



**General Certificate of Education (A-level)**  
**January 2012**

**Mathematics**

**MS/SS1A**

**(Specification 6360)**

**Statistics 1A**

**Final**

***Mark Scheme***

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## Key to mark scheme abbreviations

|              |                                                                    |
|--------------|--------------------------------------------------------------------|
| M            | mark is for method                                                 |
| m or dM      | mark is dependent on one or more M marks and is for method         |
| A            | mark is dependent on M or m marks and is for accuracy              |
| B            | mark is independent of M or m marks and is for method and accuracy |
| E            | mark is for explanation                                            |
| ✓ or ft or F | follow through from previous incorrect result                      |
| CAO          | correct answer only                                                |
| CSO          | correct solution only                                              |
| AWFW         | anything which falls within                                        |
| AWRT         | anything which rounds to                                           |
| ACF          | any correct form                                                   |
| AG           | answer given                                                       |
| SC           | special case                                                       |
| OE           | or equivalent                                                      |
| A2,1         | 2 or 1 (or 0) accuracy marks                                       |
| –x EE        | deduct x marks for each error                                      |
| NMS          | no method shown                                                    |
| PI           | possibly implied                                                   |
| SCA          | substantially correct approach                                     |
| c            | candidate                                                          |
| sf           | significant figure(s)                                              |
| dp           | decimal place(s)                                                   |

## No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

**Otherwise we require evidence of a correct method for any marks to be awarded.**

## MS/SS1A/W

| Q            | Solution                                                                                                                                                                                                       | Marks                  | Total     | Comments                                                                                                                                                                                                                                                                                                             |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b>     |                                                                                                                                                                                                                |                        |           |                                                                                                                                                                                                                                                                                                                      |
| <b>(a)</b>   | $U \sim B(40, 0.15)$                                                                                                                                                                                           | M1                     |           | Used somewhere in (a)                                                                                                                                                                                                                                                                                                |
| <b>(i)</b>   | $P(U = 6) = 0.6067 - 0.4325$<br>or<br>$= \binom{40}{6} (0.15)^6 (0.85)^{34}$<br>$= 0.174$                                                                                                                      | M1<br><br>A1           | 3         | Accept 3 dp rounding or truncation<br><br>Can be implied by a correct answer<br>AWRT (0.1742)                                                                                                                                                                                                                        |
| <b>(ii)</b>  | $P(U \leq 5) = 0.432 \text{ to } 0.433$                                                                                                                                                                        | B1                     | 1         | AWFW (0.4325)                                                                                                                                                                                                                                                                                                        |
| <b>(iii)</b> | See supplementary sheet for individual probabilities                                                                                                                                                           |                        |           |                                                                                                                                                                                                                                                                                                                      |
|              | $P(5 < U < 10) = 0.9328 \text{ or } 0.9701 \quad (p_1)$<br><br>MINUS $0.4325 \text{ or } 0.2633 \quad (p_2)$<br>$= 0.5(00) \text{ to } 0.501$                                                                  | M1<br><br>M1<br><br>A1 | 3         | Accept 3 dp rounding or truncation<br>but allow 0.97<br>$p_2 - p_1 \Rightarrow$ M0 M0 A0<br>$(1 - p_2) - p_1 \Rightarrow$ M0 M0 A0<br>$p_1 - (1 - p_2) \Rightarrow$ M1 M0 A0<br>$(1 - p_2) - (1 - p_1) \Rightarrow$ M1 M1 (A1)<br>only providing result $> 0$<br>Accept 3 dp rounding or truncation<br>AWFW (0.5003) |
| <b>(b)</b>   | Mean or $\mu = 32 \times 0.15 = 4.8$<br><br>(V or $\sigma^2 =$ ) $\frac{32 \times 0.15 \times 0.85}{}$<br>or<br>(SD or $\sigma =$ ) $\frac{\sqrt{32 \times 0.15 \times 0.85}}{}$<br><br>(SD or $\sigma = 2.02$ | B1<br><br>M1<br><br>A1 | 3         | CAO<br><br>Either numerical expression; ignore terminology<br>May be implied by 4.08 CAO seen<br>or 2.02 AWRT seen<br><br>AWRT (2.0199)<br>Do not award if labelled V or $\sigma^2$                                                                                                                                  |
|              |                                                                                                                                                                                                                |                        |           |                                                                                                                                                                                                                                                                                                                      |
|              |                                                                                                                                                                                                                | <b>Total</b>           | <b>10</b> |                                                                                                                                                                                                                                                                                                                      |

