

# MATRICES INVESTIGATION

## PART A – Triangle Matrices

1. Addition of two consecutive triangle matrices

Examples

1 mark

$$T_n + T_{n+1} = \begin{bmatrix} (n+1)^2 & (n+2)^2 \\ (n+2)^2 & (n+3)^2 \end{bmatrix}$$

3 marks

2. Determinant of triangle matrix

Examples

1 mark

$$\text{Det}(T_n) = -t_{n+1}$$

2 marks

3. Squaring of triangle matrix

Examples

1 mark

$$T_n^2 = \begin{bmatrix} t_{(n+1)^2} & t_{(n+1)(n+2)} \\ t_{(n+1)(n+2)} & t_{(n+2)^2} \end{bmatrix}$$

3 marks

4. Product of two consecutive triangle matrices

Examples

1 mark

$$T_n T_{n+1} = \begin{bmatrix} t_{(n+1)(n+2)} & t_{(n+1)(n+3)} \\ t_{(n+2)^2} & t_{(n+2)(n+3)} \end{bmatrix}$$

3 marks

## PART B – Fibonacci Matrices

### 1. Addition of two consecutive Fibonacci matrices

Examples

1 mark

$$\begin{aligned}\mathcal{F}_n + \mathcal{F}_{n+1} &= \begin{bmatrix} f_{(n+2)} & f_{(n+3)} \\ f_{(n+3)} & f_{(n+4)} \end{bmatrix} \\ &= \mathcal{F}_{n+2}\end{aligned}$$

(4 x ½ mark)

or 2 marks

### 2. Product of two consecutive Fibonacci matrices

Examples

1 mark

$$\begin{aligned}\mathcal{F}_n \mathcal{F}_{n+1} &= \begin{bmatrix} f_{2n+1} & f_{2n+2} \\ f_{2n+2} & f_{2n+3} \end{bmatrix} \\ &= \mathcal{F}_{2n+1}\end{aligned}$$

(4 x ½ mark)

or 2 marks

### 3. Product of two non-consecutive Fibonacci matrices

Examples

1 mark

$$\begin{aligned}\mathcal{F}_m \mathcal{F}_n &= \begin{bmatrix} f_{m+n} & f_{m+n+1} \\ f_{m+n+1} & f_{m+n+2} \end{bmatrix} \\ &= \mathcal{F}_{m+n}\end{aligned}$$

(4 x ½ mark)

or 2 marks

### 4. Determinant of the Fibonacci matrix

Examples

1 mark

$$\begin{aligned}\text{Det}(\mathcal{F}_n) &= (-1)^n \quad \text{or equivalent statement(s)} \\ &\quad (1 \text{ would only get 1 mark})\end{aligned}$$

2 marks

### 5. Solution to simultaneous equations

$$\begin{aligned}f_n x + f_{n+1} y &= f_m \\ f_{n+1} x + f_{n+2} y &= f_{m+1}\end{aligned}$$

such that  $m \geq n + 1$

$$\begin{aligned}x &= f_{m-n} \\ y &= f_{m-n+1}\end{aligned}$$

2 marks

2 marks