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| **Q** | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **1a** |  | **M1**  **A1** | 1.1a  2.1 | 1st  Understand how to find unknowns from a probability mass function |
|  | **(2)** |  |  |
| **1b** |  | **M1**  **A1** | 1.1a  2.1 | 2nd  Calculate the mean of a discrete random variable |
|  | **M1**  **A1** | 1.1a  1.1b |
|  | **(4)** |  |  |
| **1c** |  | **B1** | 1.1b | 3rd  Calculate the variance of a discrete random variable |
|  | **(1)** |  |  |
| **1d** |  | **B1** | 1.1b | 4th  Find the expectation of a function of a random variable |
|  | **B1** | 1.1b |
|  | **(2)** |  |  |
| **(9 marks)** | | | | |
| **Notes** | | | | |

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| **Q** | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **2** | Expectation, in points | **M1** | 3.3 | 2nd  Calculate the mean of a discrete random variable |
|  | **A1** | 1.1a |
|  | **M1** | 1.1b |
|  | **A1** | 2.1 |
| **(4 marks)** | | | | |
| **Notes**  Award 1st **M1** for attempt to form expression for expectation in terms of *k*. Does not need to be equal to 3.  Award 1st **A1** for correct equation in *k*, unsimplified or simplified.  Award 2nd **M1** for attempt to solve *their* equation in *k*.  Alternative method  20 – 0.2(20 + 2*k*) – 0.2(20 + 4*k*) = 3 for 1st M1, A1  (or any scalar multiple of this equation)  Leading to:12 – 1.2*k* = 3 as above | | | | |

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| **Q** | **Scheme** | **Marks** | **AOs** | Pearson Progression Step and Progress Descriptor |
| **3a** | 0.15 | **B1** | 1.2 | 1st  Understand how to find unknowns from a probability mass function |
|  | **(1)** |  |  |
| **3b** | E(*X*) = | **M1** | 1.1a | 2nd  Calculate the mean of a discrete random variable  3rd  Calculate the variance of a discrete random variable |
|  | **A1** | 1.1b |
|  | **M1** | 1.1a |
|  | **A1** | 2.1 |
|  | **(4)** |  |  |
| **3c** |  | **M1**  **A1** | 3.1a  1.1b | 5th  Solve problems involving functions of discrete random variables |
|  | **(2)** |  |  |
| **(7 marks)** | | | | |
| **Notes**  **3b** Allow follow through from incorrect part **a** for all **M** marks. | | | | |

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| **Q** | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **4a** |  | **M1**  **A1** | 1.1a  2.1 | 1st  Understand how to find unknowns from a probability mass function |
|  | **(2)** |  |  |
| **4b** |  | **M1**  **A1**  **M1**  **A1** | 1.1a  1.1b  1.1a  1.1b | 2nd  Calculate the mean of a discrete random variable  3rd  Calculate the variance of a discrete random variable |
|  | **(4)** |  |  |
| **4c** |  | **M1**  **A1** | 1.2  2.1 | 4th  Find the expectation of a function of a random variable |
|  | **(2)** |  |  |
| **(8 marks)** | | | | |
| **Notes**  **4b** Allow follow through from *their* *k* for **M** marks.  **4c** Allow follow through from their Var(*X*) for **M** mark. | | | | |

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| **Q** | **Scheme** | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **5a** | *a* + *b* = 0.4      *a* = 0.1, *b* = 0.3 | **B1**  **M1**  **M1**  **A1**  **A1** | 1.1b  3.1a  1.1b  1.1b  1.1b | 4th  Find the expectation of a function of a random variable |
|  | **(5)** |  |  |
| **5b** | E(*X*) = 2.7  Var(*X*) = 12.9 – 2.72 = 5.61 | **M1**  **M1**  **A1** | 1.1a  1.1b  2.1 | 2nd  Calculate the mean of a discrete random variable  3rd  Calculate the variance of a discrete random variable |
|  | **(3)** |  |  |
| **5c** | 22.44 | **B1**ft | 1.1b | 4th  Find the expectation of a function of a random variable |
|  | **(1)** |  |  |
| **5d** | P(*X* – 3 > 2*Y*) = P(*X* < 1) = 0.3 | **M1**  **A1** | 3.1a  1.1b | 5th  Solve problems involving functions of discrete random variables |
|  | **(2)** |  |  |
| **(11 marks)** | | | | |

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| **Notes**  **5a** 1st **M1** for attempt to find *Y*s.  2nd **M1** for attempt to form equation for E(*Y*).  **5c** Allow follow through from **b**. |

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| **Q** | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **6a** | [1]  (or scalar multiple of this equation, e.g. 9*a* + 6*b* + 12*c* = 5.7)  P(*Y* < 0) gives P(*X* > 2) hence  [2]  [3]  Solve system using matrices or elimination:  *a* = 0.1, *b* = 0.2, *c* = 0.3 | **M1**  **M1**  **M1**  **M1**  **M1**  **A1**  **A1** | 3.1a  1.1b  2.1  1.1b  1.1b  1.1b  1.1b | 5th  Solve problems involving functions of discrete random variables |
|  | **(7)** |  |  |
| **6b** | 27.81 ÷ 9 = 3.09 | **M1**  **A1** | 1.1a  1.2 | 4th  Find the expectation of a function of a random variable |
|  | **(2)** |  |  |
| **6c** | P(*X* < *Y*) means P(*X* < 1)  P(*X* < 1) = 0.1 + 0.2 = 0.3 | **M1**  **A1**ft | 3.1a  1.1b | 5th  Solve problems involving functions of discrete random variables |
|  | **(2)** |  |  |
| **(11 marks)** | | | | |
| **Notes**  **6a** 1st **A1** for any two of *a*, *b* and *c* correct.  **6c** Allow follow through from *their a* and *b*. | | | | |