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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **1a** |      | **B1****M1****A1** | 5.45.45.4 | 4thIntegrate functions using partial fractions with linear denominators |
|  | **(3)** |  |  |
| **1b** |     | **M1****A1****A1****A1** | 5.45.45.45.4 | 4thIntegrate functions using partial fractions with linear denominators |
|  | **(4)** |  |  |
| (7 marks) |
| Notes**1b M1** Integrates to obtain logs **A1** One term correct **A1** Both terms correct  **A1** Combines terms, including the “”, using laws of logarithms |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **2a** |      | **M1****M1****A1****A1** | 5.25.25.25.2 | 5thEvaluate integrals which extend to infinity |
|  | **(4)** |  |  |
| **2b** |      | **M1****M1****A1****A1****A1** | 5.25.25.25.25.2 | 6thIntegrate functions across limits which include values where the function is undefined |
|  | **(5)** |  |  |
| (9 marks) |
| Notes**2a M1** Use of limit **M1** Integrates **A1** Evaluates values **A1** cao**2b M1** Splits integral into two parts **M1** Integrates **A1** Uses limits twice **A1** Evaluates values **A1** cao |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **3a** |      | **M1****A1****A1** | 5.15.15.1 | 7thFind volumes of revolution when given functions in parametric form |
|  | **(3)** |  |  |
| **3b** |      | **M1****M1****A1****A1****A1** | 5.15.15.15.15.1 | 7thFind volumes of revolution when given functions in parametric form |
|  | **(5)** |  |  |
| **3c** |   | **M1****A1** | 5.15.1 | 7thFind volumes of revolution when given functions in parametric form |
|  | **(2)** |  |  |
| (10 marks) |

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| Notes**3a M1** Use of parametric form of volume **A1**  Differential correct **A1** Substitutes into formula correctly (A.G.)**3b M1** Substitutes for  **M1** Attempts to integrate **A1** Both terms correct **A1** Evalutes **A1** cao**3c M1** Uses Mass = Density × Volume **A1** cao (3 sf or better) |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **4ai** |       | **M1****A1****M1****M1****A1** | 5.55.55.55.55.5 | 6thBe able to differentiate inverse trigonometric functions using chain, product and quotient rules |
|  | **(5)** |  |  |
| **4aii** |   | **B1****B1** | 5.55.5 | 6thBe able to differentiate inverse trigonometric functions using chain, product and quotient rules |
|  | **(2)** |  |  |

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| **4b** |       Therefore minimum | **M1****M1****M1****A1****A1****M1****A1** | 5.55.55.55.55.55.55.5 | 6thBe able to differentiate inverse trigonometric functions using chain, product and quotient rules |
|  | **(7)** |  |  |
| (14 marks) |
| Notes**4ai** **M1** Uses standard result and chain rule **A1** Correct  **M1** Uses reciprocal **M1** Uses  **A1** cao**4aii** **B1** Uses chain rule or previous result **B1** cao**4b M1** Differentiates **M1** Sets   **M1** Obtains equation as polynomial in *x* **A1**  **A1**  **M1** Differentiates again **A1** Shows  and conclusion |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress Descriptor |
| **5a** |        | **B1****B1****M1****A1****A1** | 5.65.65.65.65.6 | 6thChoose appropriate trigonometric substitutions to integrate given functions |
|  | **(5)** |  |  |
| **5b** | Mean value      | **M1****A1****A1** | 5.35.35.3 | 6thEvaluate the mean value of a function |
|  | **(3)** |  |  |
| **5c** | Mean value   | **M1****A1** | 5.35.3 | 6thEvaluate the mean value of a function |
|  | **(2)** |  |  |
| (10 marks) |
| Notes**5a B1** Differentiates **B1** Substitutes for *x* **M1** Simplifies expression and integrates **A1** Answer in terms of *u* **A1** Answer in terms of *x***5b M1** Correct use of formula **A1** Substitutes values into limits **A1** Simplifies correctly**5c M1** Adds  **A1** cao Alternative for **5b** Changes limits to *u*   |