|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **1a** | The colonies occur at random | **B1** | 3.5b | 3rd  Understand the conditions for a Poisson distribution |
| The colonies occur at a constant rate | **B1** | 3.5b |
|  | **(2)** |  |  |
| **1b** | *X* ~ Po(4) | **B1** | 3.3 | 3rd  Use the Poisson distribution to model real-world situations |
| P(*X* = 0) | **M1** | 1.1b |
| = 0.0183 | **A1** | 1.1b |
|  | **(3)** |  |  |
| **1c** | *X* ~ Po(6) | **B1** | 3.3 | 3rd  Use the Poisson distribution to model real-world situations |
| 1 − P(*X* ⩽ 3) = 1 – 0.1512 | **M1** | 1.1b |
| = 0.8488 | **A1** | 1.1b |
|  | **(3)** |  |  |
| **(8 marks)** | | | | |
| **Notes**  **1a** Accept ‘colonies appear independently of one another’ | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress Descriptor** |
| **2a** | 1.04 | **B1** | 1.1b | 2nd  Understand the basics of the Poisson distribution |
|  | **(1)** |  |  |
| **2b** | *X* ~ Po(1.04) | **B1** | 3.3 | 3rd  Use the Poisson distribution to model real-world situations |
| |  |  |  | | --- | --- | --- | | ***x*** | **P(*X* = *x*)** | **Expected frequency** | | 0 | 0.3535 | 53.03 | | 1 | 0.3676 | 55.14 | | 2 | 0.1911 | 28.67 | | 3 | 0.0663 | 9.95 | | 4 | 0.0172 | 2.58 | | **M1**  **M1**  **A1** | 1.1b |
|  | **(4)** |  |  |
| **2c** | The Poisson model seems a (fairly) good fit | **B1** | 2.2b | 4th  Comment on the appropriateness of the Poisson distribution |
| because the expected frequencies are similar to the observed frequencies, oe | **B1** | 2.4 |
|  | **(2)** |  |  |
| **(7 marks)** | | | | |
| **Notes**  **2b** **M1:** (first) at least three correct probabilities  **M1:** (second) at least three correct expected frequencies  **A1:** for all correct frequencies | | | | |