# Exam: Sequences, currency, and interest calculations – **Mark Scheme**

**1a.** Only one of the following four sequences is arithmetic and only one of them is geometric.









State which sequence is

(i) arithmetic;

(ii) geometric. *[2 marks]*

## Markscheme

(i) **OR** ***(A1) (C1)***

(ii) **OR** ***(A1) (C1)***

**1b.** *[1 mark]*

For **another** geometric sequence 

write down the common ratio;

## Markscheme

**OR** ***(A1) (C1)***

**Note:** Accept ‘divide by 2’ for ***(A1)****.*

**1c.** find the **exact** value of the tenth term. Give your answer as a fraction. *[3 marks]*

## Markscheme

 ***(M1)(A1)*(ft)**

**Notes:** Award ***(M1)*** for substitution in the GP  term formula, ***(A1)*(ft)** for their correct substitution.

Follow through from their common ratio in part (b)(i).

**OR**

 ***(M1)(A1)*(ft)**

**Notes:**Award ***(M1)*** for terms 5 and 6 correct (using their ratio).

Award ***(A1)*(ft)** for terms 7, 8 and 9 correct (using their ratio).

 ***(A1)*(ft) *(C3)***

**2a.** *[3 marks]*

The second term of an arithmetic sequence is 30. The fifth term is 90.

Calculate

(i) the common difference of the sequence;

(ii) the first term of the sequence.

## Markscheme

(i) (or equivalent) ***(M1)***

**Note:** Award ***(M1)*** for **one** correct equation. Accept a list of at least 5 correct terms.

 ***(A1)***

(ii)  ***(A1)*(ft) *(C3)***

**Note:** Follow through from (a)(i), irrespective of working shown if **OR**

## Examiners report

Part (a) was answered correctly by many candidates, but working using equations was rarely seen. A “trial and error” method, based upon a list of terms was the most seen method.

**2b.** *[3 marks]*

The first, second and fifth terms of this arithmetic sequence are the first three terms of a geometric sequence.

Calculate the seventh term of the **geometric** sequence.

## Markscheme

**OR** ***(M1)(A1)*(ft)**

**Note:** Award ***(M1)*** for substituted geometric sequence formula, ***(A1)*(ft)** for their correct substitutions.

**OR**

 ***(M1)(A1)*(ft)**

**Note:** Award ***(M1)*** for a list of at least 5 consecutive terms of a geometric sequence, ***(A1)*(ft)** for terms corresponding to their answers in part (a).

 ***(A1)*(ft) *(C3)***

**Note:** Follow through from part (a).

## Examiners report

In part (b) many found the correct answer, but many others did not. Some gave the seventh term of the arithmetic sequence, some gave a term of an incorrect order and some a completely incorrect answer. Finding the correct ratio was the most common problem. Often repeated multiplication was used to find the answer, but also the formula for the nth term of a geometric sequence was used. Several did not use the correct three terms from the question.

**3a.** *[2 marks]*

The first term, , of an arithmetic sequence is . The fifth term, , of the sequence is .

Find the common difference of the sequence.

## Markscheme

 ***(M1)***

**Note:** Award ***(M1)*** for correctly substituted AP formula.

**OR**

 ***(M1)***

 ***(A1) (C2)***

***[2 marks]***

## Examiners report

Many candidates gave an answer of 8 rather than –8 but were awarded follow through marks in parts (b) and (c) where working was shown. Some candidates appeared unaware that the common difference in both the AP formula for a term and for a sum is multiplied rather than added or subtracted. Candidates who used a list to answer this question were able to gain full marks.

**3b.** *[2 marks]*

The  term, , of the sequence is .

Find the value of .

## Markscheme

 ***(M1)***

**Note:** Award ***(M1)*** for their correctly substituted AP formula.

If a list is used award ***(M1)*** for their correct values down to .

 ***(A1)*(ft) *(C2)***

**Note:** Follow through from their part (a). ***[2 marks]***

**3c.** *[2 marks]*

The  term, , of the sequence is .

Find , the sum of the first twenty terms of the sequence.

