| **Question** | **Scheme** | | **Marks** |
| --- | --- | --- | --- |
| **1(a)** |  | | M1A1**cso** |
| \* | | **(2)** |
| **1(b)** |  | | M1A1 |
|  | | M1 |
| So,  **\*** | | A1\* **cso** |
|  |  | | **(4)** |
| **1(c)** |  | | M1 |
|  | | A1 aef |
|  | | M1A1**cso** |
|  | | **dd**M1  A1 **cao and cso** |
|  |  | | **(6)** |
| **1(d)** |  | | M1A1ft |
|  | **Note parts (c) and (d) can be marked together.** | | **(2)** |
|  |  | | **(14 marks)** |
| **2(a)** |  | | M1 A1 |
|  |  | | **(2)** |
| **2(b)** |  | | M1 A1 |
|  | | A1 \* |
|  |  | | **(3)** |
| **2(c)** |  | | B1ft |
|  | | M1 |
|  | |  |
|  | | A1 \* |
|  |  | | **(3)** |
| **2(d)** |  | | M1 A1 M1 |
|  | | A1 |
|  | | A1 |
|  |  | | **(5)** |
| **2(e)** |  | | M1 A1ft |
|  |  | | **(2)** |
|  |  | | **(15 marks)** |
| **3(a)** |  |  | B1 oe |
|  | |  |
|  | Making *y* the subject of their expression and substitute this into the correct *L* formula. | M1 |
| So,  **AG** | Correct solution only. | A1 **cso** |
|  |  | | **(3)** |
| **3(b)** |  | Either  or | M1 |
|  | Correct differentiation (need not be simplified). | A1 aef |
|  | and “their ”  or “their ” | M1; |
|  | or | A1 **cso** |
|  | Substitute candidate’s value of *x*into a formula for *L*. | ddM1 |
|  | 54 | A1 **cao** |
|  |  | | **(6)** |
| **3(c)** |  | Correct ft and considering sign. | M1 |
|  | and > 0 and conclusion. | A1 |
|  |  | | **(2)** |
|  |  | | **(11 marks)** |
| **4** | , |  |  |
|  |  | M1 |
|  |  | A1 |
|  |  | M1 oe |
|  | or |  |
| When | **dependent on the previous M1** | dM1 |
|  | or  or | A1 oe |
|  |  | | **(5 marks)** |
| **5(a)** |  | | M1 A1 |
|  |  | | **(2)** |
| **5(b)** |  | |  |
|  | | M1 A1 |
|  | |  |
|  | | M1 |
|  | | A1 |
|  |  | | **(4)** |
| **5(c)** |  | | M1 A1 |
|  | |  |
| At *t*=10 | |  |
|  | | M1 A1 |
|  |  | | **(4)** |
| **5(d)** | . Hence P cannot be 270 | | B1 |
|  |  | | **(1)** |
|  |  | | **(11 marks)** |
| **6(a)** |  | | B1 |
|  |  | | **(1)** |
| **6(b)** |  | | M1 |
|  | | M1 A1 |
|  |  | | **(3)** |
| **6(c)** | At maximum | |  |
|  | |  |
| oe | | M1 |
|  | | M1,A1 |
| Sub | | A1 |
|  |  | | **(4)** |
| **6(d)** | 40 | | B1 |
|  |  | | **(1)** |
|  |  | | **(9 marks)** |
| **7** |  | | M1 A1 |
| At | | M1 |
|  | | M1 A1 |
|  |  | | **(5 marks)** |
| **8(a)** | 🞸 cso | | B1 |
|  |  | | **(1)** |
| **8(b)** |  | | M1 |
| At *x* = 8, | | A1 |
|  |  | | **(2)** |
| **8(c)** |  | | B1 |
|  | | M1 |
| At *x* = 8 | | A1 |
|  |  | | **(3)** |
|  |  | | **(6 marks)** |
| **9(a)** | or equivalent | | M1 A1 |
| At , | | M1 A1 |
|  |  | | **(4)** |
| **9(b)** | or | | M1 |
| At ,  awrt 0.031 | | A1 |
|  |  | | **(2)** |
|  |  | | **(6 marks)** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Source paper** | **Question number** | **New spec references** | **Question description** | **New AOs** |
| 1 | C2 2014 | 10 | 5.7 | Differentiation | 1.1b, 2.1, 2.2a, 2.4, 3.1b, 3.4 |
| 2 | C2 2016 | 9 | 5.1, 7.1, 7.2 and 7.3 | Trigonometry, Differentiation | 1.1b, 2.1, 2.2a, 2.4, 3.1b, 3.4 |
| 3 | C2 2011 | 8 | 7.1, 7.2 and 7.3 | Differentiation | 1.1b, 2.1 |
| 4 | C4 June 2014 | 4 | 7.4 | Differentiation | 1.1b, 3.1b |
| 5 | C3 June 2014 | 8 | 6.1, 6.2, 6.3, 6.7, 7.4 | Exponential growth, Differentiation of exponential function | 1.1b, 3.1a, 3.4, 3.5b |
| 6 | C3 2017 | 8 | 6.1, 6.2, 6.3, 6.5, 6.7, 7.4 | Real life exponential problem, quotient rule | 1.1b, 2.1, 3.1a |
| 7 | C4 Jan 2011 | 2 | 7.2, 6.4 | Differentiation | 1.1b, 2.1 |
| 8 | C4 2012 | 2 | 7.4 | Differentiation | 1.1b, 3.1a |
| 9 | C4 2011 | 3 | 7.4 | Differentiation | 1.1b |