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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **1** | Understands that integration is required to solve the problem. For example, writes | **M1** | 3.1a | 6th  Use definite integration to find areas between curves. |
| Uses the trigonometric identityto rewrite aso.e. | **M1** | 2.2a |
| Shows | **A1** | 1.1b |
| Demonstrates an understanding of the need to find  using integration by parts. For example,  o.e. is seen. | **M1** | 2.2a |
| States fully correct integral | **A1** | 1.1b |
| Makes an attempt to substitute the limits | **M1** | 2.2a |
| States fully correct answer: eitheroro.e. | **A1** | 1.1b |
| (7 marks) | | | | |
| Notes  **1**  Integration shown without the limits is acceptable for earlier method and accuracy marks. Must correctly substitute limits at step 6 | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **2a** | Correctly substitutes *x =* 1.5 intoand obtains 2.2323… | **A1** | 1.1b | 5th  Understand and use the trapezium rule. |
|  | **(1)** |  |  |
| **2b** | States or implies formula for the trapezium rule | **M1** | 2.2a | 5th  Understand and use the trapezium rule. |
| Makes an attempt to substitute into the formula | **M1** | 1.1b |
| States correct final answer 1.610 (4 s.f.) | **A1** | 1.1b |
|  | **(3)** |  |  |

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| **2c** | Recognises the need to make a substitution.  **Method 1**  is seen. | Recognises the need to make a substitution.  **Method 2**  is seen. | **M1** | 2.2a | 6th  Integrate functions by substitution. |
| Correctly statesand finds new limits  and | States and finds  and finds new limits and | **M1** | 1.1b |
| Correctly transforms the integralinto | Correctly transforms the integral into | **M1** | 2.2a |
| Correctly finds the integral | Correctly finds the integral | **M1** | 1.1b |
| Makes an attempt to substitute the limits | Makes an attempt to substitute the limits | **M1** | 1.1b |
| Correctly finds answer | Correctly finds answer | **A1** | 1.1b |
|  | | **(6)** |  |  |
| **2d** | Using more strips would improve the accuracy of the answer. | | **B1** | 3.5c | 5th  Understand and use the trapezium rule. |
|  | | **(1)** |  |  |
| (11 marks) | | | | | |
| Notes  **2c**  Either method is acceptable. | | | | | |
| Q | Scheme | | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **3a** | States that | | **M1** | 1.1b | 6th  Decompose algebraic fractions into partial fractions − linear factors. |
| Equates the various terms.  Equating *x*s  Equating numbers | | **M1** | 1.1b |
| Multiplies or or both of the equations in an effort to equate one of the two variables. | | **M1** | 1.1b |
| Finds *A* = 5 | | **A1** | 1.1b |
| Find *B* = 6 | | **A1** | 1.1b |
|  | | **(5)** |  |  |
| **3b** | Writes as | | **M1 ft** | 2.2a | 6th  Integrate functions using the reverse chain rule. |
| Makes an attempt to integrate the expression. Attempt would constitute the use of logarithms. | | **M1 ft** | 2.2a |
| Integrates the expression to find | | **A1 ft** | 1.1b |
| Makes an attempt to substitute the limits | | **M1 ft** | 1.1b |
| Simplifies to findo.e. | | **A1 ft** | 1.1b |
|  | | **(5)** |  |  |
| (10 marks) | | | | | |
| Notes  **3**  Award ft marks for a correct answer to part **b** using incorrect values from part **a**. | | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **4a** | States | **M1** | 3.3 | 8th  Solve differential equations in a range of contexts. |
| Separates the variables | **M1** | 2.2a |
| Finds | **A1** | 1.1b |
| Shows clearly progression to state  For example, is seen. May also explain the  whereis a constant. | **A1** | 2.1 |
|  | **(4)** |  |  |
| **4b** | States | **M1** | 3.3 | 8th  Solve differential equations in a range of contexts. |
| Simplifies the expression by cancellingand then taking the natural log of both sides | **M1** | 2.2a |
| States that | **A1** | 1.1b |
|  | **(3)** |  |  |
| **4c** | States | **M1** | 3.3 | 8th  Solve differential equations in a range of contexts. |
| Simplifies the expression by cancelling  and then taking the natural log of both sides | **M1** | 2.2a |
| Finds *t* = 18.613… years. Accept 18.6 years. | **A1** | 1.1b |
|  | **(3)** |  |  |
| (10 marks) | | | | |
| Notes | | | | |

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| Q | Scheme | Marks | AOs | Pearson Progression Step and Progress descriptor |
| **5a** | States | **M1** | 3.1b | 8th  Solve differential equations in a range of contexts. |
| Deduces that | **M1** | 3.1b |
| Findsand/or | **M1** | 1.1b |
| States | **M1** | 3.1b |
| Makes an attempt to find | **M1** | 1.1b |
| Shows a clear logical progression to state | **A1** | 1.1b |
|  | **(6)** |  |  |
| **5b** | Separates the variables | **M1** | 2.2a | 8th  Solve differential equations in a range of contexts. |
| Finds | **A1** | 1.1b |
| Uses the fact that *t* = 0 when *h* = 50 m to find *C* | **M1** | 1.1b |
| Substitutes *h =* 60 into the equation | **M1** | 3.1b |
| Uses law of logarithms to write | **M1** | 2.2a |
| States correct final answerminutes. | **A1** | 1.1b |
|  | **(6)** |  |  |
| (12 marks) | | | | |
| Notes | | | | |