120$ |
| (a)(ii) | Blocks of height 1.8 4.4 8 2.1 with correct widths | **4** | **B1** for each correct block<br>If **B0**, **SC1** for correct frequency densities seen |

| | | | |
|---|---|---|---|
| (b) | Valid general comment about distributions | **1** | e.g. [On average], shoppers spend less time shopping on Wednesday oe |

Question 35

| | | | |
|---|---|---|---|
| (a) | 100.2 nfww | **4** | **M1** for midpoints soi 65, 80, 95, 105, 112.5, 120<br>**M1** for use of $\sum fx$ with $x$ in correct interval including both boundaries<br>**M1**dep for $\sum fx \div 180$ dep on previous **M1** |
| (b) | 0.8<br>2.8<br>0.65 | **3** | **B1** for each<br>If zero scored, **SC1** for 1.6, 5.6 and 1.3 seen |
| (c) | 8 34 69 136 164 | **2** | **B1** for one error **FT** other values or for 3 or 4 correct |
| (d) | Correct diagram | **3** | **B1FT** for correct vertical placement for 6 plots<br>**B1** for correct horizontal placement for 6 plots<br>**B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 6 points<br>If zero scored, **SC1FT** for 5 out of 6 correct plots |
| (e)(i) | 15 to 17 | **2** | **B1** for [LQ =] 93 to 94 or [UQ =] 109 to 110 |
| (e)(ii) | 107 to 109 | **2** | **B1** for 126 seen |
| (e)(iii) | 66 to 72 | **2** | **FT** their graph for 2 marks<br>**B1** for answer 106 to 114<br>or **B1FT** *their* graph reading at 106 cm seen |

Question 36

| | | | |
|---|---|---|---|
| (a)(i) | 111.25 | **4** | **M1** for midpoints **soi**<br>(25, 75, 112.5, 137.5, 175)<br><br>**M1** for $\sum fx$ with $x$ in correct interval including both boundaries<br><br>**M1** (dep on 2nd **M1**) for $\sum fx \div 20$ |
| (a)(ii) | 2 7 11 17 | **2** | **B1** for three correct |
| (a)(iii) | $\frac{3}{20}$ oe | **1** | |

| | | | |
|---|---|---|---|
| '(b) | 20 6 | **2** | **B1** for one correct value or [SF = ] 5 or $\frac{1}{5}$ oe |
| '(c)(i) | 5 nfww | **3** | **M2** for $\sum fx \div \sum f = 4.28$ oe<br><br>or **M1** for $179 + 7x$ oe or $4.28 \times (45 + x)$ oe seen |
| (c)(ii) | 3 | **1** | |
| (c)(iii) | 4 | **1** | |

Question 37

| | | | |
|---|---|---|---|
| (a) | 40.5 or 40.45[8..] or 40.46 nfww | **4** | **M1** for 25, 32.5, 37.5, 50, 80 soi<br><br>**M1** for $\Sigma ft$<br><br>**M1 dep** for their $\Sigma ft \div 120$ |
| (b) | Fully correct histogram | **4** | **B1** for each correct bar<br><br>If 0 scored, **SC1** for frequency densities of 5.4, 4.2, 0.8 and 0.45 seen |

Question 38

| | | | |
|---|---|---|---|
| (a) | 12.8[0] | **4** | **M1** for midpoints **soi**<br><br>**M1** for use of $\sum fm$ with $m$ in correct interval including both boundaries<br><br>**M1** (dep on 2nd **M1**) for $\sum fm \div 100$ |
| (b) | 54 84 93 | **2** | **B1** for 2 correct or 1 error and 2 correct or **FT** |
| (c) | correct diagram with all points correctly plotted | **3** | **B1FT** *their* **(b)** for plots at 5 correct heights<br><br>**B1** for 5 points at upper ends of intervals on correct vertical line<br><br>**B1FT** (dep on at least **B1**) for increasing curve or polygon through 5 points<br><br>After 0 scored, **SC1FT** for 4 correct points plotted |

| | | | |
|---|---|---|---|
| )(d)(i) | 9 to 9.8 final answer | **1** | |
| )(d)(ii) | 8.5 to 11.5 | **2** | **B1** for [UQ =] 15.5 to 17.5 or [LQ =] 6 to 7 seen |
| (d)(iii) | 10, 11 or 12 | **2** | **B1** for 88 to 90 seen or for answer between 10 and 12 |

