# Mark Scheme (Results)

# October 2022

Pearson Edexcel International Advanced Level
In Statistics S2 (WST02) Paper 01

| Question Number | Scheme | Marks |
|---|---|---|
| 1(a)(i) | $\left[P\left(F<3\middle|F\sim\text{Po}(1.5)\right)=\right]0.8088$ <div align="right">awrt 0.809</div> | B1 |
| | | (1) |
| (ii) | $\left[P\left(F\geqslant6\right)=\right]1-P\left(F\leqslant5\right)$ or $1-0.9955$ | M1 |
| | $=0.0045$ <div align="right">awrt 0.0045</div> | A1 |
| | | (2) |
| (b) | $R\sim\text{Po}(10)$  $\therefore\left[P\left(R\leqslant12\right)\right]=0.7916$ <div align="right">awrt 0.792</div> | M1 |
| | $X\sim\text{B}(15,\text{"0.7916"})$ | M1 |
| | $\left[P\left(X=10\right)=\right]{}^{15}C_{10}\left(\text{"0.7916"}\right)^{10}\left(1-\text{"0.7916"}\right)^{5}$ | M1 |
| | $=0.11405\ldots$ <div align="right">awrt 0.114</div> | A1 |
| | | (4) |
| (c) | $H\sim\text{Po}(0.4)$ | M1 |
| | $\left[P\left(H=0\right)=\right]e^{-0.4}$  $[=0.6703\ldots]$  **or**  $\left[P\left(H>0\right)=\right]1-e^{-0.4}$  $[=0.32967\ldots]$ | M1 |
| | $\text{Profit}=2.4\times\text{"0.6703..."}-3\times\text{"0.32967..."}$ | dM1 |
| | $=0.6197$ <div align="right">awrt 0.62</div> | A1 |
| | | (4) |
| | **Notes** | **Total 11** |
| (a) (i) | **B1** | awrt 0.809 |
| (ii) | **M1** | Writing or using $1-P\left(F\leqslant5\right)$ |
| | **A1** | awrt 0.0045 |
| (b) | **M1** | For 0.792 or better |
| | **M1** | For writing B(15, " their 0.7916") May be implied by a fully correct method for P($X$ = 10) |
| | **M1** | A correct method to find $P\left(X=10\right)$ using a binomial distribution (implied by awrt 0.114) |
| | **A1** | awrt 0.114 |
| (c) | **M1** | Writing or using Po(0.4) e.g. P($H$ = 1) = 0.268… |
| | **M1** | Correct method to find $P\left(H=0\right)$ or $P\left(H>0\right)$ May be implied by awrt 0.67 or 1 – awrt 0.67 |
| | **M1dep** | Dependent on the previous method mark being awarded. Correct method to find the profit. Allow $7.4\times\text{"0.6703..."}+2\times\text{"0.32967..."}-5$ |
| | **A1** | awrt 0.62  Allow 62 p |

