

Full Name: SOLUTIONS



MATHEMATICS APPLICATIONS

Test 2 – Linear Models and Sequences

Chapters 2 and 3

Semester 1 2017

Section One - Calculator Free

Time allowed for this section

Working time for this section: 30 minutes

Marks available: 33 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: Nil

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. (3 marks)

Calculate the sum of all the **multiples of 5** between 1 and 50.

9 Multiples

$a = 5$

$d = 5$ ✓

$$S_{10} = \frac{9}{2} (2 \times 5 + (9-1)5)$$

$$= 4.5 (10 + 40)$$

$$= 225$$
 ✓

Alternative solutions - 1 mark for answer

2. (4 marks: 2, 2)

2 marks for method/recognition of key words

Below are four consecutive numbers of an arithmetic sequence. The middle two numbers are missing.

$$22, \dots, \dots, 76$$

$$+18 \quad +18 \quad +18$$

a) What are the two missing numbers?

$$40, 58$$

b) Determine the general rule for T_n

$$T_n = 22 + (n-1) \times 18$$

$$= 18n + 4$$
 ✓

3. (3 marks: 1, 2)

For the sequence, -4, 32, -256, ...

a) Find the common ratio

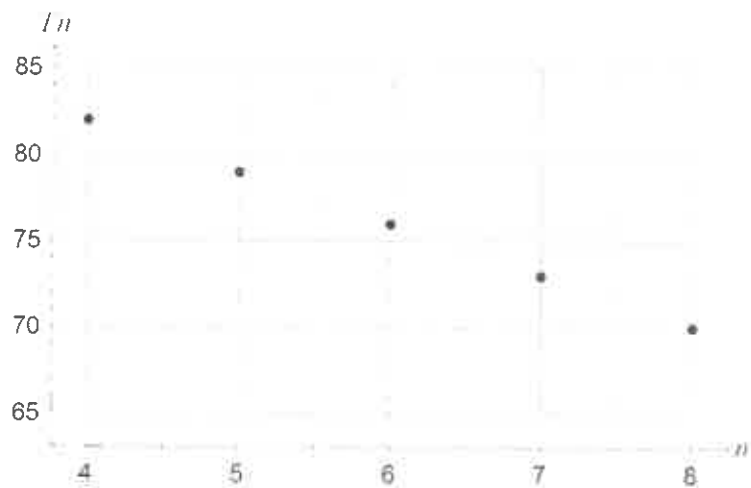
$$r = -8$$
 ✓

b) Determine the rule for the n^{th} term

$$T_n = -4 \times (-8)^{n-1}$$

4. (7 marks: 1, 1, 1, 2, 2)

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



a) Describe the feature of the graph that indicates the sequence is arithmetic.

The points are on a straight line ✓

b) Determine

(i) T_9 67 ✓ (82 - 15)

(ii) T_1 91 ✓ (82 + 9)

c) The rule for the n^{th} term of the sequence is $T_n = an + b$. Determine the values of the constants a and b .

$$\begin{aligned} T_n &= 91 + (n-1) \times (-3) \\ &= 91 - 3n + 3 \\ &= 94 - 3n \end{aligned}$$

$$\begin{aligned} a &= -3 \quad \checkmark \\ b &= 94 \quad \checkmark \end{aligned}$$

d) Determine the smallest value of n such that $T_n < 0$.