Question 39

| | | | |
|---|---|---|---|
| (a)(i) | range = 7 | **1** | |
| | mode = 21 | **1** | |
| | median = 22.5 | **2** | **M1** for evidence of middle value |
| | mean = 22.7 or 22.71… | **2** | **M1** for use of $\Sigma x \div 14$ |
| (a)(ii) | $\frac{3}{14}$ oe | **1** | |
| (b) | $x - n + 1$ final answer | **3** | **M2** for $nx - (n-1)(x+1)$<br>or **M1** for $(n-1)(x+1)$ |
| (c)(i) | 16.6 or 16.60 to 16.61 nfww | **4** | **M1** for 5, 12.5, 17.5, 22.5, 30 soi<br>**M1** for $\Sigma fx$ where $x$ is in correct interval, including boundaries<br>**M1 dep** on second M1 for $\frac{\Sigma fx}{50+85+100+120+10}$ |
| (c)(ii) | Correct histogram | **4** | **B1** for each correct block<br>If 0 scored, **SC1** for 5, 20, 24, 1 seen |

Question 40

| | | | |
|---|---|---|---|
| (a)(i) | 52 | **1** | |
| (a)(ii) | 36 | **1** | |
| (a)(iii) | 26 | **1** | **FT** 62 – *their* (a)(ii) evaluated correctly |
| (b) | Valid comment | **1** | Strict **FT** *their* (a)(iii), e.g. distances for females are more varied |
| (c) | $\frac{11}{20}$ oe | **2** | **M1** for 27 written or answer of $\frac{27}{60}$ oe |
| (d)(i) | [18 9] 14 12 5 [2] | **2** | **B1** for 1 correct value |

| | | | |
|---|---|---|---|
| (d)(ii) | 48.75 nfww | **4** | **M1** for midpoints soi<br>**M1** for use of $\sum fx$ with *their* frequencies<br>**M1** (dep on 2nd M1)<br>for $\sum fx \div$ (60 or by *their* $\sum f$) |

Question 41

| | | | |
|---|---|---|---|
| !(a)(i) | 54 | **1** | |
| (a)(ii) | 29 | **2** | **M1** for [UQ =] 65 or [LQ =] 36 |
| (a)(iii) | 32 | **1** | |
| (a)(iv) | 17, 18 or 19 | **2** | **M1** for 61 to 63 written<br>or for decimal answer in range 17 to 19 |
| !(b)(i) | 18, 26, 26 | **2** | **B1** for 1 or 2 correct |
| (b)(ii) | 51 nfww | **4** | **M1** for 10 , 30 , 50 , 70 , 90 soi<br>**M1** for $\Sigma fx$<br>**M1 dep** for *their* $\Sigma fx \div \Sigma f$ |
| !(c)(i) | 75 | **1** | |
| (c)(ii) | IQR is bigger for the girls with [boys =] 20 seen oe | **2** | **FT** *their* IQR from (a)(ii)<br>**M1** for IQR for boys = 20 isw<br>or for girls IQR is bigger than boys IQR oe isw<br>**FT** *their* IQR from (a)(iii) |

Question 42

| | | | |
|---|---|---|---|
| (a)(i) | 34 | **1** | |
| (a)(ii) | 18 | **2** | **B1** for [l.q. = ] 25 or [u.q. = ] 43 seen |
| a)(iii) | 60 | **2** | **M1** for 140 written |
| (b)(i) | 49 | **1** | |
| (b)(ii) | 20 | **1** | |
| b)(iii) | 10 | **1** | |
| b)(iv) | 220 | **2** | **M1** for<br>$3 \times 1 + 1 \times 2 + 3 \times 5 + 2 \times 10 + 4 \times 20 + 2 \times 50$ |
| (b)(v) | 14.7 or 14.66 to 14.67 | **1** | **FT** *their* (iv) ÷ 15 |

| | | | |
|---|---|---|---|
| (c) | 13.25 nfww | 6 | **B2** for frequencies 30, 40, 30 soi<br>or **B1** for 2 of these<br><br>**M1** for 5, 12.5, 22.5<br><br>**M1** $\Sigma fx$ with *their* frequencies (if seen) and each $x$ in correct interval including boundaries<br>**M1 dependent** for $\frac{\Sigma fx}{100}$ (dependent on second M1) |