**MS/SS1A/W (cont)**

| <b>Q</b>                  | <b>Solution</b>                                                                                                                                                                                                        | <b>Marks</b>                            | <b>Total</b> | <b>Comments</b>                                                                                                                                                                                                                                                         |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>2(a)</b><br><b>(i)</b> | <p>Weight, <math>X \sim N(2200, 160^2)</math></p> $P(X < 2500) = P\left(Z < \frac{2500 - 2200}{160}\right)$ $= P(Z < 1.87 \text{ to } 1.88)$ $= 0.969 \text{ to } 0.97(0)$                                             | <p>M1</p> <p>A1</p> <p>A1</p>           | 3            | <p>Standardising 2500 with 2200 and 160; allow (2200 – 2500)</p> <p>AWFW; ignore inequality and sign<br/>May be implied by a correct answer</p> <p>AWFW (0.96960)</p>                                                                                                   |
| <b>(ii)</b>               | $P(X > 2000) = P(Z > -1.25)$ $= P(Z < +1.25)$ $= 0.894 \text{ to } 0.895$                                                                                                                                              | <p>M1</p> <p>A1</p>                     | 2            | <p>Area change<br/>May be implied by a correct answer<br/>or an answer &gt; 0.5</p> <p>AWFW (0.89435)</p>                                                                                                                                                               |
| <b>(iii)</b>              | $P(2000 < X < 2500) = (i) - (1 - (ii))$ $= 0.96960 - (1 - 0.89435) = 0.863 \text{ to } 0.865$ <p><b>Note:</b><br/>If (ii) is 0.105 to 0.106, then<br/>(0.96960 – 0.10565) = 0.86395 <math>\Rightarrow</math> M0 A0</p> | <p>M1</p> <p>A1</p>                     | 2            | <p>OE; allow new start ignoring (i) &amp; (ii)<br/>Allow even if incorrect standardising<br/>providing <math>0 &lt; \text{answer} &lt; 1</math><br/>May be implied by a correct answer</p> <p>AWFW (0.86395)</p>                                                        |
| <b>(b)</b>                | $10\% \Rightarrow 90\% (0.90) \Rightarrow z = 1.28$ $z = \frac{1000 - 1125}{\sigma}$ $= -1.2816$ $\sigma = 97 \text{ to } 98$ <p><b>Note:</b><br/>Inconsistent signs <math>\Rightarrow</math> B1 M1 A1 A0 max</p>      | <p>B1</p> <p>M1</p> <p>A1</p> <p>A1</p> | 4            | <p>AWRT (1.2816)</p> <p>Standardising 1000 with 1125<br/>and <math>\sigma</math>; allow (1125 – 1000)</p> <p>Only allow: <math>\pm 1.28</math><br/><math>\pm 1.64 \text{ to } \pm 1.65</math><br/><math>\pm 2.32 \text{ to } \pm 2.33</math></p> <p>AWFW (97.53433)</p> |
|                           |                                                                                                                                                                                                                        |                                         |              |                                                                                                                                                                                                                                                                         |
|                           |                                                                                                                                                                                                                        | <b>Total</b>                            | <b>11</b>    |                                                                                                                                                                                                                                                                         |

