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| AS |
| MATHS |
| Probability and binomial distribution |
| Mark scheme |

Specification content coverage: M1, N1

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| --- | --- | --- |
| **Question** | **Solutions** | **Mark** |
| **1** | Not independent and not mutually exclusive | 1 |
|  | **Total** | **1** |
| **2 (a)** | = 0.8 | 1 |
|  | **Total** | **1** |
| **2 (b)** | = 0.2 × 0.4 = 0.08 | 1 |
|  | **Total** | **1** |
| **2 (c)** | = 0.2 + 0.4 – 0.08 = 0.52 | 2 |
|  | **Total** | **2** |
| **3 (a)** | Independent. Any reason that suggests if one student is late others might be affected eg traffic, travelling together | 2 |
|  | **Total** | **2** |
| **3 (b)** | P(*x* = 3) = 0.0596 | 1 (P(*x* = 3) must be seen) |
|  | **Total** | **1** |
| **3 (c)** | P(*X* > 4) = 1 – P(*X* ≤4) = 1 – 0.997426 = 0.00258 | 2 (1 – P(*X* ≤ 4) must be seen) |
|  | **Total** | **1** |
| **4 (a)** |  | 1 |
|  | **Total** | **1** |
| **4 (b)** |  | 1 |
|  | **Total** | **1** |
| **4 (c)** |  | 2 |
|  | **Total** | **2** |

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| **4 (d)** | Any statement suggesting gender inequality ie expected number of females less than actual. | 1 |
|  | **Total** | **1** |
| **6 (a)** |  | 1 |
|  | 1 |
|  | **Total** | **2** |
| **6 (b)** | P(1 battery failure or less) = 0.57  P(3 weeks with more than 1 battery failure) 1 – 0.573 = 0.815  Or  sum of combined 3 fails + 2 fails out of 3 + 1 fail out of 3 | 1  2 |
|  | **Total** | **3** |
| **7 (a)** | *x* – *B*(14, 0.3)  P(*x* ≤ 5) – P(*x* ≤ 1) = 0.7805 – 0.0474 = 0.7331 | 1  4 |
|  | **Total** | **5** |
| **7 (b)** | E(*X*) = 0.3 × 14 = 4.2 | 2 |
|  | **Total** | **2** |
| **7 (c)** | probability not constant | 1 |
|  | **Total** | **1** |
| **5 (a)** | 0.8 × 0.6 × 0.3 = 0.144 | 2 |
|  | **Total** | **2** |
| **5 (b)** | 0.8 × 0.6 × 0.7 + 0.8 × 0.4 × 0.3 + 0.2 × 0.6 × 0.3 = 0.468 | 3 |
|  | **Total** | **3** |
|  | **TOTAL** | **32** |

**Rationale**

It is assumed that students are proficient at using a calculator to find probabilities and cumulative probabilities of binomial distribution

15 marks scaffolded basic skill assessed

17 marks applying (including some basic proof and some more advanced problem solving)