| Question Number | Scheme | Marks |
|---|---|---|
| 2 (a) |  $2k - 0.75$    $0.25$    $-0.5$   $0.5$   $k$ | M1 A1 |
| | | (2) |
| (b) | Area $= \dfrac{1}{4} + \dfrac{1}{2}\left(\dfrac{1}{4} + 2k - \dfrac{3}{4}\right)\left(k - \dfrac{1}{2}\right) = 1$ **or** $\dfrac{1}{4}\left(k + \dfrac{1}{2}\right) + \dfrac{1}{2}(2k - 1)\left(k - \dfrac{1}{2}\right) = 1$ **or** $\dfrac{1}{4} + \left[\left(k^2 - \dfrac{3}{4}k\right) - \left(\dfrac{1}{2}^2 - \dfrac{3}{8}\right)\right] = 1$ | M1 |
| | $8k^2 - 6k - 5 = 0$   or   $k^2 - \dfrac{3}{4}k - \dfrac{5}{8} = 0$ oe | A1 |
| | $(4k - 5)(2k + 1) = 0$   or   $k = \dfrac{\dfrac{3}{4} \pm \sqrt{\left(-\dfrac{3}{4}\right)^2 + 4 \times \left(\dfrac{5}{8}\right)}}{2}$   oe | M1 |
| | $k = 1.25*$ | A1 * |
| | | (4) |
| (c) | $\left[\displaystyle\int_{-0.5}^{0.5} \dfrac{1}{4}x\,dx\right] + \displaystyle\int_{0.5}^{1.25} 2x^2 - \dfrac{3}{4}x\,dx = [0] + \left[\dfrac{2x^3}{3} - \dfrac{3}{8}x^2\right]_{0.5}^{1.25}$ | M1A1 |
| | $= \left(\dfrac{2 \times 1.25^3}{3} - \dfrac{3}{8} \times 1.25^2\right) - \left(\dfrac{2 \times 0.5^3}{3} - \dfrac{3}{8} \times 0.5^2\right)$ | dM1 |
| | $= \dfrac{93}{128}$        awrt 0.727 | A1 |
| | | (4) |
| (d) | $[Q_1 =]\ 0.5$ | B1 |
| | $Q_3{}^2 - \dfrac{3}{4}Q_3 + 0.125 = 0.5$   or   $Q_3{}^2 - \dfrac{3}{4}Q_3 - 0.375 = 0$ oe | M1 |
| | $Q_3 = \dfrac{\dfrac{3}{4} \pm \sqrt{\left(-\dfrac{3}{4}\right)^2 + 4 \times \left(\dfrac{1}{8}\right)}}{2}$ | M1 |
| | IQR $= "1.093\ldots" - 0.5$ | M1 |
| | $= 0.593\ldots$        awrt 0.59 | A1 |
| | | (5) |
| | **Notes** | **Total 15** |
| (a) | **M1** | A correct shape. Must not go below zero |
| | **A1** | A correct shape including labels. Allow 1.25 for $k$ and 1.75 for $2k - 0.75$ |
| (b) | **M1** | Equating area to 1 (0.75 if ¼ + is not present) A correct method to find the area - allow 1 sign error. May be implied by a correct 3 term quadratic. If using integration then must get to an equivalent equation as the main scheme |
| | **A1** | For a correct 3 term quadratic |
| | **M1** | A correct method to solve a 3 term quadratic (May be implied by 1.25 **and** –0.5) If the 3 term quadratic is incorrect then a correct method for solving their 3 term quadratic must be shown |
| | **A1*** | 1.25 must be the only answer given. All previous marks must be awarded. |
| (c) | **M1** | $\displaystyle\int_{-0.5}^{0.5} \dfrac{1}{4}x\,dx + \int_{0.5}^{1.25} 2x^2 - \dfrac{3}{4}x\,dx$   or   $\displaystyle\int_{0.5}^{1.25} 2x^2 - \dfrac{3}{4}x\,dx$ on its own |

| | A1 | Correct integration of $2x^2 - \dfrac{3}{4}x$ |
|---|---|---|
| | dM1 | Dep on previous M being awarded. Substituting in the correct limits (implied by $\frac{93}{128}$ or awrt 0.727 Condone 0.726) If the integration is incorrect, we must see the correct non simplified substitution into their integral. Ignore substitution into $\dfrac{1}{8}x^2$. Useful values to look for are $\frac{125}{96}, \frac{75}{128}, \frac{1}{12}$ and $\frac{3}{32}$ or $\frac{275}{384}$ and $\pm\frac{1}{96}$ |
| | A1 | For $\frac{93}{128}$ or awrt 0.727 |
| (d) | B1 | For 0.5 May be seen in their IQR |
| | M1 | A correct equation for finding $Q_3$ |
| | M1 | A correct method to solve a 3 term quadratic (implied by $Q_3 = \frac{3+\sqrt{33}}{8}$ or $\frac{3-\sqrt{33}}{8}$ or awrt 1.093 or awrt – 0.343) If the 3 term quadratic is incorrect then a correct method for solving their 3 term quadratic must be shown. If using $Q_3^2 - \dfrac{3}{4}Q_3 - \dfrac{5}{8} = 0$ then M0 |
| | M1 | Correct method to find the IQR ft their $Q_3$ or implied by awrt 0.593 |
| | A1 | awrt 0.59 Allow $\frac{-1+\sqrt{33}}{8}$ |

