

1 (a) Show that

$$\tan(r+1) - \tan r = \frac{\sin 1}{\cos(r+1)\cos r}. \quad [2]$$

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Let $u_r = \frac{1}{\cos(r+1)\cos r}$.

(b) Use the method of differences to find $\sum_{r=1}^n u_r$. [3]

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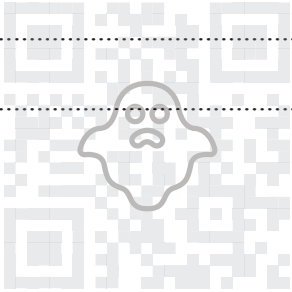
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2 The cubic equation $2x^3 - 4x^2 + 3 = 0$ has roots α, β, γ . Let $S_n = \alpha^n + \beta^n + \gamma^n$.

(a) State the value of S_1 and find the value of S_2 . [3]

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(b) (i) Express S_{n+3} in terms of S_{n+2} and S_n . [1]

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(ii) Hence, or otherwise, find the value of S_4 . [2]

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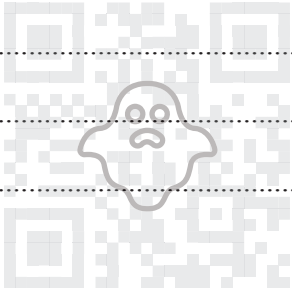
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4 The matrices **A**, **B** and **C** are given by

$$\mathbf{A} = \begin{pmatrix} 2 & k & k \\ 5 & -1 & 3 \\ 1 & 0 & 1 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 0 \end{pmatrix} \text{ and } \mathbf{C} = \begin{pmatrix} 0 & 1 & 1 \\ -1 & 2 & 0 \end{pmatrix},$$

where k is a real constant.

(a) Find **CAB**.

[3]

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(b) Given that **A** is singular, find the value of k .

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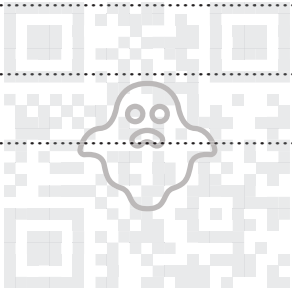
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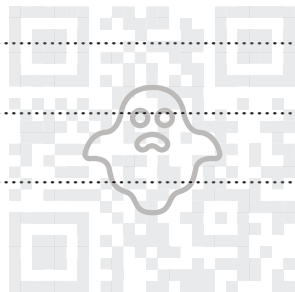
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Handwriting practice area consisting of 20 horizontal dotted lines.



(c) Sketch C , stating the coordinates of the intersections with the axes.

[3]

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(d) Sketch the curve with equation $y = \left| \frac{x^2 - x - 3}{1 + x - x^2} \right|$ and find in exact form the set of values of x for which $\left| \frac{x^2 - x - 3}{1 + x - x^2} \right| < 3$.

[6]



Handwriting practice area consisting of 20 horizontal dotted lines.