Question 42

| | | | |
|---|---|---|---|
| (a) | correct diagram | 4 | **B1** for median line correctly drawn at 148<br>**B1** for 105 soi<br>**B1** for whisker at 159 soi |
| (b) | 6.48 | 3 | **M1** for $(5 \times 8) + (6 \times 2) + (12 \times 7) + \ldots$<br><br>**M1dep** for *their* $\sum fx \div$ *their* $(8 + 2 + 12 + 2 + 0 + 1)$ |

Question 43

| | | | |
|---|---|---|---|
| (a) | 41.4 | 4 | **M1** for 10, 30, 42.5, 47.5, 55, 70<br>**M1** for $\Sigma fx$ where $x$ lies in or on the boundary of each interval.<br>**M1 dep** for $\frac{\Sigma fx}{200}$ dep on second M1 |
| (b)(i) | 112, 170 | 1 | |
| (b)(ii) | Correct diagram | 3 | **B1** for correct horizontal plot<br>**B1FT** for correct vertical plots<br>**B1 FT** dep on at least B1 earned for reasonable increasing curve or polygon through their 6 points<br><br>If 0 scored **SC1FT** for 5 out of 6 points plotted correctly |
| (b)(iii)(a) | 48 | 1 | |
| (b)(iii)(b) | 160 | 2 | **M1** for 40 seen |

| | | | |
|---|---|---|---|
| (c) | $\frac{87}{3980}$ oe | **2** | **M1** for $\frac{30}{200}\times\frac{29}{199}$ oe |
| (d) | Correct histogram | **3** | **B1** for each column<br>If 0 scored **SC1** for correct frequency densities soi 1.25, 12, 1 |

Question 44

| | | | |
|---|---|---|---|
| (a)(i) | $1.5 < h \leqslant 1.6$ | **1** | |
| (a)(ii) | 1.62 or 1.623… nfww | **4** | **M1** for 1.35, 1.45, 1.55, 1.65, 1.75 1.85 soi<br>**M1** for $\Sigma fx$<br>**M1 dep** for *their* $\Sigma fx \div 120$ |
| (b)(i) | $\frac{14}{120}$ oe | **1** | |
| (b)(ii) | $\frac{21}{20060}$ oe | **4** | **M3** for $3\left(\frac{14}{120}\times\frac{7}{119}\times\frac{6}{118}\right)$<br>or **M2** for $\frac{14}{120}\times\frac{7}{119}\times\frac{6}{118}$ isw<br>or **M1** for $\frac{14}{120},\frac{7}{119},\frac{6}{118}$<br>After 0 scored, **SC1** for answer $\frac{343}{864000}$ or $\frac{343}{288000}$ oe |
| (c)(i) | 55, 79, 106, 120 | **2** | **B1** for 2 or 3 correct |
| (c)(ii) | Correct diagram | **3** | **B1** for correct horizontal plots<br>**B1FT** for correct vertical plots<br>**B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 6 points<br>If 0 scored **SC1** for 5 out of 6 points correctly plotted |
| (d)(i) | 1.62 to 1.63 | **1** | |
| (d)(ii) | 1.57 to 1.58 | **2** | **B1** for 48 soi |

Question 45

| | | | |
|---|---|---|---|
| (a)(i) | 43 | **1** | |
| (a)(ii) | 65 | **1** | |
| (a)(iii) | 13 | **1** | |
| (b) | 80 | **3** | **M2** for $\frac{400}{18}\times\frac{60\times60}{1000}$ oe<br>Or **M1** for $\frac{400}{18}$<br>or for *their* speed in m/s $\times\frac{60\times60}{1000}$<br>or for $\frac{400}{1000}$ and $\frac{18}{60\times60}$ soi |

Question 46

| | | | |
|---|---|---|---|
| (a)(i) | 25 | **1** | |
| (a)(ii) | 10 nfww | **2** | **B1** for [lq =] 22 or [uq =] 32 |
| (a)(iii) | 27 | **1** | |
| (a)(iv) | 6 | **2** | **B1** for 114 written |
| (b)(i) | 27.9 or 27.91 to 27.92 nfww | **4** | **M1** for mid-values<br>**M1** for $\sum fx$ where $x$ lies within or on boundary of correct interval<br>**M1 dep** $\sum fx \div 120$ dep on second M1 |
| (b)(ii) | 7.6 | **2** | **M1** for $\frac{18}{10}$ oe or $\frac{38}{20}$ oe<br>or **B1** for [multiplier] 4 or ¼ |