| Question Number | | Scheme | Marks |
|---|---|---|---|
| 3(a) | | H$_0$: $p = 0.35$    H$_1$: $p \neq 0.35$ | B1 |
| | | $P(X \leqslant 8) =$ awrt $0.0303$ or $P(X \geqslant 21) =$ awrt $0.0173$ or $P(X \leqslant 20) =$ awrt $0.9827$ | M1 |
| | | $\left[ P(X \leqslant 8) = \right]$ awrt $0.0303$ and $\left[ P(X \geqslant 21) = \right]$ awrt $0.0173$ | A1 |
| | | CR $X \leqslant 8$ and $X \geqslant 21$ | A1 |
| | | | (4) |
| (b) | | 0.0476 | B1ft |
| | | | (1) |
| (c) | | H$_0$: $p = 0.028$    H$_1$: $p > 0.028$ | B1 |
| | | $Y \sim B(250, 0.028) \Rightarrow Y \sim Po(7)$ | M1 |
| | | $P(Y \geqslant 11) = 1 - P(Y \leqslant 10)$   or   $P(Y \geqslant 13) = 1 - 0.973$ | M1 |
| | | $= 0.0985$          or     Critical region $Y \geqslant 13$ | A1 |
| | | There is insufficient evidence to suggest that the <u>proportion</u> of sunflower <u>seeds</u> that grow to a height of more than 3 metres is now <u>greater</u> than 0.028 | A1 |
| | | | (5) |
| | | **Notes** | **Total 10** |
| (a) | **B1** | Both hypotheses in terms or $p$ or $\pi$ | |
| | **M1** | One of the correct probability statements. Implied by a correct critical region | |
| | **A1** | awrt 0.0303 and awrt 0.0173 | |
| | **A1** | Both parts of the critical region given. Allow alternative notation e.g. $X < 9$ and $X > 20$ Do not allow as probability statements. | |
| (b) | **B1** | For 0.0476 Allow awrt 0.0475 (calculator) or ft their **two** critical regions provided probabilities are seen in part (a) Common ft is for $X \leqslant 7$ and $X \geqslant 21$ gives 0.0297 | |
| (c) | **B1** | Both hypotheses in terms or $p$ or $\pi$ – If already lost the mark in (a) for incorrect letter allow any letter | |
| | **M1** | Po(7) written or used | |
| | **M1** | Writing or using $1 - P(Y \leqslant 10)$ or $1 - 0.9015$ or $1 - 0.973$ (May be implied by 0.0985) or may be implied by $Y \geqslant 13$ provided Po(7) seen or used |
| | | If using N(7, 6.804) or N(7, 7) allow use of $1 - P(Y \leqslant 10)$ or $1 - P(Y \leqslant 10.5)$ |
| | | B(250, 0.028) gives 0.09549… and implies M1 |
| | | N(7, 6.804) gives awrt 0.09 (Calc gives 0.08983…) or awrt 0.13 (Calc gives 0.125…) and implies M1 |
| | | N(7, 7) gives awrt 0.09 (Calc gives 0.09293…) or awrt 0.13 (Calc gives 0.1284…) and implies M1 |
| | **A1** | awrt 0.0985 or CR: $Y \geqslant 13$ provided Po(7) seen or used (Allow any letter for the CR) | |
| | **A1** | Independent of the hypotheses but dependent on the previous M1A1 being awarded. A correct conclusion in context. Allow amount/number for proportion, sunflowers for seeds and increased oe for greater. Ignore any non-contextual statements | |

| Question Number | Scheme | Marks |
|---|---|---|
| 4(a) | $X \sim B(20, \ 0.4)$ | M1 |
| | $P(5 \leqslant X < 8) = P(X \leqslant 7) - P(X \leqslant 4)$ or $0.4159 - 0.0510$ | M1 |
| | $= 0.3649 \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ awrt 0.365 | A1 |
| | | (3) |
| (b) | $Y \sim N(56, \ 33.6)$ | M1A1 |
| | $\dfrac{n - 0.5 - "56"}{\sqrt{"33.6"}} = -1.98$ | M1M1 B1 |
| | $n = 45$ | A1cao |
| | | (6) |
| | | |
| | **Notes** | **Total 9** |
| (a) | **M1** — Writing or using B(20, 0.4) | |
| | **M1** — For writing or using $P(X \leqslant 7) - P(X \leqslant 4)$ or $P(X = 5) + P(X = 6) + P(X = 7)$ | |
| | **A1** — awrt 0.365 | |
| (b) | **M1** — For writing or using N(56,…) (May be seen in a correct standardisation) | |
| | **A1** — For writing or using N(56, 33.6) (May be seen in a correct standardisation) | |
| | **M1** — For standardising (allow $\pm$) using any letter, their "56" and "33.6" and putting = to $z$ value, where $1 < |z| < 2$ Condone missing $\pm 0.5$ Condone 1 – standardisation, using any letter, their "56" and "33.6" and putting = to $z$ value, where $1 < |z| < 2$ | |
| | **M1** — M1 for using a continuity correction $-0.5$ if using $n$ or $+0.5$ if using $n - 1$. Either in their standardisation or after finding ***n*** (but not both) No need to put = to $z$ value | |
| | **B1** — For using $\pm 1.98$ or better (calc gives) 1.97914… | |
| | **A1** — 45 – must see a correct continuity correction or an awrt 45.02 or awrt 45.03 <br> 45 from no working is 0/6 | |

