Full Name: SOLUTIONS

# MATHEMATICS APPLICATIONS

## Test 3 – Recurrence Relationships

## Chapter 4

## Semester 1 2017

### Section Two - Calculator Assumed

### Time allowed for this section

Working time for this section: 35 minutes
Marks available: 38 marks

### Material required/recommended for this section

**To be provided by the supervisor**

This Question/Answer booklet
Formula sheet

**To be provided by the candidate**

Standard items: pens, pencils, pencil sharpener, eraser, correction fluid, ruler, highlighters

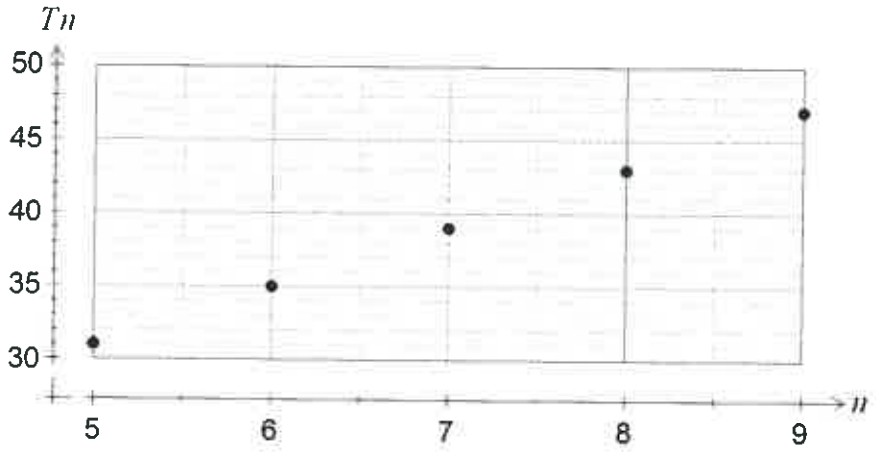
Special items: drawing instruments, templates, notes on one unfolded sheet of A4 paper, and up to three calculators satisfying the conditions set by the Curriculum Council for this course.

**Important note to candidates**

No other items may be used in this section of the examination. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

1. (6 marks)

The terms of a sequence are shown in the graph below.




(a) Choose the best description of the sequence from geometric, arithmetic or neither, explaining your choice. [2]

It appears linear ∴ arithmetic. ✓ ✓

(b) Determine

(i) $T_{10}$. [1]

$51 \quad (47+4)$

(ii) $T_1$. [1]

$31 - 4 - 4 - 4 - 4 = 15$

(c) Determine the recursive rule for this sequence. [2]

$T_n = 15 + (n-1) \times 4$ ✓ ✓

$= 4n + 11$

* no simplification is necessary (preferred).

2. (9 marks)

a. A sequence is defined by $T_{n+1} = 2T_n$, where $T_1 = 9$.

i. Determine the next two terms of the sequence. [2]

$T_2 = 18$ ✓

$T_3 = 36$ ✓

ii. State a rule for the $n^{th}$ term of this sequence. [1]

$T_n = 9 \times 2^{n-1}$ ✓

iii. Determine $T_5$ [2]

$T_5 = 9 \times 2^4$

$= 144$

b. The first-order recurrence relation $t_{n+1} = bt_n + c$ was used with $t_1 = 3$ to calculate $t_2 = 4$ and $t_3 = 7$. Determine the values of *b*, *c* and $t_4$. [4]

$4 = 3b + c$

$7 = 4b + c$

✓process

$3 = b$ ✓

$\therefore c = -5$ ✓

$b = 3$

$c = -5$

hence $t_{n+1} = 3t_n - 5$

$t_4 = 3 \times 7 - 5$ ✓

$= 16$

$t_4 = 16$

6

3. (5 marks)

(a) Some consecutive terms of an arithmetic sequence are shown in the table below.

| n | 4 | 5 | 6 | 7 |
|---|---|---|---|---|
| $T_n$ | 21.5 | 24.2 | 26.9 | 29.6 |

2.7 2.7 2.7

(i) Determine the eighth term of this sequence. (2 marks)

$29.6 + 2.7 = 32.3$ ✓ ✓ (difference)

(ii) Determine the first term of the sequence. (1 marks)

$21.5 - 3 \times 2.7 = 21.5 - 8.1$ ✓

$= 13.4$ ✓

2

(iii) State a difference equation for this sequence. (2 marks)

$T_{n+1} = T_n + 2.7$ ✓ , $T_1 = 13.4$ ✓

**End of Section One**