Question 47

| | | | |
|---|---|---|---|
| (a) | Disagree: the median for the women is greater (than the median for the men) oe<br><br>Disagree: the men have a smaller [interquartile] range of times oe | **2** | **B1** for each correct statement oe |

| | | | |
|---|---|---|---|
| (b)(i) | 87.4 nfww | **4** | **M1** for mid-points **soi** (30, 80, 130, 190, 270)<br>**M1** for use of $\Sigma fm$ with $m$ in correct interval including both boundaries<br><br>**M1** (dep on 2nd M1) for $\Sigma fm \div (41 + 24 + 23 + 8 + 4)$ |
| (b)(ii)(a) | 90 | **1** | |
| (b)(ii)(b) | 8 | **2** | **B1** for 92 seen |
| (b)(iii) | 2.4 | **2** | **M1** for $\frac{24}{40}$ or $\frac{8}{60}$<br>Or **B1** for [multiplier] 18 or $\frac{1}{18}$ |

Question 48

| | | | |
|---|---|---|---|
| (a)(i) | 70 | **1** | |
| (a)(ii) | 78 | **1** | |
| (a)(iii) | Value in range $86 < V \leq 90$ | **1** | |
| (a)(iv) | One general comment interpreting the median comparison nfww<br>e.g. Students did better on second test oe<br>OR<br>One general comment interpreting IQR/range comparison nfww<br>e.g. Students marks were more consistent on the 2nd test oe | **1** | |
| (b) | 31.2 | **4** | **M1** for mid-values soi<br><br>**M1** for $\Sigma fm$ where $m$ is any value in interval including boundaries<br><br>**M1** (dep on second **M1**) for *their* $\Sigma fm \div 50$ |
| (c)(i) | 38 | **1** | |
| (c)(ii) | Blocks of heights 4.4 and 3.4 with correct widths | **2** | **B1** for each correct block<br><br>If **B0** scored, **SC1** for both correct frequency densities soi |

Question 49

| | | | |
|---|---|---|---|
| (a)(i) | 4 | **1** | |
| (a)(ii) | 7 | **1** | |
| (a)(iii) | 8 | **1** | |
| (b)(i) | 14 | **1** | |
| (b)(ii) | 4 | **2** | **B1** for [ l.q. =] 11 or [u.q =] 15 |
| (c) | 8.09 | **3** | **M1** for $5 \times 3 + 10 \times 6 + 43 \times 7 + 75 \times 8 + 48 \times 9 + 21 \times 10$<br><br>**M1 dep** ÷ 200 |
| (d) | 30, 70, 40, 36, 24 seen | **B2** | **B1** for 3 or 4 correct<br>or<br>**M1** for $1 \times (80 - 50)$, $3.5 \times (100 - 80)$, $4 \times (110 - 100)$, $3.6 \times (120 - 110)$ and $0.6 \times (160 - 120)$ oe |
| | *(their* $30 \times 65$ + *their* $70 \times 90$ + *their* $40 \times 105$ + *their* $36 \times 115$ + *their* $24 \times 140) \div 200$ | **M3** | **M1** for midpoints soi<br>**M1** for $\Sigma fx$, $x$ in interval or boundary of interval<br>**M1 dep on second M1** for ÷ 200 |
| | 99.75 | **A1** | |