| Question Number | | Scheme | Marks |
|---|---|---|---|
| 5(a) | | $d = 7$ | B1 |
| | | $\dfrac{c}{3} - \dfrac{7}{6} = 1 - \dfrac{1}{6}("7" - c)^2$ | M1 |
| | | $\dfrac{c}{3} - \dfrac{7}{6} = 1 - \dfrac{1}{6}("49" - 2 \times "7" c + c^2)$ oe $\quad$ or $\quad c^2 - 12c + 36 = 0$ oe | dM1 |
| | | $(c-6)^2 = 0 \therefore c = 6 *$ | A1* |
| | | | (4) |
| (b) | | $P(X > 3.5) = 1 - \dfrac{1}{6}(3.5 - 3)^2$ | M1 |
| | | $\qquad\qquad = \dfrac{23}{24}$ oe $\hfill$ awrt 0.958 | A1 |
| | | | (2) |
| (c) | | $P(3.5 < X < 5.5) = \left(\dfrac{5.5}{3} - \dfrac{7}{6}\right) - \left(\dfrac{1}{6}(3.5-3)^2\right)\left[ = \dfrac{5}{8}\right]$ oe | M1 |
| | | $P(X > 4.5 \mid 3.5 < X < 5.5) = \dfrac{\left(\dfrac{5.5}{3} - \dfrac{7}{6}\right) - \left(\dfrac{4.5}{3} - \dfrac{7}{6}\right)}{"5\big/8"}$ | M1 |
| | | $\qquad\qquad = \dfrac{8}{15}$ oe $\hfill$ awrt 0.533 | A1 |
| | | | (3) |
| | | **Notes** | **Total 9** |
| (a) | **B1** | realising $d = 7$ | |
| | **M1** | Forming an equation in $c$ with their $d$ or $d$ | |
| | **dM1** | Dependent on previous M1. Multiplying out brackets and would reduce to a 3 term quadratic correct for their $d$ or $d$ | |
| | **A1*** | All previous marks must be awarded. For solving the correct 3TQ and statement | |
| (b) | **M1** | Substitution of 3.5 into correct expression | |
| | **A1** | Allow equivalent fractions or awrt 0.958 | |
| (c) | **M1** | Correct method to calculate $P(3.5 < X < 5.5)$ may use $1 - "\dfrac{23}{24}"$ for $\left(\dfrac{1}{6}(3.5-3)^2\right)$ <br><br> Useful figures are $\left(\dfrac{5.5}{3} - \dfrac{7}{6}\right) = \dfrac{2}{3}$ and $\left(\dfrac{1}{6}(3.5-3)^2\right) = \dfrac{1}{24}$ | |
| | **M1** | Correct method using their 5/8 <br><br> Useful figure is $\left(\dfrac{5.5}{3} - \dfrac{7}{6}\right) - \left(\dfrac{4.5}{3} - \dfrac{7}{6}\right) = \dfrac{1}{3}$ | |
| | **A1** | Allow equivalent fractions or awrt 0.533 | |