## MS/SS1A/W (cont)

| Q          | Solution                                                                                                                                                                                                              | Marks                                       | Total                 | Comments                                                                                                                                                                                             |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>3</b>   | See supplementary sheet for alternative solutions and additional guidelines to parts (a), (c) and (d)                                                                                                                 |                                             |                       |                                                                                                                                                                                                      |
| <b>(a)</b> | $b$ (gradient) = $-0.076$<br>$b$ (gradient) = $-0.07$ to $-0.08$<br><br>$a$ (intercept) = $5.35$ to $5.36$<br>$a$ (intercept) = $5.1$ to $5.6$<br><br>Thus $y = (5.35 \text{ to } 5.36) - 0.076x$                     | <br>B2<br>(B1)<br><br>B2<br>(B1)<br><br>BF1 | <br><br><br><br><br>5 | <br>AWRT; including $-ve$ sign ( $-0.07582$ )<br>AWFW; including $-ve$ sign<br><i>Treat rounding of correct answers as ISW</i><br>AWFW ( $5.35385$ )<br>AWFW<br><br>F on $a$ and $b$ even if rounded |
| <b>(b)</b> | $a$ : calorific value of wood with zero/no moisture or dry maximum calorific value<br><br>$b$ : each 1(%) rise in moisture content reduces calorific value by $0.076$ MWh/tonne<br><br>As $x$ increases $y$ decreases | <br>B1<br><br>B2<br>(B1)                    | <br><br>3             | <br>OE; $a \leq 0 \Rightarrow B0$<br><br>In context and with values; F on $b$<br>$b \geq 0 \Rightarrow B0$<br><br>Negative relationship/correlation                                                  |
| <b>(c)</b> | $y_{27} = 3.28$ to $3.32$<br>$= 2.5$ to $3.5$                                                                                                                                                                         | <br>B2<br>(B1)                              | <br>2                 | <br>AWFW ( $3.30659$ )<br>AWFW; even if by interpolation from original data giving likely values of $3$ or $3.04$                                                                                    |
| <b>(d)</b> | $r(35, 2.5) = -0.21$ to $-0.19$<br>$= 0.1$ to $0.3$                                                                                                                                                                   | <br>B2<br>(B1)                              | <br>2                 | <br>AWFW; including $-ve$ sign ( $-0.20000$ )<br>AWFW; ignore sign                                                                                                                                   |
| <b>(e)</b> | Good/reasonable/accurate/correct/etc<br><br>Accept more positive qualifying adjectives                                                                                                                                | <br>B1                                      | <br>1                 | <br>OE; ignore reasoning<br><br>Very good (B1) Not good (B0)                                                                                                                                         |
|            |                                                                                                                                                                                                                       |                                             |                       |                                                                                                                                                                                                      |
|            |                                                                                                                                                                                                                       |                                             | <b>13</b>             |                                                                                                                                                                                                      |