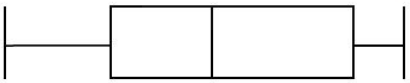
Question 50

| | | | |
|---|---|---|---|
| (a)(i) | Correct histogram | **3** | **B1** for each correct block<br>If 0 scored, **SC1** for any two of fds 7.5, 3.33…, 0.8 oe soi |
| (a)(ii) | 3.7875 or 3.79 or 3.787 or 3.788 | **4** | **M1** for 0.75, 1.5, 3, 5.5, 9.5 soi<br>**M1** for $\Sigma fx$<br>**M1 dep** for *their* $\Sigma fx \div 40$ |
| (a)(iii) | $\frac{11}{40}$ oe | **1** | |
| (a)(iv) | $\frac{30}{203}$ oe | **3** | **M2** for $[2\times]\frac{4}{29}\times\frac{15}{28}$ oe<br>or **M1** for $\frac{4}{29}$ or $\frac{15}{29}$ oe seen<br>After 0 scored, **SC1** for $[2\times]\left(\frac{4}{40}\times\frac{26}{39}\right)$ oe<br>or for answer $\frac{120}{841}$ oe |
| (b)(i) | 4.6 | **1** | |
| (b)(ii) | 3.2 | **1** | |
| (b)(iii) | [median] remains the same oe<br>and<br>one is below [the median/middle] and one is above oe | **2** | **B1** for each statement |

Question 51

| | | | |
|---|---|---|---|
| (a)(i) | 3 22 43 48 50 | **2** | **B1** for 4 correct<br>or **M1** for one error in adding. |
| (a)(ii) | correct diagram | **3** | **B1FT** *their* **(a)(i)** for 5 correct heights<br>**B1** for 5 points at upper ends of intervals on correct vertical line<br>**B1FT dep on at least B1** for increasing curve through *their 5* points<br><br>After 0 scored, **SC1** for 4 of *their* points correctly plotted |
| (a)(iii) | 35 to 38 | **1** | |
| (b) | Correct box-and-whisker diagram<br>  <br>1.45 1.57 1.64 1.71 1.83 | **4** | **B1** for median 1.64 drawn<br>**B1** for LQ 1.57 drawn<br>**B1** for UQ 1.71 drawn<br><br>If 0 scored **SC1** for 1.64, 1,57 or 1.71 seen |

Question 52

| | | | |
|---|---|---|---|
| (a)(i) | $\frac{60}{360}\times 600$ oe | **1** | |
| (a)(ii) | 45 | **2** | **M1** for $\frac{27}{360}\times 600$ oe |
| (a)(iii) | Correct straight line on the pie chart | **2** | **B1** for 75 |
| (b) | Correct diagram<br>  <br>0.6 3.4 5.2 7.5 8.7 | **3** | **B1** for any three of 0.6, 3.4, 5.2, 7.5, 8.7 correctly placed<br><br>**B1** for 7.5 and 8.7 seen |

| | | | |
|---|---|---|---|
| (c)(i) | 5 | **1** | |
| (c)(ii) | 2 | **1** | |
| (c)(iii) | 3 | **1** | |
| (d) | 39.2 | **4** | **M1** for mid-values soi<br>**M1** for $\Sigma fx$ with $x$ in correct interval including boundaries<br>**M1 dep** for $\frac{\Sigma fx}{50}$ dep on second M1 |

Question 53

| | | | |
|---|---|---|---|
| (a)(i) | 90 | **1** | |
| (a)(ii) | 68 | **1** | |
| (a)(iii) | 52 | **1** | **FT** 120 – *their* (a)(ii) |
| (a)(iv) | 20 | **2** | **B1** for 60 in working or as answer |
| (b)(i) | 97.5 | **4** | **M1** for mid-points soi<br>(50, 70, 90, 115, 145, 180)<br>**M1** for use of $\Sigma fm$ with $m$ in correct interval including both boundaries<br>**M1** for (dep on 2nd M1) for $\Sigma fm \div 80$ |
| (b)(ii) | Bars with heights 0.9, 0.5, 0.3, 0.175 and with correct widths | **4** | **B1** for each correct bar<br>If 0 scored, **SC1** for 3 or 4 correct frequency densities |
| (b)(ii) | Bars with heights 0.9, 0.5, 0.3, 0.175 and with correct widths | **4** | **B1** for each correct bar<br>If 0 scored, **SC1** for 3 or 4 correct frequency densities |
| (b)(iii) | $\frac{28}{395}$ oe | **3** | **M2** for [2 ×] $\frac{16}{80}\times\frac{14}{79}$ oe<br>or **M1** for $\frac{16}{80}$ or $\frac{16}{79}$ oe or $\frac{14}{80}$ oe or $\frac{14}{79}$ oe seen<br>If 0 scored, **SC1** for answer $\frac{7}{100}$ oe |