| Question Number | Scheme | Marks |
|---|---|---|
| 6(a) | $\left(2\times\dfrac{a}{a+7}\times\dfrac{1}{4}\times\dfrac{3}{4}\right)+\left(\dfrac{a}{a+7}\times\dfrac{1}{4}\times\dfrac{1}{4}\right)=\dfrac{63}{256}$ or $\dfrac{a}{a+7}\times\left(1-\left(\dfrac{3}{4}\right)^{2}\right)=\dfrac{63}{256}$ or $\dfrac{a}{a+7}\times\left[\left(\dfrac{1}{4}\right)^{2}+2\times\dfrac{1}{4}\times\dfrac{3}{4}\right]=\dfrac{63}{256}$ | M1 M1 |
| | $\dfrac{a}{7+a}=\dfrac{63}{256}\div\dfrac{7}{16}$ or $\dfrac{a}{7+a}=\dfrac{9}{16}$ $\qquad\therefore a=9$ * | A1* |
| | | (3) |
| (b) | Range ($R$) 0, 5, 10 (and 15) | B1 |
| | Bag: $P(20)=\dfrac{9}{16}$ and $P(5)=\dfrac{5}{16}$ and $P(10)=\dfrac{2}{16}$ | B1 |
| | $[P(R=0)=]\dfrac{5}{16}\times\dfrac{1}{4}\times\dfrac{1}{4}+\dfrac{2}{16}\times\dfrac{3}{4}\times\dfrac{3}{4}$ $[P(R=5)=]2\times\dfrac{5}{16}\times\dfrac{1}{4}\times\dfrac{3}{4}+\dfrac{5}{16}\times\dfrac{3}{4}\times\dfrac{3}{4}+2\times\dfrac{2}{16}\times\dfrac{1}{4}\times\dfrac{3}{4}+\dfrac{2}{16}\times\dfrac{1}{4}\times\dfrac{1}{4}$ $[P(R=10)=]\dfrac{9}{16}\times\dfrac{3}{4}\times\dfrac{3}{4}$ | M1 M1 M1 |
| | <table><tr><td>$R$</td><td>0</td><td>5</td><td>10</td><td>15</td></tr><tr><td>$r$</td><td>$\dfrac{23}{256}$</td><td>$\dfrac{89}{256}$</td><td>$\dfrac{81}{256}$</td><td>$\dfrac{63}{256}$</td></tr></table> | A1cao |
| | | (6) |
| | **Notes** | **Total 9** |

| (a) | **M1** | For use of $\dfrac{a}{a+7}$ in an equation |
|---|---|---|
| | **M1** | Setting up a correct equation to find the value of $a$ |
| | **A1*** | $a=9$ with at least one further correct line of working |
| (b) | **B1** | For the 3 ranges 0, 5 and 10 and no extra incorrect ones or all extras have probability of 0 |
| | **B1** | For the correct 3 probabilities written or used for the bag $\frac{2}{16}$ and/or $\frac{5}{16}$ may be implied by a correct answer for $P(R=0)$ or $P(R=5)$ and $\frac{9}{16}$ may be implied by a correct answer for $P(R=10)$ |
| | | **NB $p$ and $q$ must be consistent for the next 3 method marks** |
| | **M1** | A correct method to find one probability for $P(R=0)$ or $P(R=5)$ or $P(R=10)$ allow $p\times q\times q+r\times(1-q)\times(1-q)$ or $2\times p\times q\times(1-q)+p\times(1-q)\times(1-q)+2\times r\times q\times(1-q)+r\times q\times q$ or $m\times(1-p)\times(1-p)$ where $m$, $p$, $q$ and $r$ are probabilities. (May be implied by $\frac{23}{256}$ or $\frac{89}{256}$ or $\frac{81}{256}$) |
| | **M1** | A correct method to find two probabilities from $P(R=0)$ or $P(R=5)$ or $P(R=10)$ allow $p\times q\times q+r\times(1-q)\times(1-q)$ or $2\times p\times q\times(1-q)+p\times(1-q)\times(1-q)+2\times r\times q\times(1-q)+r\times q\times q$ or $m\times(1-p)\times(1-p)$ where $m$, $p$, $q$ and $r$ are probabilities. (May be implied by 2 from $\frac{23}{256}$ or $\frac{89}{256}$ or $\frac{81}{256}$) |
| | **M1** | A correct method to find all 3 probability for $P(R=0)$ and $P(R=5)$ and $P(R=10)$ allow $p\times q\times q+r\times(1-q)\times(1-q)$ or $2\times p\times q\times(1-q)+p\times(1-q)\times(1-q)+2\times r\times q\times(1-q)+r\times q\times q$ or $m\times(1-p)\times(1-p)$ where $m$, $p$, $q$ and $r$ are probabilities. (May be implied by $\frac{23}{256}$ and $\frac{89}{256}$ and $\frac{81}{256}$) or these 3 probabilities that sum to $\frac{193}{256}$ |