## MS/SS1A/W (cont)

| Q      | Solution                                                                                                                                                                                                                                                                                                             | Marks                              | Total | Comments                                      |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------|-----------------------------------------------|-------|---|------|------|------|----|------|------|------|-------|------|------|------|----|--|-----------------------------------|
| 4      | See supplementary sheet for alternative solutions to parts (a)(i) and (b)(ii)                                                                                                                                                                                                                                        |                                    |       |                                               |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
|        | (a)(i) Table Method<br>(2- way with either R or C totals)<br><table><tr><td></td><td>A</td><td>A'</td><td>Total</td></tr><tr><td>E</td><td>0.55</td><td>0.05</td><td>0.60</td></tr><tr><td>E'</td><td>0.30</td><td>0.10</td><td>0.40</td></tr><tr><td>Total</td><td>0.85</td><td>0.15</td><td>1.00</td></tr></table> |                                    | A     | A'                                            | Total | E | 0.55 | 0.05 | 0.60 | E' | 0.30 | 0.10 | 0.40 | Total | 0.85 | 0.15 | 1.00 | B1 |  | 0.15 or 0.4; CAO; allow fractions |
|        |                                                                                                                                                                                                                                                                                                                      |                                    | A     | A'                                            | Total |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
|        |                                                                                                                                                                                                                                                                                                                      | E                                  | 0.55  | 0.05                                          | 0.60  |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
|        |                                                                                                                                                                                                                                                                                                                      | E'                                 | 0.30  | 0.10                                          | 0.40  |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
| Total  | 0.85                                                                                                                                                                                                                                                                                                                 | 0.15                               | 1.00  |                                               |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
| B1     |                                                                                                                                                                                                                                                                                                                      | 0.05 and 0.3; CAO; allow fractions |       |                                               |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
| Bdep1  | 3                                                                                                                                                                                                                                                                                                                    | 0.1; AG so dependent on B1 B1      |       |                                               |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
| (ii)   | $P(\geq 1) = 0.9$ or $9/10$                                                                                                                                                                                                                                                                                          | B1                                 | 1     | CAO                                           |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
| (iii)  | $P(1) = 0.3 + 0.05 = 1 - (0.55 + 0.10)$<br>$= 0.35$ or $35/100$ or $7/20$                                                                                                                                                                                                                                            | B1                                 | 1     | CAO                                           |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
| (b)(i) | $P(3) = 0.55 \times 0.30$<br><br>$= 0.165$ or $165/1000$ or $33/200$                                                                                                                                                                                                                                                 | B1                                 |       | OE; implied by correct answer                 |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
|        |                                                                                                                                                                                                                                                                                                                      | B1                                 | 2     | CAO                                           |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
| (ii)   | $0.55 \times (1 - 0.3)$ or $0.385$<br><br>or $(0.3 \times 0.75)$ or $0.225$<br>or $(0.05 \times 0.75)$ or $0.0375$<br>or $(0.35 \times 0.75)$ or $0.2625$<br><br>$(0.385 + 0.2625) + 0.165$<br><br>$= 0.812$ to $0.813$                                                                                              | M1                                 |       |                                               |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
|        |                                                                                                                                                                                                                                                                                                                      | M1                                 |       | At least one of these expressions or values   |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
|        |                                                                                                                                                                                                                                                                                                                      | B1                                 |       | OE; implied by correct answer                 |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
|        |                                                                                                                                                                                                                                                                                                                      | A1                                 | 4     | AWFW (0.8125)<br>CAO; for equivalent fraction |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
|        |                                                                                                                                                                                                                                                                                                                      |                                    |       |                                               |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |
|        |                                                                                                                                                                                                                                                                                                                      | Total                              | 11    |                                               |       |   |      |      |      |    |      |      |      |       |      |      |      |    |  |                                   |

| Q        | Solution                                                                                                                                                   | Marks                      | Total    | Comments                                                                      |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------|-------------------------------------------------------------------------------|
| <b>5</b> | $151.5 \text{ cm} = 1.515 \text{ m} \approx 1.5 \text{ m}$<br><br>Thus (could be) correct<br><br>$n \times 26.6 > 10$<br><br>Thus (likely to be) incorrect | B1<br>Bdep1<br>B1<br>Bdep1 | 4        | OE<br>OE; dependent on B1<br>OE; accept any $n \geq 1$<br>OE; dependent on B1 |
|          |                                                                                                                                                            |                            |          |                                                                               |
|          |                                                                                                                                                            |                            | <b>4</b> |                                                                               |

