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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **1a** | Writes:  as | **M1** | 2.2a | 6th  Understand the binomial theorem for rational n. |
| Uses the binomial expansion to write: | **M1** | 2.2a |
| Simplifies to obtain: | **M1** | 1.1b |
| Writes the correct final answer: … | **A1 ft** | 1.1b |
|  | **(4)** |  |  |
| **1b** | Either states or states | **B1** | 3.2b | 6th  Understand the conditions for validity of the binomial theorem for rational n. |
|  | **(1)** |  |  |
| **1c** | Makes an attempt to substitute  into  For example | **M1** | 1.1b | 6th  Understand the binomial theorem for rational n. |
| Continues to simplify the expression:  And states the correct final answer: | **A1** | 1.1b |
|  | **(2)** |  |  |

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| **1d** | Substitutes  into  Obtains: | **M1 ft** | 2.2a | 6th  Understand the binomial theorem for rational n. |
| States that | **M1 ft** | 1.1b |
| Deduces that | **A1 ft** | 1.1b |
|  | **(3)** |  |
| (10 marks) | | | | |
| Notes  **1a**  Award 3 marks if a student has used an incorrect expansion but worked out all the other steps correctly.  **1d**  Award all three marks if a student provided an incorrect answer in part **a**, but accurately works out an approximation for root 2 consistent with this incorrect answer. | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **2a** | Correctly states that | **M1** | 2.2a | 6th  Understand the binomial theorem for rational n. |
| Simplifies to obtain … | **M1** | 1.1b |
| Deduces that | **M1** | 2.2a |
| Solves to find | **A1** | 1.1b |
|  | **(4)** |  |  |
| **2b** | . Award mark for –500 seen. | **A1** | 1.1b | 6th  Understand the binomial theorem for rational n. |
| . Award mark for 500 seen. | **A1** | 1.1b |
|  | **(2)** |  |  |
| (6 marks) | | | | |
| **Notes** | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **3a** | Writes  as | **M1** | 2.2a | 6th  Understand the binomial theorem for rational n. |
| Expands | **M1** | 1.1b |
| Simplifies:    Award mark even if *x2* term is not seen. | **M1** | 1.1b |
| Uses  to write *a* = 64. | **A1** | 1.1b |
| Uses to write *b* = –6. | **A1** | 1.1b |
|  | **(5)** |  |  |
| **3b** | States expansion is valid for | **B1 ft** | 3.2b | 6th  Understand the conditions for validity of the binomial theorem for rational n. |
| Solves to state | **A1 ft** | 1.1b |
|  | **(2)** |  |  |
| **3c** | Substitutes *a* = 64 and *b* = –6 into | **M1 ft** | 1.1b | 6th  Understand the binomial theorem for rational n. |
| Finds | **A1 ft** | 1.1b |
|  | **(2)** |  |  |
| (9 marks) | | | | |
| Notes  **3a**  Note *x*2 term is not necessary to answer part **a**, so is not required. Will be needed to answer part **c**.  **3b**  Award marks for a correct conclusion using incorrect values of *a* and *b* from part **a**.  **3c**  Award marks for a correct answer using incorrect values of *a* and *b* from part **a**. | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **4a** | Correctly writes  as:  or | **M1** | 2.2a | 6th  Understand the binomial theorem for rational n. |
| Completes the binomial expansion: | **M1** | 2.2a |
| Simplifies to obtain | **A1** | 1.1b |
| Correctly writes as:  or | **M1** | 2.2a |
| Completes the binomial expansion: | **M1** | 2.2a |
| Simplifies to obtain | **A1** | 1.1b |
| Simplifies by subtracting to obtain  Reference to the need to subtract, or the subtracting shown, must be seen in order to award the mark. | **A1** | 1.1b |
|  | **(7)** |  |  |

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| **4b** | Makes an attempt to substitute *x* = 0.01 into f(*x*).  For example,  is seen. | **M1** | 1.1b | 6th  Understand the binomial theorem for rational n. |
| States the answer 1.5997328 | **A1** | 1.1b |
|  | **(2)** |  |  |
| **4c** | Makes an attempt to substitute *x* = 0.01 into  For example  is seen. | **M1 ft** | 1.1b | 6th  Understand the binomial theorem for rational n. |
| States the answer 1.59974907… Accept awrt 1.60. | **M1 ft** | 1.1b |
| Finds the percentage error: 0.0010% | **A1 ft** | 1.1b |
|  | **(3)** |  |  |
| (12 marks) | | | | |
| Notes  4a  If one expansion is correct and one is incorrect, or both are incorrect, award the final accuracy mark if they are subtracted correctly.  **4c**  Award all 3 marks for a correct answer using their incorrect answer from part **a**. | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **5a** | Makes an attempt to set up a long division. For example,  is seen. | **M1** | 2.2a | 7th  Expand rational functions using partial fraction decomposition. |
| Long division completed so that a 2 is seen in the quotient and a remainder of –2*x* – 7 is also seen. | **M1** | 1.1b |
| States | **M1** | 2.2a |
| Either equates variables or makes a substitution in an effort to find *B* or *C*. | **M1** | 2.2a |
| Finds | **A1** | 1.1b |
| Finds | **A1** | 1.1b |
|  | **(6)** |  |  |
| **5b** | Correctly writes  or  as | **M1 ft** | 2.2a | 6th  Understand the binomial theorem for rational n. |
| Simplifies to obtain | **A1 ft** | 1.1b |
| Correctly writes  as | **M1 ft** | 2.2a |
| Correctly writes  as | **M1 ft** | 2.2a |
| Simplifies to obtain | **A1 ft** | 1.1b |
| States the correct final answer: | **A1 ft** | 1.1b |
|  | **(6)** |  |  |
| **5c** | The expansion is only valid for | **B1** | 3.2b | 6th  Understand the conditions for validity of the binomial theorem for rational n. |
|  | **(1)** |  |  |
| (13 marks) | | | | |
| Notes  **5a**  **Alternative method.**  Writes the RHS as a single fraction.    **5b**  Award all 6 marks for a correct answer using their incorrect values of *A*, *B* and/or *C* from part **a**. | | | | |