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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **1a** | **Figure 1**    Force descriptions in words (one mark each) | **B4** | 2.5 | 3rd  Draw force diagrams. |
|  | **(4)** |  |  |
| **1b** | Weight force is 9.8 × 6 | **M1** | 1.1b | 7th  The concept of limiting equilibrium. |
| = 58.8 (N) (Accept awrt 59) | **A1** | 1.1b |
| Resolve forces in vertical direction. | **M1** | 3.1b |
| Normal reaction on floor is 58.8 (N) (Accept awrt 59) | **A1** | 1.1b |
| Take moments about base of ladder. | **M1** | 3.1b |
| 58.8 × 5 sin 20 = *N* × 10 cos 20 | **M1** | 1.1b |
| *N* = 10.70… (N) (Accept awrt 11) | **A1** | 1.1b |
| Resolve forces in horizontal direction. | **M1** | 3.1b |
| Friction force on floor is 10.70… (N) (Accept awrt 11) | **A1** | 1.1b |
| *μR* = 0.3 × 58.8 | **M1** | 1.1b |
| = 17.6 (N) | **A1** | 1.1b |
| > *F* | **A1** | 2.4 |
| So does not slip. | **A1** | 2.4 |
|  | **(13)** |  |  |
| (17 marks) | | | | |
| **Notes** | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **2a** | No net force means | **M1** | 1.1b | 4th  Calculate resultant forces using vectors. |
| So *f* = −5 | **A1** | 2.2a |
|  | **(2)** |  |  |
| **2b** | Use of moment = force perpendicular distance from pivot. | **M1** | 1.1a | 5th  Find resultant moments by considering direction. |
| Moment = 2 × 1 + 3 × 3 + 5 × 3 | **M1** | 1.1b |
| = 26 N cm | **A1ft** | 1.1b |
| = 0.26 N m | **A1ft** | 1.1b |
|  | **(4)** |  |  |
| (6 marks) | | | | |
| Notes | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **3a** | Net force is **C** + **W** | **M1** | 3.1b | 4th  Calculate resultant forces using vectors. |
|  | **A1** | 1.1b |
|  | **(2)** |  |  |
| **3b** | Use of Newton’s 2nd Law. | **M1** | 3.1b | 5th  Use Newton's second law to model motion in two directions. |
|  | **M1** | 1.1b |
|  | **A1** | 1.1b |
|  | **(3)** |  |  |
| **3c** |  | **M1** | 1.1a | 5th  Use the equations of motion to solve problems in familiar contexts. |
|  | **M1** | 1.1b |
| *x* = *t* + 25*t*2 | **A1** | 1.1b |
| *y* = *t* − 5*t*2 | **A1** | 1.1b |
|  | **(4)** |  |  |
| **3d** | Substitute *t* = 10 | **M1** | 3.1b | 5th  Use the equations of motion to solve problems in familiar contexts. |
| *x* *=* 2510 | **A1** | 1.1b |
| *y* = −490 | **A1** | 1.1b |
| Distance travelled | **M1** | 1.1a |
| 2557.38…(m) (Accept awrt 2560) | **A1** | 3.2a |
|  | **(5)** |  |  |
| (14 marks) | | | | |
| Notes | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **4a** | Resultant force is **A** + **B** | **M1** | 3.1b | 5th  Use Newton's second law to model motion in two directions. |
| = 3**i** – **j** (N) | **A1** | 1.1b |
| Use of Newton’s 2nd Law. | **M1** | 3.1b |
|  | **M1** | 1.1b |
| 6**i** – 2**j** (m s−2) | **A1** | 1.1b |
|  | **M1** | 1.1a |
|  | **M1** | 1.1b |
| *x* = 3 + 3*t*2 | **A1** | 1.1b |
| *y* = 4 – *t*2 | **A1** | 1.1b |
|  | **(9)** |  |  |
| **4b** | *x* = 3 + 3*t*2 > 0 for all *t* > 0 | **M1** | 2.4 | 4th  Complete proofs by deduction and direct algebraic methods. |
| so *x* ≠ 3 | **A1** | 2.2a |
|  | **(2)** |  |  |
| **4c** | Anything resonable. For example, a ball in a river with wind.  Descriptions of **A** and **B**.  For example, **A** is force due to water.  For example, **B** is force due to wind. | **B1**  **B1** | 3.5  3.5 | 3rd  Understand assumptions common in mathematical modelling. |
|  |  | **(2)** |  |  |
| (13 marks) | | | | |
| Notes  **4b**  Accept any valid argument (For example, equivalent argument for *y*) | | | | |