1 Solve the inequality \( |2x - 3| > 5 \). \[3\]

2 Show that \( \int_0^6 \frac{1}{x + 2} \, dx = 2 \ln 2 \). \[4\]

3 (i) Show that the equation \( \tan(x + 45^\circ) = 6 \tan x \) can be written in the form \( 6 \tan^2 x - 5 \tan x + 1 = 0 \). \[3\]

(ii) Hence solve the equation \( \tan(x + 45^\circ) = 6 \tan x \), for \( 0^\circ < x < 180^\circ \). \[3\]

4 The polynomial \( x^3 + 3x^2 + 4x + 2 \) is denoted by \( f(x) \).
   (i) Find the quotient and remainder when \( f(x) \) is divided by \( x^2 + x - 1 \). \[4\]
   (ii) Use the factor theorem to show that \( (x + 1) \) is a factor of \( f(x) \). \[2\]

5 (i) Given that \( y = 2^x \), show that the equation \( 2^x + 3(2^{-x}) = 4 \)

   can be written in the form \( y^2 - 4y + 3 = 0 \). \[3\]

(ii) Hence solve the equation \( 2^x + 3(2^{-x}) = 4 \),

   giving the values of \( x \) correct to 3 significant figures where appropriate. \[3\]

6 The equation of a curve is \( x^2 y + y^2 = 6x \).

(i) Show that \( \frac{dy}{dx} = \frac{6 - 2xy}{x^2 + 2y} \). \[4\]

(ii) Find the equation of the tangent to the curve at the point with coordinates \( (1, 2) \), giving your answer in the form \( ax + by + c = 0 \). \[3\]
7 (i) By sketching a suitable pair of graphs, show that the equation
\[ e^{2x} = 2 - x \]
has only one root. \[2\]

(ii) Verify by calculation that this root lies between \(x = 0\) and \(x = 0.5\). \[2\]

(iii) Show that, if a sequence of values given by the iterative formula
\[ x_{n+1} = \frac{1}{2} \ln(2 - x_n) \]
converges, then it converges to the root of the equation in part (i). \[1\]

(iv) Use this iterative formula, with initial value \(x_1 = 0.25\), to determine the root correct to 2 decimal places. Give the result of each iteration to 4 decimal places. \[3\]

8 (i) By differentiating \( \frac{\cos x}{\sin x} \), show that if \( y = \cot x \) then \( \frac{dy}{dx} = -\csc^2 x \). \[3\]

(ii) By expressing \( \cot^2 x \) in terms of \( \csc^2 x \) and using the result of part (i), show that
\[ \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \cot^2 x \, dx = 1 - \frac{\pi}{4}. \] \[4\]

(iii) Express \( \cos 2x \) in terms of \( \sin^2 x \) and hence show that \( \frac{1}{1 - \cos 2x} \) can be expressed as \( \frac{1}{2} \csc^2 x \). Hence, using the result of part (i), find
\[ \int \frac{1}{1 - \cos 2x} \, dx. \] \[3\]