$$0 = 94 - 3n$$

$$3n = 94$$

$$n = 31\frac{1}{3} \quad \checkmark$$

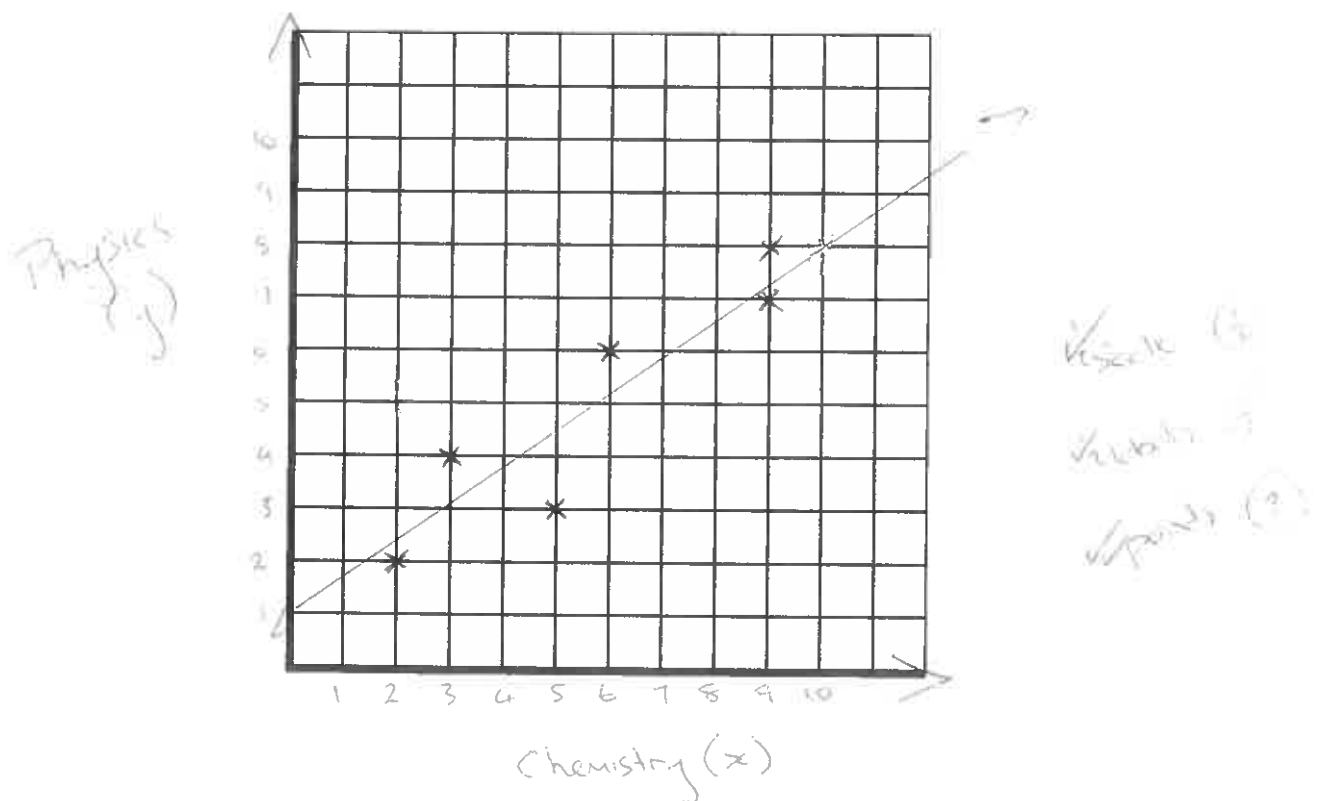
$$\therefore \text{Term 32 } (n = 32) \quad \checkmark$$

5. (15 marks: 3, 2, 2, 4, 3, 1)

The marks for Chemistry and Physics tests (out of 10) were recorded in the table below for 6 students:

Chemistry (x)	2	3	5	6	7	9	9
Physics (y)	5 2	4	3	6	E	7	8

a) Draw a scatterplot to represent this information



b) Draw the line of best fit 'by eye' and hence estimate a Physics mark for the student who was unable to sit that test (score E).