| | **A1** | Correct ranges with correct associated probabilities attached. All extras must have an associated probability of 0 (Does not have to be seen in a table) **NB Allow decimal answers correct to 3 decimal places** $\frac{23}{256} = 0.090$ $\frac{89}{256} = 0.348$ $\frac{81}{256} = 0.316$ $\left[\frac{63}{256} = 0.246\right]$ |
|---|---|---|

| Question Number | Scheme | Marks |
|---|---|---|
| 7(i) | $\dfrac{a+b}{2}=9$ and $\dfrac{13-5}{b-a}=\dfrac{1}{5}$ or $a=-11$ and $b=29$ | M1 |
| | $P\left(X>\dfrac{"29"-"11"}{3}\right)\left[=P(X>6)\right]$ or $P\left(X>\dfrac{9\times2}{3}\right)\left[=P(X>6)\right]=\dfrac{23}{40}$ | M1A1 |
| | | (3) |
| (ii) | $\dfrac{1}{12}(c-1)^2=0.48 \Rightarrow c=3.4$ | M1 |
| | $E(Y)=\dfrac{1+"3.4"}{2}$ | M1 |
| | $E(Y^2)=0.48+"\left(\dfrac{1+3.4}{2}\right)"^2=5.32$ | M1A1 |
| | | (4) |
| (iii) | $\qquad\qquad W\sim U[0,20] \qquad X\sim U[10,20] \qquad Y\sim U[0,10]$ | |
| | $W<6$ or $W>14$ or $X<12$ or $Y>8$ any letter, ignore distribution | M1 |
| | $2\times P(W<6)= 2\times\dfrac{(6-0)}{20}$ or $2\times P(W>14)=2\times\dfrac{(20-14)}{20}$ or $P(W<6)=\dfrac{6-0}{20}$ **and** $P(W>14)=\dfrac{20-14}{20}$ or $P(X>14)=\dfrac{20-14}{10}$ or $P(Y<6)=\dfrac{6-0}{10}$ | M1 |
| | $P(8<W<12)=\dfrac{12-8}{20}$ or $P(X<12)=\dfrac{12-10}{10}$ or $P(Y>8)=\dfrac{10-8}{10}$ | M1 |
| | $P(\text{ shortest side }<6)="\dfrac{3}{10}"+"\dfrac{3}{10}"+"\dfrac{1}{5}"$ or $"\dfrac{1}{5}"+"\dfrac{3}{5}" =\dfrac{4}{5}$ | dM1A1 |
| | | (5) |
| | **Alternative 1** | |
| | $6<W<8$ or $12<W<14$ any letter, ignore distribution | M1 |
| | $P(6<W<8)=\dfrac{8-6}{20}$ or $P(12<W<14)=\dfrac{14-12}{20}$ | M1 |
| | $P(6<W<8)=\dfrac{1}{10}$ and $P(12<W<14)=\dfrac{1}{10}$ or $2\times P(6<W<8)=2\times\dfrac{1}{10}$ or $2\times P(12<W<14)=2\times\dfrac{1}{10}$ | M1 |
| | $P(\text{shortest side}<6)=1-"\dfrac{1}{10}"-"\dfrac{1}{10}"$ or $1-"\dfrac{2}{10}" =\dfrac{4}{5}$ | dM1A1 |
| | **Alternative 2** | (5) |
| | $W>10$ or $12<W<14$ or $6<W<8$ or $W<10$ any letter, ignore distribution | M1 |
| | $P(12<W<14)=\dfrac{14-12}{20}$ and $P(W>10)=\dfrac{20-10}{20}$ or $P(6<W<8)=\dfrac{8-6}{20}$ and $P(W<10)=\dfrac{10-0}{20}$ | M1 |
| | $P(12<W<14|W>10)=\dfrac{"1/10"}{"1/2"}\left[=\dfrac{1}{5}\right]$ or $P(6<W<8|W<10)=\dfrac{"1/10"}{"1/2"}\left[=\dfrac{1}{5}\right]$ | M1 |
| | $P(\text{ shortest side }<6)=1-"\dfrac{1}{5}" =\dfrac{4}{5}$ | dM1A1 |
| | | (5) |
| | **NB** Any answer of $\tfrac{4}{5}$ scores 5/5 provided it has not come from incorrect working | |
| | | **Total 12** |

