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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **1a** |  | **M1****A1****M1****M1****A1** | 1.1a1.1b1.1a1.1b2.1 | 6thUnderstand and use the method of differences to sum series, including using partial fractions |
|  | **(5)** |  |  |
| **1b** |  | **B1** | 2.2a | 6thUnderstand and use the method of differences to sum series, including using partial fractions |
|  | **(1)** |  |  |
| **1c** |  | **M1****A1****M1****A1** | 1.1a2.2a1.1b1.1b | 6thUnderstand and use the method of differences to sum series, including using partial fractions |
|  | **(4)** |  |  |
| (10 marks) |

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| Notes**1a: M1** for splitting into two fractions over *r* and *r* + 1 **A1** for correct values of *A* and *B* **M1** for expanding from 1 to *n* **M1** for cancelling out terms **A1** for showing that *a* = 3**1b: B1** cao**1c: M1** for writing as a subtraction of two sums **A1** a correct expression using answer to part **a** **M1** for subtracting **A1** cao |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **2a** |  | **M1****A1** | 1.1a1.1b | 6thUnderstand and use the method of differences to sum series, including using partial fractions |
|  | **(2)** |  |  |
| **2b** |  | **M1****M1****A1** | 2.2a1.1b2.1 | 6thUnderstand and use the method of differences to sum series, including using partial fractions |
|  | **(3)** |  |  |
| (5 marks) |
| Notes**2a: M1** for expanding **A1** cao**2b: M1** for correct expression using part **a** **M1** for correct expansion **A1** cao (A.G.) |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **3a** |  | **M1****M1****A1** | 1.1a1.1b1.1b | 6thUnderstand and use the method of differences to sum series, including using partial fractions |
|  | **(3)** |  |  |
| **3b** |  | **M1****M1****A1****M1****A1** | 2.2a1.1b1.1b1.1a2.1 | 6thUnderstand and use the method of differences to sum series, including using partial fractions |
|  | **(5)** |  |  |
| (8 marks) |
| Notes**3a: M1** for splitting into three fractions in the correct format **M1** for multiplying through by (*r* + 2)(*r* + 3)(*r* + 4) **A1** for correct values of *A*, *B* and *C***3b: M1** for writing in partial fraction form **M1** for writing out terms from 1 to *n* **A1** cao **M1** for attempting to add the three fractions **A1** cao |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **4a** |  | **M1****A1****M1****A1** | 1.1a1.1b1.22.1 | 4thBe able to find higher derivatives of functions |
|  | **(4)** |  |  |
| **4b** |  | **M1****M1****B1****M1****A1** | 1.1a1.1a1.1b1.1a1.1b | 5thExpress functions as an infinite series using Maclaurin’s expansion |
|  | **(5)** |  |  |
| (9 marks) |
| Notes**4a: M1** for differentiating twice using the product rule **A1** for correct second differential **M1** for correctly substitutes for  **A1** cao (A.G.)**4b: M1** for attempting3rd differential **M1** for attempting4th differential **B1** for substituting *x* = 0 and obtaining correct values **M1** for using standard Maclaurin expansion **A1** cao |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **5a** |  | **M1****M1****A1** | 1.1a1.1a2.1 | 5thFind and recognise the series expansions of standard functions |
|  | **(3)** |  |  |
| **5b** |  | **M1****M1****A1** | 1.1a1.1b1.1b | 7thDerive the series expansions of composite functions |
|  | **(3)** |  |  |
| (6 marks) |
| Notes**5a: M1** for splitting the expression **M1** for attempting to substitute –*x* into the standard expansion for e*x* **A1** cao (A.G)**5b: M1** for attempting to use the standard expansion for sin *x* **M1** for substituting in 3*x*2 **A1** cao |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **6a** |  | **M1****B1****M1****A1****A1** | 1.1a1.1b1.1b1.1b2.1 | 7thDerive the series expansions of composite functions |
|  | **(5)** |  |  |
| **6b** |  | **B1** | 1.1b | 6thUnderstand the values of *x* for which series expansions are valid |
|  | **(1)** |  |  |
| **6c** |  | **M1****A1****M1****A1** | 2.2a1.1b1.1b1.1b | 5thExpress functions as an infinite series using Maclaurin’s expansion |
|  | **(4)** |  |  |

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| **6d** |  | **M1****A1** | 2.2a1.1b | 7thDerive the series expansions of composite functions |
|  | **(2)** |  |  |
| (12 marks) |
| Notes**6a : M1** for using of the law of logarithms **B1** for correctly substituting 3*x* into standard expression **M1** for substituting –2*x* into standard expression **A1** for correct expansion for ln(1 – 2*x*) **A1** cao (A.G.)**6b: B1** for correct range**6c: M1** for setting up equation for *x* **A1** for solving for *x* **M1** substitutes value of *x* into expression from part **a** **A1** cao**6d: M1** for bringing out the power of a half **A1** cao |