✓ for appropriate line

✓ for value estimated from line (my case 6 for physics)

c) Describe the relationship

Positive Linear Strong ✓ (will accept moderate for this time)

Context: The relationship suggests that Physics marks will increase as Chemistry marks increase. ✓

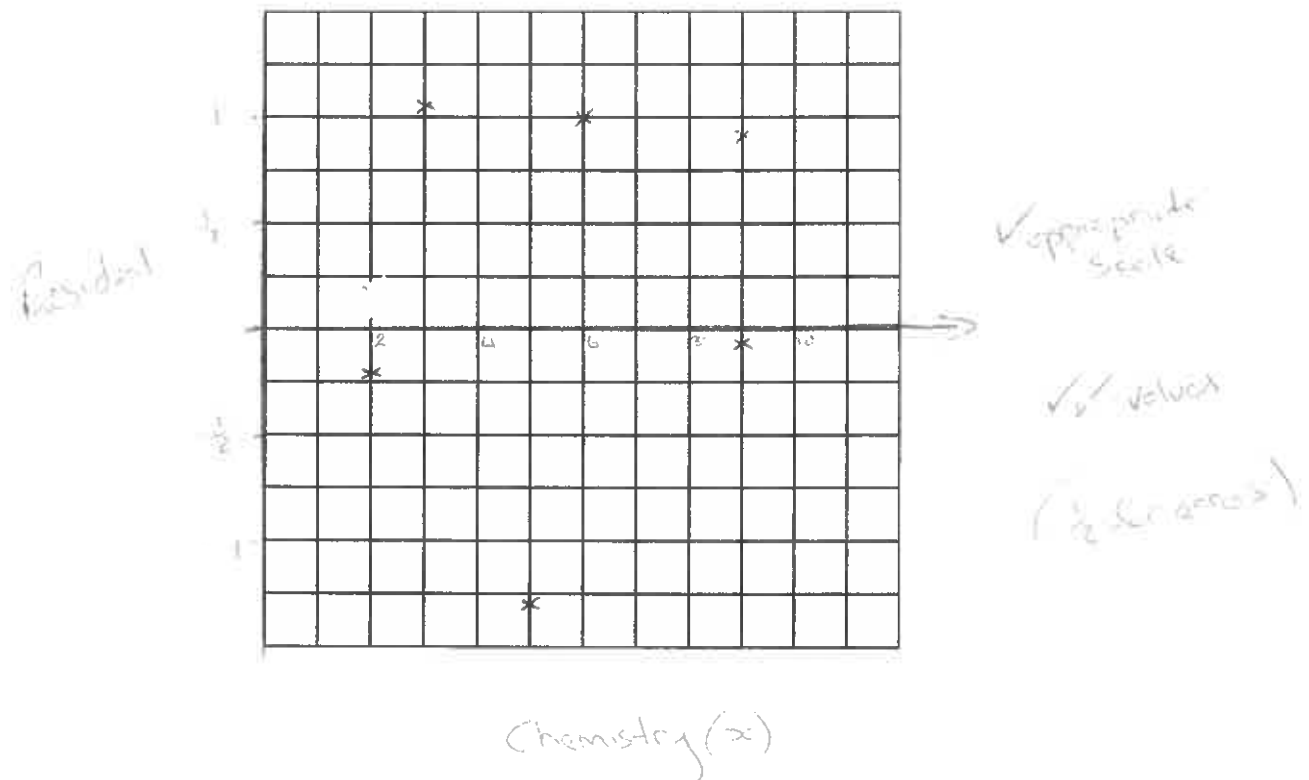
The 'Line of Best Fit' equation for the relationship is:

$$y = 0.7x + 0.8$$

d) Complete the table of residuals to 1 d.p.

Chemistry (x)	2	3	5	6	9	9
Physics (y)	2	4	3	6	7	8
Predicted Physics	2.2	2.9	4.3	5.0	7.1	7.1
Residual	-0.2	1.1	-1.3	1.0	-0.1	0.9

e) Draw a residual plot.



f) Using the residual plot, decide if the data being investigated is linear or non-linear.

no pattern is probably linear

✓