

# Pearson Edexcel AS Further Mathematics 8FM0

## FPure2 – 2 Further Matrix Algebra

Time allowed: 45 minutes

School: [www.CasperYC.club](http://www.CasperYC.club)

Name:

Teacher:

Question	Points	Score
1	7	
2	5	
3	10	
4	13	
Total:	35	

How I can achieve better:

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Last updated: February 3, 2026











4. The two sequences  $x_n$  and  $y_n$  satisfy the recurrence relations

$$x_1 = 2 \quad x_{n+1} = 5x_n - y_n \quad n \geq 1.$$

$$y_1 = 1 \quad y_{n+1} = 3x_n + y_n$$

(a) Find the value of  $x_3$ . [2]

These recurrence relations can be written in matrix form as

$$\begin{pmatrix} x_1 \\ y_1 \end{pmatrix} = \begin{pmatrix} 2 \\ 1 \end{pmatrix} \quad \begin{pmatrix} x_{n+1} \\ y_{n+1} \end{pmatrix} = \mathbf{A} \begin{pmatrix} x_n \\ y_n \end{pmatrix}, \quad n \geq 1$$

where  $\mathbf{A} = \begin{pmatrix} 5 & -1 \\ 3 & 1 \end{pmatrix}$ .

(b) Find [5]

- i. the eigenvalues of  $\mathbf{A}$ ,
- ii. the corresponding eigenvectors of  $\mathbf{A}$ .

(c) Hence write down matrices  $\mathbf{P}$  and  $\mathbf{D}$  such that  $\mathbf{P}^{-1}\mathbf{A}\mathbf{P} = \mathbf{D}$ , where  $\mathbf{D}$  is a diagonal matrix. [2]

New sequences  $u_n$  and  $v_n$  can be formed from  $x_n$  and  $y_n$  using the transformation

$$\begin{pmatrix} u_n \\ v_n \end{pmatrix} = \mathbf{P}^{-1} \begin{pmatrix} x_n \\ y_n \end{pmatrix}$$

(d) Show that [2]

$$\begin{pmatrix} u_{n+1} \\ v_{n+1} \end{pmatrix} = \mathbf{D} \begin{pmatrix} u_n \\ v_n \end{pmatrix}.$$

(e) Hence find closed form expressions for the original sequences  $x_n$  and  $y_n$ . [2]

Total: 13

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