## Markscheme

 ***(M1)***

**Note:** Award ***(M1)*** for their correctly substituted sum of an AP formula.

If a list is used award ***(M1)*** for their correct terms up to 

 ***(A1)*(ft)**

**Note:** Follow through from their part (a).

**OR**

 ***(M1)***

**Note:** Award ***(M1)*** for correctly substituted sum of an AP formula.

 ***(A1) (C2)***

**Note:** If candidates have listed the terms correctly and given the common difference as , award ***(M1)(A0)*** for part (a), ***(M1)(A0)*** for an answer of  or  for part (b) and ***(M1)(A1)*(ft)** for an answer of  in part (c) with working seen.

***[2 marks]***

**4a.** *[2 marks]*

The fourth term, *u*, of a geometric sequence is 135. The fifth term, *u*, is 101.25 .

Find the common ratio of the sequence.

## Markscheme

 ***(M1)***

 ***(A1)*** ***(C2)***

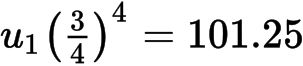
## Examiners report

The weakest candidates erroneously used an arithmetic sequence rather than a geometric sequence as specified in the question.

**4b.** *[2 marks]*

Find *u*, the first term of the sequence.

## Markscheme

 ***(M1)***

**OR**

 ***(M1)***

**OR**

(by list)

 ***(M1)***

**Notes:** Award ***(M1)*** for their correct substitution in geometric sequence formula, or stating explicitly  and .

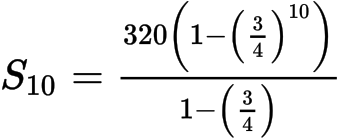
 ***(A1)*(ft)** ***(C2)***

**Note:** Follow through from their answer to part (a).

**4c.** *[2 marks]*

Calculate the sum of the first 10 terms of the sequence.

## Markscheme

 ***(M1)***

**Notes:** Award ***(M1)*** for their correct substitution in geometric series formula.

Accept a list of all their ten geometric terms.

= 1210 (1207.918...) ***(A1)*(ft)** ***(C2)***

**Note:** Follow through from their parts (a) and (b).

**8a.** Shiyun bought a car in 1999. The value of the car  , in USD, is depreciating according to the exponential model



where *t* is the time, in years, that Shiyun has owned the car.

Write down the value of the car when Shiyun bought it. *[1 mark]*

## Markscheme

 ***(A1)*** ***(C1)*** ***[1 mark]***

## Examiners report

A substituted value of  in part (a) saw many incorrect answers of  for this part of the question. Part (b) was better attempted with many correct answers seen. Many candidates picked up the first two marks of part (c) equating a correct expression to half their answer found in part (a). Many though did not seem to know the correct process of using their GDC to find the required answer. Much *trial and improvement* was seen here with varying degrees of success.

**8b.** *[2 marks]*

Calculate the value of the car three years after Shiyun bought it. Give your answer correct to **two decimal places**.

## Markscheme

 ***(M1)*** ***(A1)*** ***(C2)***

***[2 marks]***

**8c.** *[3 marks]*

Calculate the time for the car to depreciate to half of its value since Shiyun bought it.

## Markscheme

 ***(A1)*(ft)*(M1)***

**Notes:** Award ***(A1)*(ft)** for  seen. Follow through from their answer to part (a). Award ***(M1)*** for equating their half value to  . Allow the use of an inequality.

**OR**

Graphical method (sketch):

***(A1)*(ft)** for  seen on the sketch. Follow through from their answer to part (a). ***(A1)*(ft)**

***(M1)*** for the exponent model and an indication of their intersection with their horizontal line. ***(M1)***

 ***(A1)*(ft) *(C3)***

***[3 marks]***

**9a.** *[2 marks]* ***Give your answers to parts (a) to (e) to the nearest dollar.***

On Hugh’s 18th birthday his parents gave him options of how he might receive his monthly allowance for the next two years.

