Write your name here

Surname	Other Names

AS/A Level Mathematics

Recurrence Relations

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

• Use **black** ink or ball-point pen.
• If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
• **Fill in the boxes** at the top of this page with your name.
• Answer **all** questions and ensure that your answers to parts of questions are clearly labelled..
• Answer the questions in the spaces provided
– there may be more space than you need.
• You should show sufficient working to make your methods clear.
Answers without working may not gain full credit.
• Answers should be given to three significant figures unless otherwise stated.

Information

• The marks for **each** question are shown in brackets
– use this as a guide as to how much time to spend on each question.

Advice

• Read each question carefully before you start to answer it.
• Try to answer every question.
• Check your answers if you have time at the end.

1 A sequence $x_1, x_2, x_3, \ldots$ is defined by

$$x_1 = 2$$
$$x_{n+1} = ax_n - 5, \ \ n \geq 1$$

(a) Find an expression for x_2 in terms of a

(b) Show that $x_3 = 2a^2 - 5a - 5$ **(1)**

Given that $x_3 = 20$ **(2)**

(c) Find the possible values of a. **(3)**

(Total for question 1 is 6 marks)

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2 A sequence $x_1, x_2, x_3, \ldots$ is defined by

$$x_1 = k$$
$$x_n = 4x_{n-1} - 1, \ \ n \geq 2$$

(a) Find an expression for x_2 in terms of k **(1)**

(b) Show that $x_3 = 16k - 5$ **(2)**

(c) Find $\displaystyle\sum_{r=1}^{4} a_r$ in terms of k **(3)**

(Total for question 2 is 6 marks)

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3 A sequence $u_1, u_2, u_3, \ldots$ is defined by

$$u_1 = 1$$
$$u_{n+1} = (u_n - 1)^2, \qquad n \geq 1$$

(a) Find u_2, u_3 and u_4 **(3)**

(b) Write down the value of u_{100} **(1)**

(Total for question 3 is 4 marks)

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4 A sequence $u_1, u_2, u_3, \ldots$ is defined by

$$u_1 = 3$$
$$u_{n+1} = u_n + c, \ \ n \geq 1$$

Given $u_5 = 21$

(a) Find the value of c **(3)**

(b) Find an expression for u_n in terms of n **(2)**

(Total for question 4 is 5 marks)

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5 A sequence $u_1, u_2, u_3, \ldots$ is defined by

$$u_1 = 3, \ u_2 = 5$$
$$u_n = u_{n-1} + u_{n-2}, \qquad n \geq 3$$

Find u_3, u_4 and u_5

(Total for question 5 is 3 marks)