## MS/SS1A/W (cont)

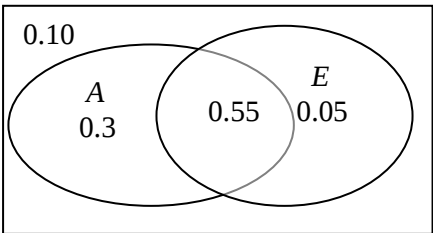
| Q      | Solution                                                                                                                                                                                               | Marks        | Total     | Comments                                                                                                                                                                                                       |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6(a)   | See supplementary sheet for alternative solutions                                                                                                                                                      |              |           |                                                                                                                                                                                                                |
|        | $\bar{x} - ns = (45.8 - n \times 24.0) < 0$<br>SC: Accept quoted values of<br>(-4 to -1) ( $n = 2$ ) or<br>(-28.5 to -23.5) ( $n = 3$ ) (both AFWF) and<br>negative salaries are impossible            | M1<br><br>A1 | 2         | Allow (45 to 47) and any multiple of (23.5 to 24.5) which gives value $< 0$<br>Must clearly state the value of a numerical expression<br>OE; must be in context<br>Negative values impossible $\Rightarrow$ A0 |
| (b)(i) | Large sample or $n > 25$ or 30 or $n = 50$<br>so                                                                                                                                                       | B1           |           | OE                                                                                                                                                                                                             |
|        | CLT applies                                                                                                                                                                                            | Bdep1        | 2         | Must indicate CLT; dependent on B1<br>Indication that other than sample mean is normally distributed $\Rightarrow$ Bdep0                                                                                       |
| (ii)   | 99% (0.99) $\Rightarrow z = 2.57$ to 2.58                                                                                                                                                              | B1           |           | AWFW (2.5758)                                                                                                                                                                                                  |
|        | CI for $\mu$ is $\bar{x} \pm z \times \frac{s}{\sqrt{n}}$                                                                                                                                              | M1           |           | Used with (45.8 & 24.0) and $z(1.64 \text{ to } 2.58)$ & $\div \sqrt{n}$ with $n > 1$                                                                                                                          |
|        | Thus $45.8 \pm 2.5758 \times \frac{24.0}{\sqrt{50}}$                                                                                                                                                   | AF1          |           | F on $z(1.64 \text{ to } 1.65 \text{ or } 2.32 \text{ to } 2.33 \text{ or } 2.57 \text{ to } 2.58)$ and $\div \sqrt{50 \text{ or } 49}$                                                                        |
|        | Hence $45.8 \pm (8.7 \text{ to } 8.8)$<br>or $45800 \pm (8700 \text{ to } 8800)$<br>OR<br>$(37.0) \text{ to } 37.1, 54.5 \text{ to } 54.6)$<br>or $(37000 \text{ to } 37100, 54500 \text{ to } 54600)$ | A1           | 4         | CAO/AFWF (8.74)<br>Ignore (absence of) quoted units<br>AFWF                                                                                                                                                    |
| (c)    | See supplementary sheet for additional illustrations                                                                                                                                                   |              |           |                                                                                                                                                                                                                |
|        | Clear correct comparison of 55 or 55000 with c's UCL or CI                                                                                                                                             | B1           |           | Accept 55000 compared with c's 54.5 to 54.6 (ie different units)                                                                                                                                               |
|        | (6/50 or 0.12 or 12%) $</\neq$ 0.25 or 25%                                                                                                                                                             | B1           |           | OE; correct comparison mentioning both 12% and 25%                                                                                                                                                             |
|        | Reject both/each of the two claims                                                                                                                                                                     | Bdep1        | 3         | Dependent on B1 B1                                                                                                                                                                                             |
|        |                                                                                                                                                                                                        |              |           |                                                                                                                                                                                                                |
|        |                                                                                                                                                                                                        | <b>Total</b> | <b>11</b> |                                                                                                                                                                                                                |

## MS/SS1A/W (cont)

| Q          | Solution                                                                                                                                                                                                                                              | Marks  | Total  | Comments                           |        |          |   |      |            |          |        |        |        |        |          |  |  |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|------------------------------------|--------|----------|---|------|------------|----------|--------|--------|--------|--------|----------|--|--|
| 1          | Alternative solution                                                                                                                                                                                                                                  |        |        |                                    |        |          |   |      |            |          |        |        |        |        |          |  |  |
| (a)(iii)   | B(40, 0.15) expressions stated for at least 3 terms within $5 \leq U \leq 10$ gives probability = 0.5(00) to 0.501                                                                                                                                    | M2     |        | Can be implied by a correct answer |        |          |   |      |            |          |        |        |        |        |          |  |  |
|            |                                                                                                                                                                                                                                                       | A1     | 3      | AWFW (0.5003)                      |        |          |   |      |            |          |        |        |        |        |          |  |  |
|            | <table><tr><td><math>u</math></td><td>(5)</td><td>6</td><td>7</td><td>8</td><td>9</td><td>(10)</td></tr><tr><td><math>P(U = u)</math></td><td>(0.1692)</td><td>0.1742</td><td>0.1492</td><td>0.1087</td><td>0.0682</td><td>(0.0373)</td></tr></table> | $u$    | (5)    | 6                                  | 7      | 8        | 9 | (10) | $P(U = u)$ | (0.1692) | 0.1742 | 0.1492 | 0.1087 | 0.0682 | (0.0373) |  |  |
| $u$        | (5)                                                                                                                                                                                                                                                   | 6      | 7      | 8                                  | 9      | (10)     |   |      |            |          |        |        |        |        |          |  |  |
| $P(U = u)$ | (0.1692)                                                                                                                                                                                                                                              | 0.1742 | 0.1492 | 0.1087                             | 0.0682 | (0.0373) |   |      |            |          |        |        |        |        |          |  |  |
|            |                                                                                                                                                                                                                                                       |        |        |                                    |        |          |   |      |            |          |        |        |        |        |          |  |  |

