



Mixed Sequences Exam Questions (from OCR 4722)

Q1, (Jun 2006, Q6)

- (i) John aims to pay a certain amount of money each month into a pension fund. He plans to pay £100 in the first month, and then to increase the amount paid by £5 each month, i.e. paying £105 in the second month, £110 in the third month, etc.

If John continues making payments according to this plan for 240 months, calculate

- (a) how much he will pay in the final month, [2]
(b) how much he will pay altogether over the whole period. [2]

- (ii) Rachel also plans to pay money monthly into a pension fund over a period of 240 months, starting with £100 in the first month. Her monthly payments will form a geometric progression, and she will pay £1500 in the final month.

Calculate how much Rachel will pay altogether over the whole period. [5]

Q2, (Jun 2007, Q7)

- (a) In an arithmetic progression, the first term is 12 and the sum of the first 70 terms is 12 915. Find the common difference. [4]
(b) In a geometric progression, the second term is -4 and the sum to infinity is 9. Find the common ratio. [7]

Q3, (Jun 2008, Q10)

Jamie is training for a triathlon, which involves swimming, running and cycling.

- On Day 1, he swims 2 km and then swims the same distance on each subsequent day.
- On Day 1, he runs 2 km and, on each subsequent day, he runs 0.5 km further than on the previous day. (Thus he runs 2.5 km on Day 2, 3 km on Day 3, and so on.)
- On Day 1 he cycles 2 km and, on each subsequent day, he cycles a distance 10% further than on the previous day.

- (i) Find how far Jamie runs on Day 15. [2]
(ii) Verify that the distance cycled in a day first exceeds 12 km on Day 20. [3]
(iii) Find the day on which the total distance cycled, up to and including that day, first exceeds 200 km. [4]
(iv) Find the total distance travelled, by swimming, running and cycling, up to and including Day 30. [4]
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Q4, (Jun 2010, Q4)

A sequence u_1, u_2, u_3, \dots is defined by $u_n = 5n + 1$.

(i) State the values of u_1, u_2 and u_3 . [1]

(ii) Evaluate $\sum_{n=1}^{40} u_n$. [3]

Another sequence w_1, w_2, w_3, \dots is defined by $w_1 = 2$ and $w_{n+1} = 5w_n + 1$.

(iii) Find the value of p such that $u_p = w_3$. [3]

Q5, (Jun 2010, Q9)

A geometric progression has first term a and common ratio r , and the terms are all different. The first, second and fourth terms of the geometric progression form the first three terms of an arithmetic progression.

(i) Show that $r^3 - 2r + 1 = 0$. [3]

(ii) Given that the geometric progression converges, find the exact value of r . [5]

(iii) Given also that the sum to infinity of this geometric progression is $3 + \sqrt{5}$, find the value of the integer a . [4]

Q6, (Jan 2012, Q6)

A sequence u_1, u_2, u_3, \dots is defined by $u_n = 85 - 5n$ for $n \geq 1$.

(i) Write down the values of u_1, u_2 and u_3 . [2]

(ii) Find $\sum_{n=1}^{20} u_n$. [3]

(iii) Given that u_1, u_5 and u_p are, respectively, the first, second and third terms of a geometric progression, find the value of p . [4]

(iv) Find the sum to infinity of the geometric progression in part (iii). [2]

Q7, (Jan 2013, Q6)

(i) The first three terms of an arithmetic progression are $2x, x + 4$ and $2x - 7$ respectively. Find the value of x . [3]

(ii) The first three terms of another sequence are also $2x, x + 4$ and $2x - 7$ respectively.

(a) Verify that when $x = 8$ the terms form a geometric progression and find the sum to infinity in this case. [4]

(b) Find the other possible value of x that also gives a geometric progression. [4]

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Q8, (Jun 2013, Q8)

Sarah is carrying out a series of experiments which involve using increasing amounts of a chemical. In the first experiment she uses 6 g of the chemical and in the second experiment she uses 7.8 g of the chemical.

- (i) Given that the amounts of the chemical used form an arithmetic progression, find the total amount of chemical used in the first 30 experiments. [3]
- (ii) Instead it is given that the amounts of the chemical used form a geometric progression. Sarah has a total of 1800 g of the chemical available. Show that N , the greatest number of experiments possible, satisfies the inequality

$$1.3^N \leq 91,$$

and use logarithms to calculate the value of N .

[6]

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