

**SECTION A – CORE****Instructions for Section A**

Answer **all** questions in the spaces provided.

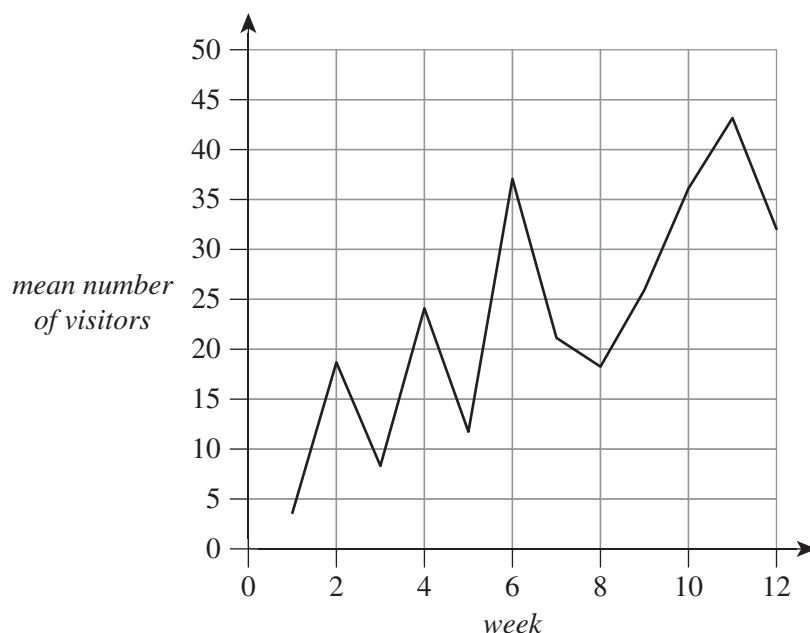
You need not give numerical answers as decimals unless instructed to do so. Alternative forms may include, for example,  $\pi$ , surds or fractions.

In ‘Recursion and financial modelling’, all answers should be rounded to the nearest cent unless otherwise instructed.

Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

**Data analysis****Question 1** (12 marks)

A new museum was opened and the *mean number of visitors* per week over the first 12 weeks is displayed in the graph below.



- a. What is the name for the type of graph above? 1 mark
- 
- b. Draw the smoothed time-series curve using the three-point moving median method on the graph above. 2 marks

**Recursion and financial modelling****Question 5** (3 marks)

A puzzle magazine runs a special issue that only contains mathematical puzzles. Three of the puzzles from this special issue are shown below.

- a. Define the sequence  $\{1, 5, 29, 173\}$  by expressing  $t_{n+1}$  in terms of  $t_n$ . 1 mark

---

---

---

---

- b. Given  $t_{n+1} = -0.5t_n + 4$ ;  $t_1 = 400$ , find  $t_3$ . 1 mark

---

---

---

---

- c. What is special about the sequence  $t_{n+1} = 3t_n - 2$ ;  $t_1 = 1$ ? 1 mark

---

---

---

---

**Question 8** (3 marks)

After all the loans are paid off and the company is running debt free, the magazine is sold off by the joint owners Bob and Charli for \$1 200 000. The money is shared evenly and invested in different ways.

- a. Bob invests all his money in a three-year term deposit which is paying 2.8% per annum, credited annually.

How much will Bob have after the three-year period?

1 mark

---

---

---

---

- b. Charli buys a new car for \$65 000 and then invests the remainder for three years at 4.5% per annum, compounding monthly.

How much money will Charli have after the three-year period?

1 mark

---

---

---

---

---

- c. Charli also decides to sell her car, which depreciated in value by 18% in the first year and 12% in each of the following two years.

What is the value of her car after this time?

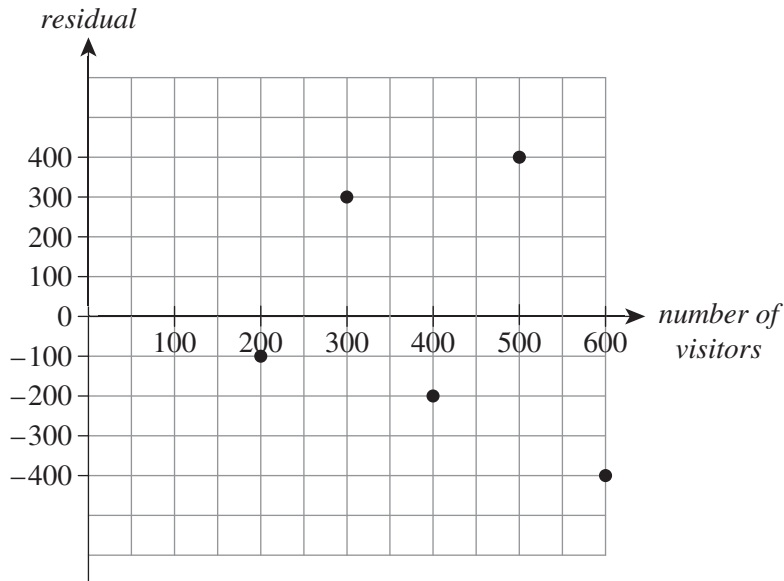
1 mark

---

---

**END OF SECTION A**

c.



A2  
 correct labelling A1  
 correct scatterplot information A1

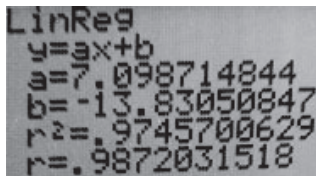
d. There is no pattern, so linearity is confirmed.

A1

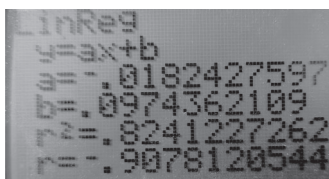
e. Enter the data into your technology and transform the  $x$  values into  $x^2$  and  $\frac{1}{y}$ , then calculate the value of  $r$  for each.

M1

$x^2$ :



$\frac{1}{y}$ :



Since  $r$  is 0.99 for  $x^2$  and  $-0.91$  for  $\frac{1}{y}$ , the  $x^2$  transformation better linearises the data.

A1

### Recursion and financial modelling

#### Question 5 (3 marks)

a. Each successive term is found by multiplying the previous term by 6 and then subtracting 1.

$$t_{n+1} = 6t_n - 1; t_1 = 1$$

A1

b.

|                                    |                   |
|------------------------------------|-------------------|
|                                    | $V_0 = \$25\,000$ |
| $V_{n+1} = 0.8(25\,000) = 20\,000$ | $V_1 = \$20\,000$ |
| $V_{n+1} = 0.8(20\,000) = 16\,000$ | $V_2 = \$16\,000$ |
| $V_{n+1} = 0.8(16\,000) = 12\,800$ | $V_3 = \$12\,800$ |
| $V_{n+1} = 0.8(12\,800) = 10\,240$ | $V_4 = \$10\,240$ |
| $V_{n+1} = 0.8(10\,240) = 8192$    | $V_5 = \$8192$    |

At the end of the fifth year, the value has reached \$8192.

A1

**Question 8** (3 marks)

a.  $A = PR^n$

$$= 600\,000(1.028)^3$$

$$= \$651\,824.37$$

A1

b.  $600\,000 - 65\,000 = 535\,000$

$$V_0 = 535\,000, V_n = V_0 R^n$$

$$= 535\,000 \left( 1 + \frac{4.5}{100} \right)^{36}$$

$$= \$612\,172.59$$

A1

c.  $V = 65\,000 \times 0.82 \times 0.88^2$

$$= \$41\,275.52$$

A1