| Q                          | Solution                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Marks                               | Total                                | Comments                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>3</b><br><br><b>(a)</b> | <b>Alternative solutions and additional guidelines</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                     |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                            | <p>Attempt at <math>\sum x</math> <math>\sum x^2</math> <math>\sum y</math> &amp; <math>\sum xy</math> (<math>\sum y^2</math>)</p> <p><b>or</b></p> <p>Attempt at <math>S_{xx}</math> &amp; <math>S_{xy}</math> (<math>S_{yy}</math>)</p> <p>Attempt at correct formula for <math>b</math> (gradient)<br/> <math>b</math> (gradient) = <math>-0.076</math><br/> <math>a</math> (intercept) = 5.35 to 5.36<br/>         Thus <math>y = (5.35 \text{ to } 5.36) - 0.076x</math></p> <p>Notes:<br/>         1 If <math>a</math> and <math>b</math> interchanged and equation <math>y = ax + b</math> used <math>\Rightarrow</math> max of 5 marks<br/>         2 If <math>a</math> and <math>b</math> interchanged and equation <math>y = a + bx</math> used <math>\Rightarrow</math> maximum of BF1<br/>         3 Marks lost here cannot be gained from subsequent work in parts (d) and/or (e)</p> | M1<br><br><br>m1<br>A1<br>A1<br>BF1 | <br><br><br><br><br><br><br><b>5</b> | <p>455 20475 35.1 &amp; 883.5 (121.33)<br/>(all 4 attempted)</p> <p>4550 &amp; <b>-345</b> (26.56)<br/>(both attempted)</p> <p>AWRT<br/>AWFW<br/>F on <math>a</math> and <math>b</math> even if rounded</p> <p>If <math>a</math> and <math>b</math> are not identified anywhere in equation, then:<br/> <math>-0.07</math> to <math>-0.08 \Rightarrow</math> B1<br/> <math>5.1</math> to <math>5.6 \Rightarrow</math> B1</p> |
| <b>(c)</b>                 | $y_{27} = (5.35 \text{ to } 5.36) - 0.076 \times 27$<br><br>$= 3.28 \text{ to } 3.32$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | M1<br><br>A1                        | <br><br><b>2</b>                     | <p>Clear evidence of correct use of <math>c</math>'s equation with <math>x = 27</math></p> <p>AWFW (3.30659)</p>                                                                                                                                                                                                                                                                                                             |
| <b>(d)</b>                 | $r(35, 2.5) = 2.5 - y_{35}$<br><br>$= 2.5 - \{(5.35 \text{ to } 5.36) - 0.076 \times 35\}$<br><br>$= -0.21 \text{ to } -0.19$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | M1<br><br>A1                        | <br><br><b>2</b>                     | <p>Used; allow <math>y_{35} - 2.5</math></p> <p>AWFW (-0.20000)</p>                                                                                                                                                                                                                                                                                                                                                          |
|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                     |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                              |

