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2. (a) Show that $f(x) = x^4 + x - 1$ has a real root α in the interval $[0.5, 1.0]$. (2)
- (b) Starting with the interval $[0.5, 1.0]$, use interval bisection twice to find an interval of width 0.125 which contains α . (3)
- (c) Taking 0.75 as a first approximation, apply the Newton Raphson process twice to $f(x)$ to obtain an approximate value of α . Give your answer to 3 decimal places. (5)



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4. A right angled triangle T has vertices $A(1, 1)$, $B(2, 1)$ and $C(2, 4)$. When T is transformed by the matrix $\mathbf{P} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$, the image is T' .

(a) Find the coordinates of the vertices of T' . (2)

(b) Describe fully the transformation represented by \mathbf{P} . (2)

The matrices $\mathbf{Q} = \begin{pmatrix} 4 & -2 \\ 3 & -1 \end{pmatrix}$ and $\mathbf{R} = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ represent two transformations. When T is transformed by the matrix \mathbf{QR} , the image is T'' .

(c) Find \mathbf{QR} . (2)

(d) Find the determinant of \mathbf{QR} . (2)

(e) Using your answer to part (d), find the area of T'' . (3)



9. The rectangular hyperbola H has cartesian equation $xy = 9$

The points $P\left(3p, \frac{3}{p}\right)$ and $Q\left(3q, \frac{3}{q}\right)$ lie on H , where $p \neq \pm q$.

(a) Show that the equation of the tangent at P is $x + p^2y = 6p$. (4)

(b) Write down the equation of the tangent at Q . (1)

The tangent at the point P and the tangent at the point Q intersect at R .

(c) Find, as single fractions in their simplest form, the coordinates of R in terms of p and q . (4)

