| Question Number | Scheme | Marks |
|---|---|---|
| 6(a) | $\mathrm{E}(X) = -4a + (-3b) + a + 2b + 5\times 0.2 [= -3a - b + 1]$ | B1 |
| | | (1) |
| (b)(i) | $[\mathrm{E}(X) =] 0$ | B1 |
| (ii) | $a + b + a + b + 0.2 = 1$ | B1 |
| | $2a + 2b = 0.8$<br>$3a + b = 1$ $\Rightarrow$ e.g. $4a = 1.2$ or $4b = 0.4$ | M1 |
| | Solving simultaneously to give $a = 0.3$ $b = 0.1$ | A1A1 |
| | | (5) |
| (c) | $\mathrm{Var}(1-3X) = 9\mathrm{Var}(X)$ $\quad$ $y$ : 13 10 −2 −5 −14 | M1 |
| | $\mathrm{E}(X^2) = (-4)^2 a + (-3)^2 b + a$<br>$+(2^2)b + 25\times 0.2 [= 11.4]$ $\quad$ $\mathrm{Var}(1-3X) = \begin{pmatrix} 13^2\times 0.3 + 10^2\times 0.1 + \\ (-2)^2\times 0.3 + (-5)^2\times 0.1 \\ +(-14)^2\times 0.2 \end{pmatrix} - 1^2$ | M1 |
| | $\mathrm{Var}(1-3X) = 102.6$ $\quad$ awrt 103 | A1 |
| | | (3) |
| (d)(i) | $[\mathrm{P}(Y<0) = \mathrm{P}(1-X<0) =]$<br>$\mathrm{P}(X>1) = "0.1" + 0.2 = 0.3$ $\quad$ [$y$ : 5 4 0 −1 −4]<br>$\mathrm{P}(Y<0) = "0.1" + 0.2 = 0.3$ | M1A1ft |
| (ii) | $[\mathrm{P}(Y<k) = \mathrm{P}(1-X<k) =] \mathrm{P}(X>(1-k)) = 0.2$ or $1-k=2$ $\quad$ $\mathrm{P}(Y<-1) = 0.2$ | M1 |
| | $k = -1$ | A1 |
| | | (4) |
| | **Notes** | **Total 13** |
| (a) | **B1** | For a correct expression for E($X$) need not be simplified. May be seen in part (b)<br>Do not ISW e.g. $\frac{-4a + (-3b) + a + 2b + 5\times 0.2}{5}$ oe |
| **Mark (i) and (ii) together as one part** | | |
| (b)(i) | **B1** | For 0 Condone E($X$)$^2$ = 0 |
| (ii) | **B1** | For using sum of probabilities = 1 to form an equation in $a$ and $b$ May be seen in (i) |
| | **M1** | For eliminating one variable only ft their 2 equations if working is shown.<br>May be implied by $a = 0.3$ or $b = 0.1$ |
| | **A1** | For $a = 0.3$ or $b = 0.1$ |
| | **A1** | For both $a = 0.3$ and $b = 0.1$ |
| (c) | **M1** | For $3^2$Var($X$) or $3^2$E($X^2$) or for all 5 correct $y$ values seen or used |
| | **M1** | For a correct algebraic expression for E($X^2$) or Var($X$) e.g. $17a + 13b + 5$ or a correct numerical expression ft their $a$ and their $b$ May be seen in part (b) or a fully correct expression for Var(1 − 3$X$) including the $-1^2$ |
| | **A1** | Awrt 103 Allow $\frac{513}{5}$ |
| (d)(i) | **M1** | For P($X$ > 1) or for $X$ = 2 and $X$= 5 only or for $Y$ = −1 and $Y$ = −4 or $"b"+0.2$<br>Allow $b$ + 0.2 if no $b$ value stated in part b |
| | **A1ft** | Ft their $b$ provided $b$ and $b$ + 0.2 are probabilities |
| (ii) | **M1** | For P($X$ > (1 − $k$)) = 0.2 or 1 − $k$ = 2 or P($Y$ < −1)=0.2 May be implied by $k$ = −1 |
| | **A1** | Cao |