1 Solve the inequality $|x - 4| > |x + 1|$. [4]

2 The polynomial $x^4 - 9x^2 - 6x - 1$ is denoted by $f(x)$.

(i) Find the value of the constant $a$ for which

$$f(x) \equiv (x^2 + ax + 1)(x^2 - ax - 1).$$

(ii) Hence solve the equation $f(x) = 0$, giving your answers in an exact form. [3]

3

![Diagram](image)

The diagram shows the curve $y = e^{2x}$. The shaded region $R$ is bounded by the curve and by the lines $x = 0$, $y = 0$ and $x = p$.

(i) Find, in terms of $p$, the area of $R$. [3]

(ii) Hence calculate the value of $p$ for which the area of $R$ is equal to 5. Give your answer correct to 2 significant figures. [3]

4 (i) Show that the equation

$$\tan(45^\circ + x) = 4 \tan(45^\circ - x)$$

can be written in the form

$$3 \tan^2 x - 10 \tan x + 3 = 0.$$ [4]

(ii) Hence solve the equation

$$\tan(45^\circ + x) = 4 \tan(45^\circ - x),$$

for $0^\circ < x < 90^\circ$. [3]
5  (i) By sketching a suitable pair of graphs, show that the equation

\[ \ln x = 2 - x^2 \]

has exactly one root. \[3\]

(ii) Verify by calculation that the root lies between 1.0 and 1.4. \[2\]

(iii) Use the iterative formula

\[ x_{n+1} = \sqrt{2 - \ln x_n} \]

to determine the root correct to 2 decimal places, showing the result of each iteration. \[3\]

6  The equation of a curve is \( y = \frac{1}{1 + \tan x} \).

(i) Show, by differentiation, that the gradient of the curve is always negative. \[4\]

(ii) Use the trapezium rule with 2 intervals to estimate the value of

\( \int_{0}^{\frac{1}{4}\pi} \frac{1}{1 + \tan x} \, dx \),

giving your answer correct to 2 significant figures. \[3\]

(iii) The diagram shows a sketch of the curve for \( 0 \leq x \leq \frac{1}{4}\pi \). State, with a reason, whether the trapezium rule gives an under-estimate or an over-estimate of the true value of the integral in part (ii). \[1\]

7  The parametric equations of a curve are

\[ x = 2\theta - \sin 2\theta, \quad y = 2 - \cos 2\theta. \]

(i) Show that \( \frac{dy}{dx} = \cot \theta \). \[5\]

(ii) Find the equation of the tangent to the curve at the point where \( \theta = \frac{1}{4}\pi \). \[3\]

(iii) For the part of the curve where \( 0 < \theta < 2\pi \), find the coordinates of the points where the tangent is parallel to the \( x \)-axis. \[3\]