1 (i) Solve the equation \(|x + 2| = |x - 13|\). \[2\]

(ii) Hence solve the equation \(|3^y + 2| = |3^y - 13|\), giving your answer correct to 3 significant figures. \[2\]

2 Solve the equation \(3 \sin 2\theta \tan \theta = 2\) for \(0^\circ < \theta < 180^\circ\). \[4\]

3 (a) Find \(\int 4 \cos \left(\frac{1}{2}x + 2\right) \, dx\). \[2\]

(b) Use the trapezium rule with three intervals to find an approximation to
\[\int_0^{12} \sqrt{(4 + x^2)} \, dx,\]
giving your answer correct to 3 significant figures. \[3\]

4 The parametric equations of a curve are
\[x = 2 \ln(t + 1), \quad y = 4e^t.\]
Find the equation of the tangent to the curve at the point for which \(t = 0\). Give your answer in the form \(ax + by + c = 0\), where \(a, b\) and \(c\) are integers. \[6\]

5

The variables \(x\) and \(y\) satisfy the equation \(y = K(2^px)\), where \(K\) and \(p\) are constants. The graph of \(\ln y\) against \(x\) is a straight line passing through the points \((1.35, 1.87)\) and \((3.35, 3.81)\), as shown in the diagram. Find the values of \(K\) and \(p\) correct to 2 decimal places. \[6\]
6. The polynomial \( p(x) \) is defined by
\[
p(x) = x^3 + 2x + a,
\]
where \( a \) is a constant.

(i) Given that \( (x + 2) \) is a factor of \( p(x) \), find the value of \( a \). [2]

(ii) When \( a \) has this value, find the quotient when \( p(x) \) is divided by \( (x + 2) \) and hence show that the equation \( p(x) = 0 \) has exactly one real root. [5]

7. It is given that \[
\int_0^a \left( \frac{1}{2} e^{3x} + x^2 \right) \, dx = 10,
\]
where \( a \) is a positive constant.

(i) Show that \( a = \frac{1}{3} \ln(61 - 2a^3) \). [4]

(ii) Show by calculation that the value of \( a \) lies between 1.0 and 1.5. [2]

(iii) Use an iterative formula, based on the equation in part (i), to find the value of \( a \) correct to 3 decimal places. Give the result of each iteration to 5 decimal places. [3]

8. The diagram shows the curve \( y = \tan x \cos 2x \), for \( 0 \leq x < \frac{1}{2} \pi \), and its maximum point \( M \).

(i) Show that \( \frac{dy}{dx} = 4 \cos^2 x - \sec^2 x - 2 \). [5]

(ii) Hence find the \( x \)-coordinate of \( M \), giving your answer correct to 2 decimal places. [4]