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<th>MARK SCHEME</th>
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<td>MAXIMUM MARK : 50</td>
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<td>SYLLABUS/COMPONENT : 8709/2</td>
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<td>MATHEMATICS</td>
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<td>Question</td>
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| 4 | Attempt at \( Y = mX + c \)  
   \( Y = -0.6X + c \)  
   Puts \( Y = \ln y \) and \( X = \ln x \)  
   \( \ln y = -0.6\ln x + 3 \)  
   \( y = e^{3x^{0.6}} \)  
   \( n = -0.6 \) and \( A = e^3 = 20.1 \) | M1 | Attempt at any \( y = mx + c \) eqn  
   M and c correct  
   A1 | A1 | A1A1 | M1 | Correct elimination of logs  
   6 |

| 5 (a) | \( y = \frac{e^{2x}}{2x+3} \)  
   \( \frac{dy}{dx} = \frac{(2x+3)2e^{2x} - e^{2x}2}{(2x+3)^2} \)  
   If \( x = 0 \), \( \frac{dy}{dx} = \frac{4}{9} \) | M1 | Correct \( u/v \) formula – or \( uv \)  
   with \( e^{x}(2x+3)^{-1} \)  
   A1 | A1 | A1 | A1 | A1 | Co |

(b) | Implicit differentiation.  
   \[ 2x + 2y \frac{dy}{dx} = y + x \frac{dy}{dx} \]  
   At \((3,2)\), \( \frac{dy}{dx} = -4 \)  
   Eqn of tangent  
   \( y - 2 = -4(x - 3) \)  
   or \( y + 4x = 14 \) | M1 | Some evidence of implicit  
   needed  
   A1 | A1 | A1 | LHS,  
   A1 RHS  
   8 |

| 6 (i) | \( y = x^2 \cos x \)  
   \( \frac{dy}{dx} = 2x \cos x - x^2 \sin x \)  
   \( = 0 \) when \( x = 0 \) or \( 2 \cos x = x \sin x \)  
   \( \Rightarrow x \tan x = 2 \). | M1 | Correct \( uv \) formula  
   Unsimplified ok  
   A1 | A1 | A1 | Putting his \( \frac{dy}{dx} = 0 \)  
   A1 | Co |

(ii) | \( u_2 = 1.107 \)  
   \( u_3 = 1.065 \)  
   \( u_4 = 1.081 \)  
   \( u_5 = 1.075 \)  
   \( u_6 = 1.078 \)  
   \( u_7 = 1.077 \)  
   → Limit of 1.08 | M1 | Correct manipulation of \( u_{n+1} \)  
   from \( u_n \)  
   A1 | A1 | A1 | First two correct  
   A1 | Correct limit |

(iii) | Since a limit is reached (=L)  
   \( u_{n+1} = u_n = L \)  
   \( L = \tan^{-1} \left( \frac{2}{L} \right) \)  
   \( L \tan L = 2. \) | M1 | Putting \( u_{n+1} = u_n = L \)  
   A1 | A1 | Co |
| (i) | \[
\int_{0}^{\pi/4} \sin 2x \, dx = \left[-\frac{\cos 2x}{2}\right] = 0 - (-\frac{\sqrt{2}}{2}) = \frac{\sqrt{2}}{2}
\]

\[
\int_{0}^{\pi} \cos^2 x \, dx = \int \frac{\cos 2x + 1}{2} \, dx = \left[\frac{\sin 2x}{4} + \frac{x}{2}\right]
\]

\[
= \frac{1}{8} (2 + \pi)
\]

| (ii) | \[
\int (2s + 3c)^2 \, dx = \int (4s^2 + 9c^2 + 12sc) \, dx
\]

12sc = 6sin2x Internal = 6 \times \frac{1}{2} = 3

9c^2 Internal = 9 \times \frac{1}{8} \times (\pi + 2)

4s^2 = 4 - 4c^2

Internal = 4x between 0 and \frac{\pi}{4}

4 \times \text{integral of } c^2 \text{ from 0 to } \frac{\pi}{4}

= 9.36 \text{ or } 13\pi/8 + 17/4

| M1 | Needs “-” and \cos 2x.
| A1 | Co
| M1 | Using double angles + attempt at integration
| A1 | Co
| DM1 | Use of limits 0 to \pi/4
| A1 | Co beware of fortuitous answers.
| B1 | Correct squaring – needs all terms
| B1 | There could be alternatives to these marks.
| B1 | They could also be implied.
| M1 | Dealing correctly with \int 4s^2
| A1 | Correct in either form.

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