## MS/SS1A/W (cont)

| Q              | Solution                                                                                                                                                                                                                      | Marks                        | Total | Comments                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>4</b>       | <b>Alternative solutions</b>                                                                                                                                                                                                  |                              |       |                                                                                                                                        |
| <b>(a)(i)</b>  | Venn Diagram Method                                                                                                                                                                                                           | B1                           |       | 0.55; CAO                                                                                                                              |
|                |                                                                                                                                              | B1                           |       | 0.3 and 0.05; CAO                                                                                                                      |
|                |                                                                                                                                                                                                                               | Bdep1                        | 3     | 0.1; AG so dependent on B1 B1                                                                                                          |
| <b>(a)(i)</b>  | Formula Method<br>$P(\geq 1) = 0.85 + 0.60 - 0.55$<br>OR<br>$0.85 + 0.60 - 0.55 + p = 1$<br>OR<br>$0.15 + 0.40 - 0.45$<br><br>$P(0) = 1 - P(\geq 1)$<br>OR $= 1 - 0.9 = 0.1$<br>$0.9 + p = 1$<br>OR<br>$= 0.1$                | M2<br>(M1)<br><br>A1         | 3     | Full justification for numerical expression<br>Insufficient justification or numerical expression only<br><br>AG; gained from M2 or M1 |
| <b>(b)(ii)</b> | $0.1 \times (1 - 0.4)$ or 0.06<br><br>$(0.3 \times 0.25)$ or 0.075<br>or $(0.05 \times 0.25)$ or 0.0125<br>or $(0.35 \times 0.25)$ or 0.0875<br>or $(0.1 \times 0.4)$ or 0.04<br><br>$1 - (0.1875)$<br><br>$= 0.812$ to 0.813 | M1<br><br>M1<br><br>B1<br>A1 | 4     | At least one of these expressions or values<br><br>OE; implied by correct answer<br>AFWW (0.8125)<br>CAO for equivalent fraction       |
| <b>(b)(ii)</b> | $(0.55 + p)$ where $0 < p < 0.45$<br><br>$(0.3 \times 0.75)$ or 0.225<br>or $(0.05 \times 0.75)$ or 0.0375<br>or $(0.35 \times 0.75)$ or 0.2625<br><br>$0.55 + 0.2625$<br><br>$= 0.812$ to 0.813                              | M1<br><br>M1<br><br>B1<br>A1 | 4     | At least one of these expressions or values<br><br>OE; implied by correct answer<br>AFWW (0.8125)<br>CAO for equivalent fraction       |
|                |                                                                                                                                                                                                                               |                              |       |                                                                                                                                        |

**MS/SS1A/W (cont)**

| <b>Q</b>    | <b>Solution</b>                                                                             | <b>Marks</b> | <b>Total</b> | <b>Comments</b>                                                                                                                      |
|-------------|---------------------------------------------------------------------------------------------|--------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>6(a)</b> | <b>Alternative solutions</b>                                                                |              |              |                                                                                                                                      |
|             | $P(X < 0 \mid N(45.8, 24.0^2)) = P(Z < -1.91)$<br><br>$= 0.027 \text{ to } 0.03$            | M1<br><br>A1 | 2            | Standardising 0 using 45.8 & 24.0<br><br>In addition to probability within range, must state that negative salaries are impossible   |
|             | $P(X > 60 \mid N(45.8, 24.0^2)) = P(Z > 0.59)$<br><br>$= 0.27 \text{ to } 0.28$             | M1<br><br>A1 | 2            | Standardising 60 using 45.8 & 24.0<br><br>In addition to probability within range, must compare calculated value to $6/50 = 0.12$ OE |
| <b>(c)</b>  | <b>Additional comment illustrations</b>                                                     |              |              |                                                                                                                                      |
|             | It/(claimed) mean/(claimed) value > UCL/CI                                                  | B0           |              | Must indicate 55 or 55000                                                                                                            |
|             | 99% have (mean) weights between CLs so ...                                                  | B0           |              |                                                                                                                                      |
|             | Any comparison of 60 (£60 000) with UCL/CI                                                  | B0           |              | Value of 60 does not refer to mean                                                                                                   |
|             | $P(X > 60 \mid N(45.8, 24.0^2)) = P(Z > 0.59)$<br>$= (0.27 \text{ to } 0.28) > 6/50 = 0.12$ | B0           |              | Assumes salaries $\sim N$ ; cf (a)(ii)                                                                                               |
|             |                                                                                             |              |              |                                                                                                                                      |