1 Solve the inequality $|x - 3| > |x + 2|$. [4]

2 The variables $x$ and $y$ satisfy the relation $3^y = 4^{x+2}$.

(i) By taking logarithms, show that the graph of $y$ against $x$ is a straight line. Find the exact value of the gradient of this line. [3]

(ii) Calculate the $x$-coordinate of the point of intersection of this line with the line $y = 2x$, giving your answer correct to 2 decimal places. [3]

3 The parametric equations of a curve are

$$x = 3t + \ln(t - 1), \quad y = t^2 + 1, \quad \text{for } t > 1.$$ [4]

(i) Express $\frac{dy}{dx}$ in terms of $t$. [3]

(ii) Find the coordinates of the only point on the curve at which the gradient of the curve is equal to 1. [4]

4 The polynomial $2x^3 - 3x^2 + ax + b$, where $a$ and $b$ are constants, is denoted by $p(x)$. It is given that $(x - 2)$ is a factor of $p(x)$, and that when $p(x)$ is divided by $(x + 2)$ the remainder is $-20$.

(i) Find the values of $a$ and $b$. [5]

(ii) When $a$ and $b$ have these values, find the remainder when $p(x)$ is divided by $(x^2 - 4)$. [3]

5 (i) By sketching a suitable pair of graphs, show that the equation

$$\sec x = 3 - x,$$

where $x$ is in radians, has only one root in the interval $0 < x < \frac{1}{2}\pi$. [2]

(ii) Verify by calculation that this root lies between 1.0 and 1.2. [2]

(iii) Show that this root also satisfies the equation

$$x = \cos^{-1}\left(\frac{1}{3 - x}\right).$$ [1]

(iv) Use the iterative formula

$$x_{n+1} = \cos^{-1}\left(\frac{1}{3 - x_n}\right),$$

with initial value $x_1 = 1.1$, to calculate the root correct to 2 decimal places. Give the result of each iteration to 4 decimal places. [3]
6  (i) Express \( \cos^2 x \) in terms of \( \cos 2x \).  

(ii) Hence show that 

\[
\int_0^{\frac{3\pi}{2}} \cos^2 x \, dx = \frac{3\pi}{6} + \frac{1}{8} \sqrt{3}.
\]

(iii) By using an appropriate trigonometrical identity, deduce the exact value of 

\[
\int_0^{\frac{3\pi}{2}} \sin^2 x \, dx.
\]

7  

The diagram shows the part of the curve \( y = e^x \cos x \) for \( 0 \leq x \leq \frac{3\pi}{2} \). The curve meets the \( y \)-axis at the point \( A \). The point \( M \) is a maximum point.

(i) Write down the coordinates of \( A \).  

(ii) Find the \( x \)-coordinate of \( M \).  

(iii) Use the trapezium rule with three intervals to estimate the value of 

\[
\int_0^{\frac{3\pi}{2}} e^x \cos x \, dx,
\]

giving your answer correct to 2 decimal places.  

(iv) 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 (iii).