| **Question** | **Scheme** | **Marks** |
| --- | --- | --- |
| **1(a)** |    |   |
|  |  |
| Applies  to get  | M1A1 |
|   | A1\* |
|  |  | **(3)** |
| **1(b)** |    | M1 |
|  (5,7) | A1 A1 |
|  |  | **(3)** |
|  |  | **(6 marks)** |
| **2(a)** |   | M1A1 |
|  |  | **(2)** |
| **2(b)** |   | M1A1 |
|  When , Gradient = 160 | M1 |
|  Equation of tangent is  oe | dM1 |
|   cso  | A1 |
|  |  | **(5)** |
|  |   | **(7 marks)** |
| **3(a)** |    | B1\* |
|  |  | **(1)** |
| **3(b)** |   | M1A1A1 |
|  At *P*   | M1 |
|   accept  | M1A1 |
|    | A1 |
|  |  | **(7)** |
|  |  | **(8 marks)** |
| **4(a)** |    | B1 |
| Use  | M1 |
| Uses  and to get or in terms of just *x* | M1 |
|  ( conclusion stated with no errors previously) | A1\* |
|  |  | **(4)** |
| **4(b)** |  | M1 A1 A1 |
| When ,  =  =  | dM1 A1 |
|  |  | **(5)** |
| **4(c)** |  | M1 A1 |
|  | A1 |
|  |  | **(3)** |
|  |  | **(12 marks)** |
| **5(a)** |  or   | B1 |
|  |  | **(1)** |
| **5(b)** |    | M1A1 |
|  Sub  into  |  |
|   (= 75.4) /  | M1 |
|  Equation of tangent   | M1 |
|  Using  with  cso | M1 A1 |
|  |  | **(6)** |
|  |   | **(7 marks)** |
| **6(a)** |  | M1 A1 |
| Sets  | M1 |
|   | M1 |
|   4dp | A1 |
|  |  | **(5)** |
| **6(b)** |  | M1 A1 |
| Uses  in their expression | M1 |
|   | M1 A1 |
|  |  | **(5)** |
|  |  | **(10 marks)** |
| **7(a)** |  | M1A1 |
|    | M1 A1 |
|  |  | **(4)** |
| **7(b)** |  critical values of   | M1 |
|    | A1 |
|  |  | **(2)** |
| **7(c)** |   | B1 |
|    | M1 M1 A1 |
|  |   | **(4)** |
|  |  | **(10 marks)** |
| **8(a)** | *x*2 – 9 = (*x* + 3)(*x* – 3) | B1 |
|  |  |
|  | M1 |
|  | M1A1 |
|  | A1\* |
|  |  | **(5)** |
| **8(b)** |  |  |
|  | M1 M1 A1 |
|  | M1 A1 |
| Uses m1m2 = –1 to give gradient of normal =  | M1 |
|  | M1 |
| or any equivalent form | A1 |
|  |  | **(8)** |
|  |  | **(13 marks)** |
| **9(a)** |  Applies to   |  |
|     | M1 A1 |
|    | A1 |
|  |  | **(3)** |
| **9(b)** |  Sets  | M1 |
|   | M1 A1 |
| Sub into  | dM1 A1 |
|  Range   | A1 |
|  |  | **(6)** |
| **9(c)** | Accept  is NOT a ONE to ONE functionAccept  is a MANY to ONE functionAccept would be ONE to MANY | B1 |
|  |  | **(1)** |
|  |  | **(10 marks)** |
| **10(a)** |  | B1 |
|  | M1 |
|   | A1\* |
|  |  |  **(3)** |
| **10(b)** |  |  |
|  Applies  to with and  |  |
|   | M1 A1 |
|   | A1 |
|  |   | **(3)** |
| **10(c)** |  |  |
|  If f(*x*) is an increasing function as ,  | M1 |
|  for all values of *x* as   | A1 |
|  |  | **(2)** |
|  |   | **(8 marks)** |
| **11(a)** |   | M1 A1 |
|  | M1 |
|   | A1 |
|  |  | **(4)** |
| **11(b)** |    | M1A1ft |
| Substitutes  into  | M1 |
| Uses  with  to form equation of normal |  |
|   or equivalent cso | M1 A1 |
|  |  | **(5)** |
|  |  | **(9 marks)** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Source paper** | **Question number** | **New spec references** | **Question description** | **New AOs** |
| 1 | C3 June 2014 | 1 | 7.4, | Differentiation using quotient rule | 1.1b, 2.1 |
| 2 | C3 Jan 2013 | 1 | 7.3, 7.4 | Differentiation | 1.1b, 2.1 |
| 3 | C3 June 2014 | 3 | 7.3, 7.4, 7.5 | Finding equation of tangent from *x* = f(*y*)  | 1.1b |
| 4 | C3 June 2014R | 4 | 7.2, 7.4, 6.3, 2.6, 5.5 | Differentiation  | 1.1b, 2.1, 3.1a |
| 5 | C3 2015 | 5 | 7.2, 7.3, 7.4 | Differentiation, including chain rule, diff of sin2*x* and tangent  | 1.1b |
| 6 | C3 2016 | 5 | 7.2, 7.3, 7.4, 7.5, 5.6 | Differentiation, Trigonometry | 1.1b, 2.1, 3.1a |
| 7 | C3 2017 | 7 | 5.5, 7.2, 7.4  | Differentiation of product + *x* = f(*y*) | 1.1b, 2.1, 3.1a |
| 8 | C3 2011 | 7 | 2.6, 7.3, 7.4 | Partial fractions, Differentiation | 1.1b, 3.1a |
| 9 | C3 2015 | 7 | 7.4, 2.8 | Differentiation using product rule, turning points leading to range | 1.1b, 2.1, 2.4 |
| 10 | C3 2015 | 9 | 2.6, 7.3, 7.4  | Rational expression followed by quotient rule | 1.1b, 2.1, 2.4 |
| 11 | C3 2016 | 6 | 2.6, 7.3, 7.4 | Algebraic division, equation of normal  | 1.1b, 3.1a |