1 Integrate to obtain $k\ln(2x+5)$ **M1**

Obtain correct $\frac{3}{2}\ln(2x+5)$ **A1**

Apply limits and use logarithm law for $\ln a - \ln b$ **M1**

Use logarithm power law **M1**

Obtain $\ln 125$ **A1** [5]

2 **(i)** Either State or imply non-modulus equation $(2x+3)^2 = (x+8)^2$ or corresponding pair of linear equations **B1**

Solve 3-term quadratic equation or 2 linear equations **M1**

Obtain $x = -\frac{11}{3}$ and $x = 5$ **A1**

Or Obtain $x = 5$ from graphical method, inspection, equation, … **B1**

Obtain $x = -\frac{11}{3}$ similarly **B2** [3]

(ii) Use logarithms to solve equation of form $2^y = k$ where $k > 0$ **M1**

Obtain 2.32 **A1** [2]

3 Obtain $\frac{\mathrm{d}x}{\mathrm{d}t} = \mathrm{e}^t + (t+1)\mathrm{e}^t$ or equivalent **B1**

Obtain $\frac{\mathrm{d}y}{\mathrm{d}t} = t(t+4)^{-\frac{1}{2}}$ **B1**

Substitute $t = 0$ and divide to obtain gradient of tangent **M1**

Obtain $\frac{3}{4}$ following their first derivatives **A1**

Form equation of tangent through $(1, 12)$ **M1**

Obtain $3x - 4y + 45 = 0$ or equivalent of required form **A1** [6]

4 **(i)** Attempt division, or equivalent, at least as far as quotient $3x^2 + kx$ **M1**

Obtain partial quotient $3x^2 + 11x$ **A1**

Obtain complete quotient $3x^2 + 11x + 20$ with no errors seen **A1**

Confirm remainder is 39 **B1** [4]

(ii) State or imply $(x-2)(3x^2 + 11x + 20) = 0$ **B1**

Calculate discriminant of quadratic factor or equivalent **M1**

Obtain –119 or equivalent and confirm only one real root **A1** [3]

5 **(i)** Integrate to obtain $\mathrm{e}^{3x} + 5\mathrm{e}^x$ **B1**

Apply both limits and subtract for expression of form $k_1\mathrm{e}^{3x} + k_2\mathrm{e}^x$ **M1**

Obtain $\mathrm{e}^{3a} + 5\mathrm{e}^a = 106$ or similarly simplified equivalent **A1**

Rearrange and introduce logarithms **M1**

Confirm given answer $a = \frac{1}{3}\ln(106 - 5\mathrm{e}^a)$ **A1** [5]

(ii) Use the iterative formula correctly at least once **M1**
Obtain final answer 1.477 **A1**
Show sufficient iterations to justify accuracy to 3 d.p. or show sign change in interval (1.4765, 1.4775) **A1** [3]

6 **(i)** State or imply $R = 3$ **B1**
Use appropriate formula to find α **M1**
Obtain 41.81° **A1** [3]

(ii) **(a)** Attempt to find one correct value of $\theta + \alpha$ **M1**
Obtain one correct value (30.7 or 245.6) of θ **A1**
Carry out correct method to find second answer **M1**
Obtain second correct answer and no others in range **A1** [4]

(b) State greatest value is 13, following their value of R **B1**
State least value is 7, following their value of R **B1** [2]

7 **(i)** Use quotient rule or equivalent to find first derivative **M1**
Obtain $\dfrac{2\cos 2x(\cos x + 1) + \sin 2x \sin x}{(\cos x + 1)^2}$ or equivalent **A1**
Use at least one of $\cos 2x = 2\cos^2 x - 1$ and $2x = 2\sin x \cos x$ **B1**
Express first derivative in terms of $\cos x$ only **M1**
Obtain $\dfrac{2\cos^3 x + 4\cos^2 x - 2}{(\cos x + 1)^2}$ or equivalent **A1**
Factorise numerator or divide numerator by $(\cos x + 1)$ or equivalent **M1**
Confirm given answer $\dfrac{2(\cos^2 x + \cos x - 1)}{\cos x + 1}$ correctly **A1** [7]

(ii) Use quadratic formula or equivalent to find value of $\cos x$ **M1**
Obtain x-coordinate 0.905 **A1**
Obtain x-coordinate –0.905 and no others in range **A1** [3]