Question 54

| | | | |
|---|---|---|---|
| (a) | Correct box-and-whisker plot | **4** | **B1** for lowest value and highest value at 30 and 90<br>**B1** for LQ and UQ at 50 and 72<br>**B1** for median at 63 |
| (b)(i) | 56 | **2** | **M1** for 24 soi |
| (b)(ii) | 16 | **2** | **B1** for 64 written |
| (c)(i) | 14, 22 | **1** | |
| (c)(ii) | 61.5 | **4** | **M1** for 35, 45, 55, 65, 75, 85 soi<br>**M1** for $\Sigma fx$<br>**M1 dep** for *their* $\Sigma fx \div (8 + 12 +$ *their* $14 +$ *their* $22 + 14 + 10)$ or $\Sigma fx \div 80$ |
| (c)(iii) | $\frac{35}{69}$ oe | **3** | **M2** for $[2]\left(\frac{10}{24}\times\frac{14}{23}\right)$ oe<br>or **M1** for $\frac{10}{24}$ or $\frac{14}{24}$ oe seen<br>If 0 scored, **SC1** for answer $\frac{35}{72}$ oe |

Question 55

| | | | |
|---|---|---|---|
| (a) | 121 or 120.8… or $120\frac{5}{6}$ | **4** | **M1** for midpoints soi<br><br>**M1** for use of $\sum fx$ with $x$ in correct interval including both boundaries but **not** if $x$ is 50, 50, 100 and 300<br><br>**M1** (dep on 2nd M1) for $\sum fx \div 120$ |
| (b) | 12.4 5 1.4 | **3** | **B1** for each<br>If 0 scored **SC1** for fd's [0.86,] 0.62, 0.25 and 0.07 oe |
| (c) | 43 74 99 120 | **2** | **B1** for 2 or 3 correct |
| (d) | Correct diagram | **3** | **B1** for correct horizontal placement for 4 plots<br>**B1FT** for correct vertical placement for 4 plots<br>**B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 4 points<br><br>If 0 scored **SC1 FT** for 3 out of 4 points correctly plotted |
| (e)(i) | Strict FT *their* **median** reading | **1** | |
| (e)(ii) | Strict FT *their* **UQ** reading | **1** | |
| (e)(iii) | Strict FT *their* reading at **40th percentile** | **2** | **B1** for 48 written or mark at cf = 48 on graph |
| (e)(iv) | Strict FT *their* reading at 400 – *their* reading at 250 | **2** | **B1** for either correct reading at 250 or 400 |

Question 56

| | | | |
|---|---|---|---|
| (a) | 25.2 or 25.23… | **4** | **M1** for midpoints **soi**<br>**M1** for use of $\sum fx$ with $x$ in correct interval including both boundaries<br>**M1** (**dep** on 2nd M1) for $\sum fx \div 150$ |
| (b) | 5 correct blocks | **4** | **B3** for 4 correct blocks<br>or **B2** for 3 correct blocks<br>or **B1** for 2 correct blocks<br>or block widths 10, 10, 5, 15, 10<br>If 0 scored **SC1** for 4 correct frequency densities from 1.2, 3.8, 6.4, 3.33[3…] and 1.8 oe soi |
| (c)(i) | 12, 50, 82, 132, 150 | **2** | **B1** for 3 or 4 correct |
| (c)(ii) | 92 | **2** | **M1** for $150 - 12$ oe seen<br>If 0 scored, **SC1** for answer 8[%] |

Question 57

| | | | |
|---|---|---|---|
| (a)(i) | 1 \| 7 7 8 8 9 9<br>2 \| 1 1 1 1 2 3 3 4 5 | **2** | **B1** for one row correctly ordered or for fully correct unordered stem-and-leaf diagram or for a correct diagram with one error or omission |
| (a)(ii) | 21 | **1** | |
| (a)(iii) | 23 | **1** | |
| (a)(iv) | 48 | **2** | **M1** for $\frac{2}{15}[\times 360]$ or $\frac{360}{15}[\times 2]$ |
| (b)(i) | 120 | **1** | |
| (b)(ii) | 130 | **1** | |
| (b)(iii) | 60 | **1** | |
| (c)(i) | 93.4 | **4** | **M1** for mid-values soi<br>**M1** for $\Sigma fx$<br>**M1 dep on second M** for $\Sigma fx \div 200$ |
| (c)(ii) | 19 | **2** | **M1** for $\frac{86}{50}$ or $\frac{114}{60}$ |

