1 Obtain derivative of the form $\frac{k}{5x+1}$, where $k = 1$, 5 or $\frac{1}{5}$ M1

Obtain correct derivative $\frac{5}{5x+1}$ A1

Substitute $x = 4$ into expression for derivative and obtain $\frac{5}{21}$ A1√ [3]

2 **EITHER** State or imply non-modular inequality $(2x - 3)^2 \leqslant (3x)^2$, or corresponding equation or pair of linear equations M1

Make reasonable solution attempt at a 3-term quadratic, or solve two linear equations M1

Obtain critical values –3 and $\frac{3}{5}$ A1

State correct answer $x \leqslant -3$ or $x \geqslant \frac{3}{5}$ A1

OR State one critical value, e.g. $x = -3$, by solving a linear equation (or inequality) or from a graphical method or by inspection B1

State the other critical value correctly B2

State correct answer $x \leqslant -3$ or $x \geqslant \frac{3}{5}$ B1 [4]

3 Use $2\ln(x + 3) = \ln(x + 3)^2$ M1

Use law for addition or subtraction of logarithms M1

Obtain correct quadratic expression in x A1

Make reasonable solution attempt at a 3-term quadratic M1

State $x = 9$ and no other solutions (condone $x = -1$ not deleted) A1 [5]

4 **(i)** State correct expression $\frac{1}{2} + \frac{1}{2}\cos 2x$, or equivalent B1 [1]

(ii) Integrate an expression of the form $a + b\cos 2x$, where $ab \neq 0$, correctly M1

State correct integral $\frac{1}{2}x + \frac{1}{4}\sin 2x$, or equivalent A1

Obtain correct integral (for $\sin 2x$ term) of $-\frac{1}{2}\cos 2x$ B1

Attempt to substitute limits, using exact values M1

Obtain given answer correctly A1 [5]

5 Use trig identity correctly to obtain a quadratic in $\tan 2\theta$ M1

Solve the quadratic correctly M1

Obtain $\tan 2\theta = 1$ or $-\frac{4}{5}$ A1

Obtain one correct answer A1

Carry out correct method for second answer from either root M1

Obtain remaining 3 answers from 22.5°, 112.5°, 70.7°, 160.7° and no others in the range A1

[Ignore answers outside the given range] [6]

6 **(i)** Substitute $x = 1$ or $x = -2$ and equate to zero — M1
Obtain a correct equation in any form with powers of x values calculated — A1
Obtain a second correct equation in any form — A1
Solve a relevant pair of equations for a or for b — M1
Obtain $a = 3$ and $b = -5$ — A1 [5]

(ii) Attempt division by $x^2 + x - 2$, or equivalent, and reach a partial quotient of $x^2 + kx$ — M1
Obtain partial quotient $x^2 + 2x$ — A1
Obtain $x^2 + 2x - 1$ with no errors seen — A1
S.C. M1A1√ if 'a' and/or 'b' incorrect — [3]

7 **(i)** At any stage, state the correct derivative of $e^{\frac{1}{2}x}$ — B1
Use product rule — M1
Obtain correct derivative in any form — A1
Equate derivative to 3 and obtain given equation correctly — A1 [4]

(ii) Consider sign of $2 + 6e^{-\frac{1}{2}x} - x$, or equivalent — M1
Complete the argument correctly with appropriate calculations — A1 [2]

(iii) Use the iterative formula correctly at least once — M1
Obtain final answer 3.21 — A1
Show sufficient iterations to justify its accuracy to 2 d.p. or show there is a sign change in the interval (3.205, 3.215) — B1 [3]

8 **(i)** State $2y\frac{dy}{dx}$ as derivative of y^2, or equivalent — B1

Equate derivative of LHS to zero and solve for $\frac{dy}{dx}$ — M1

Obtain given answer correctly — A1 [3]

(ii) Equate gradient expression to –1 and rearrange — M1
Obtain $y = 2x$ — A1
Substitute into original equation to obtain an equation in x^2 (or y^2) — M1
Obtain $2x^2 - 3x - 2 = 0$ (or $y^2 - 3y - 4 = 0$) — A1
Correct method to solve their quadratic equation — M1
State answers $(-\frac{1}{2}, -1)$ and $(2, 4)$ — A1 [6]