**M2 for** $P(12<X<14)=\dfrac{14-12}{10}$ or $P(6<Y<8)=\dfrac{8-6}{10}$

| | | Notes | |
|---|---|---|---|
| | | **NB Allow any letter throughout the question** | |
| (i) | **M1** | For setting up 2 correct equations May be implied correct answers for $a$ and $b$ | |
| | **M1** | Realising the need to find P($X > 6$) or allow use of "their $a$" and " their $b$" or their " $\frac{a+b}{2} = 9$ " | |
| | **A1** | 23/40 oe or 0.575 | |
| (ii) | **M1** | Correct equation to find $c$ with $c = \ldots$ | |
| | **M1** | Correct method for finding E($Y$) using "their $c$" | |
| | **M1** | Correct method for finding E($Y^2$) using "their E($Y$)$^2$" | |
| | **A1** | For 5.32 (Allow $\frac{133}{25}$ ) | |
| (iii) | **M1** | For identifying a correct region required to answer the question. Allow any letter and ignore the distribution associated with the letter. May be implied by $W < 6$ or $W > 14$ or $X < 12$ or $Y > 8$ | |
| | **M1** | For a correct method to find a required probability. Allow any letter but the probability must be associated to the correct distribution. e.g. $2 \times P(W < 6) = 2 \times \frac{3}{10}$ or $2 \times P(W > 14) = 2 \times \frac{3}{10}$ or $P(W < 6) = \frac{3}{10}$ **and** $P(W > 14) = \frac{3}{10}$ or $P(X > 14) = \frac{3}{5}$ or $P(Y < 6) = \frac{3}{5}$ | |
| | **M1** | For a correct method to find a second required probability. Allow any letter but the probability must be associated to the correct distribution. e.g. $P(8 < W < 12) = \frac{1}{5}$ or $P(X < 12) = \frac{1}{5}$ or $P(Y > 8) = \frac{1}{5}$ | |
| | **dM1** | Dependent on previous 3 M marks. For $P(W < 6) + P(W > 14) + P(8 < W < 12)$ or $P(X > 14) + P(X < 12)$ or $P(Y < 6) + P(Y > 8)$ ft their probabilities | |
| | **A1** | cao | |

**Alternative 1**

| | | | |
|---|---|---|---|
| (iii) | **M1** | For identifying a correct region required to answer the question. Allow any letter and ignore the distribution associated with the letter. May be implied by $6 < W < 8$ or $12 < W < 14$ | |
| | **M1** | For a correct method to find a required probability. Allow any letter but the probability must be associated to the correct distribution. e.g. $P(6 < W < 8) = \frac{1}{10}$ or $P(12 < W < 14) = \frac{1}{10}$ | |
| | **M1** | For a correct method to find a second required probability. Allow any letter but the probability must be associated to the correct distribution. e.g. $P(6 < W < 8) = \frac{1}{10}$ and $P(12 < W < 14) = \frac{1}{10}$ or $2 \times P(6 < W < 8) = 2 \times \frac{1}{10}$ or $2 \times P(12 < W < 14) = 2 \times \frac{1}{10}$ | |
| | **dM1** | Dependent on previous 3 M marks. For $1 - "\frac{1}{10}" - "\frac{1}{10}"$ or $1 - "\frac{2}{10}"$ | |
| | **A1** | cao | |

**Alternative 2**

| | | | |
|---|---|---|---|
| | **M1** | For identifying a correct region required to answer the question. Allow any letter and ignore the distribution associated with the letter. May be implied by $W > 10$ or $12 < W < 14$ or $W < 10$ or $6 < W < 8$ | |
| | **M1** | For a correct method to find both the required probabilities. Allow any letter but the probability must be associated to the correct distribution. e.g. $P(12 < W < 14) = \frac{1}{10}$ **and** $P(W > 10) = \frac{1}{2}$ or $P(6 < W < 8) = \frac{1}{10}$ **and** $P(W < 10) = \frac{1}{2}$ | |
| | **M1** | For correct use of conditional probability e.g. $\frac{"\frac{1}{10}"}{"\frac{1}{2}"}$ | |
| | **dM1** | Dependent on previous 3 M marks. For $1 - "\frac{1}{5}"$ | |
| | **A1** | cao | |