Question 58

| | | | |
|---|---|---|---|
| (a) | Correct histogram | **3** | **B1** for each correct block<br>If 0 scored, **SC1** for two of $\frac{28}{15}$, $\frac{33}{20}$, $\frac{13}{10}$ or 1.87 or 1.866 to 1.867, 1.65, 1.3 |
| (b) | 38.65 | **4** | **M1** for 12.5, 20, 32.5, 50, 65 soi<br>**M1** for $\sum fx$ where $x$ is in the correct interval including boundaries<br>**M1dep** for $\sum fx \div 100$ |

Question 59

| | | | |
|---|---|---|---|
| (a)(i) | 211.275 | **4** | **M1** for mid-points **soi**<br>(90, 125, 175, 250, 350)<br><br>**M1** for use of $\Sigma fm$ with $m$ in correct interval including both boundaries<br><br>**M1** for (dep on 2nd M1) for $\Sigma fm \div 200$ |
| (a)(ii) | $32 \times 350 - 32 \times 330$ oe or better, or the reverse of this | **M1** | |
| | 3.2 or – 3.2 final answer | **B1** | |
| (a)(iii) | 1.75<br><br>7.6<br><br>1.6 | **3** | **B2** for two correct heights<br>or **B1** for one correct height or 3 correct frequency densities<br><br>or **M1** for scale factor of 5 or 0.2 |
| (b) | $\frac{4}{25}$ oe | **1** | |
| (c)(i) | $\frac{39}{995}$ oe | **2** | **M1** for $\frac{40}{200} \times \frac{39}{199}$ oe |
| (c)(ii) | $\frac{147}{4975}$ oe | **3** | **M2** for [2×] $\frac{84}{200} \times \frac{7}{199}$ oe<br>or **B1** for $\frac{84}{200}$ and $\frac{7}{199}$ or $\frac{84}{199}$ and $\frac{7}{200}$ oe<br>If 0 scored, **SC1** for answer $\frac{147}{5000}$ oe |

Question 60

| | | | |
|---|---|---|---|
| (a)(i) | 9.4 | **1** | |
| (a)(ii) | 2.4 | **2** | **B1** for [uq =] 10.4 or [lq =] 8 but not as final answer |
| (a)(iii) | 18 | **2** | **B1** for 82 seen |
| (b)(i) | 34.65 or $34\frac{13}{20}$ | **4** | **M1** for midpoints 10, 25, 32.5, 40, 52.5 soi<br>**M1** for $\Sigma fx$ where values of $x$ are in interval or on boundary<br>**M1 dep on second M** for $\frac{\Sigma fx}{150}$ |
| (b)(ii) | 0.3, 5.7, ..., 7.95, 1.5 | **3** | **B2** for any two correct<br>or **B1** for one correct or for at least three frequency densities seen 0.2, 3.8, 8, 5.3, 1 oe<br>or **M1** for [factor] 1.5 |
| (b)(iii) | $\frac{7}{745}$ oe | **2** | **M1** for $\frac{15}{150} \times \frac{14}{149}$ |

Question 61

| | | | |
|---|---|---|---|
| (a)(i) | 7 | **1** | |
| (a)(ii) | 8 | **1** | |
| (a)(iii) | 8.31 | **3** | **M1** for $3\times6 + 32\times7 + 19\times8 + 29\times9 + 11\times10 + 6\times11$ oe<br>**M1dep on M1** for $\frac{\sum fx}{100}$ |
| (a)(iv) | $\frac{23}{110}$ oe | **2** | **M1** for $\frac{k}{100}\times\frac{k-1}{99}$ oe, $k < 100$<br>or **B1** for $\frac{46}{100}$ and $\frac{45}{99}$ |
| (b)(i) | 53 | **1** | |
| (b)(ii) | 20 | **1** | |
| (c)(i) | 151.975 | **4** | **M1** for 80, 155, 250 soi<br>**M1** for $\sum fx$ where $x$ is in correct interval including boundaries<br>**M1 dep** for $\frac{\sum fx}{200}$ dep on second M1 |
| (c)(ii) | Correct histogram completed with widths 110 to 200 and 200 to 300 and heights 1.1 and 0.41 | **2** | **B1** for one correct block<br>If 0 scored, **SC1** for 1.1 and 0.41 seen |