**Option A**  each month for two years

**Option B**  in the first month,  in the second month,  in the third month, increasing by  each month for two years

**Option C**  in the first month and increasing by  each month for two years

**Option D** Investing  at a bank at the beginning of the first year, with an interest rate of  per annum, **compounded monthly**.

Hugh does not spend any of his allowance during the two year period.

If Hugh chooses **Option A**, calculate the total value of his allowance at the end of the two year period.

## Markscheme

***The first time an answer is not given to the nearest dollar in parts (a) to (e), the final (A1) in that part is not awarded.***

 ***(M1)***

**Note:** Award ***(M1)*** for correct product.

 ***(A1)(G2)*** ***[2 marks]***

**9b.** *[5 marks]*

If Hugh chooses **Option B**, calculate

(i) the amount of money he will receive in the 17th month;

(ii) the total value of his allowance at the end of the two year period.

## Markscheme *The first time an answer is not given to the nearest dollar in parts (a) to (e), the final (A1) in that part is not awarded.*

(i)  ***(M1)(A1)***

**Note:** Award ***(M1)*** for substituted arithmetic sequence formula, ***(A1)*** for correct substitution.

 ***(A1)(G2)***

(ii)  ***(M1)***

**OR**

 ***(M1)***

**Note:** Award ***(M1)*** for correct substitution in arithmetic series formula.

 ***(A1)*(ft)*(G1)***

**Note:** Follow through from part (b)(i). ***[5 marks]***

**9c.** *[5 marks]*

If Hugh chooses **Option C**, calculate

(i) the amount of money Hugh would receive in the 13th month;

(ii) the total value of his allowance at the end of the two year period.

## Markscheme

***The first time an answer is not given to the nearest dollar in parts (a) to (e), the final (A1) in that part is not awarded.***

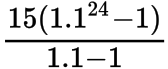
(i)  ***(M1)(A1)***

**Note:** Award ***(M1)*** for substituted geometric sequence formula, ***(A1)*** for correct substitutions.

 ***(A1)(G2)***

**Note:** Award ***(M1)(A1)(A0)*** for .

Award ***(G1)*** for  if workings are not shown.

(ii)  ***(M1)***

**Note:** Award ***(M1)*** for correct substitution in geometric series formula.

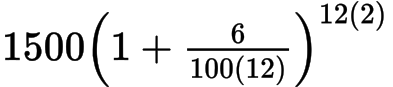
 ***(A1)*(ft)*(G1)***

**Note:** Follow through from part (c)(i).

***[5 marks]***

**9d.** If Hugh chooses **Option D**, calculate the total value of his allowance at the end of the two year period.

## Markscheme *[3 marks]*

 ***(M1)(A1)***

**Note:** Award ***(M1)*** for substituted compound interest formula, ***(A1)*** for correct substitutions.

**OR**









 ***(A1)(M1)***

**Note:** Award ***(A1)*** for  seen, ***(M1)*** for other correct entries.

**OR**









 ***(A1)(M1)***

**Note:** Award ***(A1)*** for  seen, ***(M1)*** for other correct entries.

 ***(A1)(G2)*** ***[3 marks]***

**9e.** *[1 mark]*

State which of the options, A, B, C or D, Hugh should choose to give him the greatest total value of his allowance at the end of the two year period.

## Markscheme

Option D ***(A1)*(ft)**

**Note:** Follow through from their parts (a), (b), (c) and (d). Award ***(A1)*(ft)** only if values for the four options are seen and only if their answer is consistent with their parts (a), (b), (c) and (d). ***[1 mark]***

**9f.** *[3 marks]* Another bank guarantees Hugh an amount of  after two years of investment if he invests $1500 at this bank. The interest is **compounded annually**.

Calculate the interest rate per annum offered by the bank.

## Markscheme

 ***(M1)(A1)***

**Note:** Award ***(M1)*** for substituted compound interest formula equated to , ***(A1)*** for correct substitutions into formula.

**OR**









 ***(A1)(M1)***

**Note:** Award ***(A1)*** for  seen, ***(M1)*** for other correct entries.

 ***(A1)(G2)*** ***[3 marks]***