Question 62

| | | | |
|---|---|---|---|
| (a)(i) | Correct curve | **3** | **B1** for correct horizontal placement for 6 plots<br>**B1** for correct vertical placement for 6 plots<br>**B1 dep on at least B1** for reasonable increasing curve through *their* 6 points<br>If 0 scored, **SC1** for 4 out of 6 points correctly plotted |
| (a)(ii)(a) | 87 to 89.5 | **1** | |
| (a)(ii)(b) | 12.5 to 14 | **2** | **B1** for [LQ =] 80.5 to 81.5 or [UQ =] 94 to 94.5 |
| (a)(ii)(c) | Strict FT, 200 – *their* cumul freq reading from *their* graph at 110 given to nearest integer | **2** | **B1FT** for correct cumul freq at 110 seen or for non-integer answer |

| | | | |
|---|---|---|---|
| (b)(i) | 3576 | **4** | **M1** for midpoints soi<br>**M1** for use of $\sum fx$ where $x$ is in the correct interval including boundaries<br>**M1** (dep on 2nd **M1**) for $\sum fx \div 50$ |
| (b)(ii) | 5 3.2 3 | **3** | **B1** for each<br><br>If 0 scored, **SC1** for 3 frequency densities<br>$\frac{12}{600}, \frac{15}{900}, \frac{16}{1500}, \frac{7}{700}$ seen oe to 3sf or better<br>or multiplier 3 or 300 |

Question 63

| | | | |
|---|---|---|---|
| (a)(i) | 1 \| 3 5 7 8<br>2 \| 1 1 2 7 8 9<br>3 \| 1 1 1 8<br><br>1 \| 7 represents 17 [messages] | **3** | **B2** for fully correct stem-and-leaf diagram<br><br>OR<br>**B1** for two rows correct or for fully correct unordered stem-and-leaf diagram or for a correct diagram with one error or omission<br><br>**B1** for correct key |
| (a)(ii) | 24.5 | **1** | |
| (a)(iii) | 31 | **1** | |
| (a)(iv) | 25 | **1** | |
| (b) | $\frac{14}{33}$ oe | **2** | **M1** for $\frac{8}{12} \times \frac{7}{11}$ |

Question 64

| | | | |
|---|---|---|---|
| (a)(i) | $1.65 < h \leq 1.8$ | **1** | |
| (a)(ii) | 1.63875 | **4** | **M1** for midpoints **soi**<br><br>**M1** for use of $\sum fh$ with $h$ in correct interval including both boundaries<br><br>**M1dep on 2nd M1** for $\sum fh \div 80$ |
| (b)(i) | $\frac{1}{40}$ oe | **1** | |
| (b)(ii) | $\frac{63}{395}$ oe | **3** | **M2** for $\frac{56}{80} \times \frac{9}{79}$ [×2] oe<br>or **B1** for $\frac{56}{80}$ or $\frac{9}{79}$ or $\frac{9}{80}$ or $\frac{56}{79}$ oe seen<br><br>If 0 or B1 scored, instead award **SC2** for answer $\frac{117}{632}$ oe<br>or **SC1** for answer $\frac{63}{400}$ oe |
| (c)(i) | 15, 39, 71, 80 | **2** | **B1** for 3 correct<br>or **M1** for 1 error in addition with other values then consistent |
| (c)(ii) | Correct curve | **3** | **B1** for correct horizontal placement for 5 plots<br>**B1FT** for correct vertical placement for 5 plots<br>**B1FT dep on at least B1** for reasonable increasing curve or polygon through *their* 5 points<br><br>If 0 scored **SC1 FT** for 4 out of 5 points correctly plotted |
| (d)(i) | Strict FT *their* UQ – *their* LQ | **2dep** | **B1dep** for *their* UQ or *their* LQ seen<br>Dep on increasing curve/polygon for 2 marks or B1 |
| (d)(ii) | Strict FT *their* reading at 48 | **2dep** | **B1** for 48 written |

Question 66

| | | | |
|---|---|---|---|
| (a)(i) | 55.87 | **4** | **M1** for midpoints soi<br><br>**M1** for use of $\sum fm$ where $m$ is in the correct interval including boundaries<br><br>**M1** (dep on 2nd M1) for $\sum fm \div 1000$ |
| (a)(ii) | $\frac{177}{500}$ cao | **2** | **M1** for $\frac{154+200}{1000}$ oe |