Arithmetic Sequences and Series IB Questions

**1.** A teacher earns an annual salary of 45 000 USD for the first year of her employment
Her annual salary increases by 1750 USD each year.

(a) Calculate the annual salary for the fifth year of her employment.

(3)

 She remains in this employment for 10 years.

(b) Calculate the **total** salary she earns in this employment during these 10 years.

(3)

(Total 6 marks)

**2.** Mr Jones decides to increase the amount of money he spends on food by *d* GBP every year. In the first year he spends *a* GBP. In the 8th year he spends twice as much as in the 4th year. In the 20th year he spends 4000 GBP.

 Find the value of *d*.

(Total 4 marks)

**3.** The fourth term of an arithmetic sequence is 12 and the tenth term is 42.

(a) Given that the first term is *u*1 and the common difference is *d*, write down two equations in *u*1 and *d* that satisfy this information.

(b) Solve the equations to find the values of *u*1 and *d*.

(Total 8 marks)

**4.** The *n*th term of an arithmetic sequence is given by *un* = 63 – 4*n.*

(a) Calculate the values of the first two terms of this sequence.

(2)

(b) Which term of the sequence is –13?

(2)

(c) Two consecutive terms of this sequence, *uk* and *uk +* 1, have a sum of 34. Find *k.*

(3)

(Total 7 marks)

**5.** The fifth term of an arithmetic sequence is 20 and the twelfth term is 41.

(a) (i) Find the common difference.

(2)

(ii) Find the first term of the sequence.

(1)

(b) Calculate the eighty-fourth term.

(1)

(c) Calculate the sum of the first 200 terms.

(2)

(Total 6 marks)

**6.** A tree begins losing its leaves in October. The number of leaves that the tree loses each day increases by the same number on each successive day.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Date in October** | 1 | 2 | 3 | 4 | ..................... |
| **Number of leaves lost** | 24 | 40 | 56 | 72 | ..................... |

 (a) Calculate the number of leaves that the tree loses on the 21st October.

(3)

(b) Find the total number of leaves that the tree loses in the 31 days of the month of October.

(3)

(Total 6 marks)

**7.** The first term of an arithmetic sequence is 3 and the sum of the first two terms is 11.

(a) Write down the second term of this sequence.

(1)

(b) Write down the common difference of this sequence.

(1)

(c) Write down the fourth term of this sequence.

(1)

(d) The *n*th term is the first term in this sequence greater than 1000.
Find the value of *n*.

(3)

(Total 6 marks)

Arithmetic Sequences and Series IB Questions- Answers

**1.** (a) 45000 + (5 – 1)1750 (M1)(A1)

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

 = 52000 USD (A1) (C3)

**Notes:** If a list is used, award (M1)for recognizing AP, award (A1)for seeing 52000 in their list, (A1)for final answer.

(b) (2(45000) + (10 – 1)(1750)) (M1)(A1)

**Notes:** Award (M1) for substituted AP formula, (A1)(ft) for correct substitutions. Follow through from their common difference used in part (a).

 = 528750 USD (A1)(ft) (C3)

**Notes:** Accept 529000.
If a list is used, award (M1)for recognizing sum of AP, (A1)for seeing 60750 included in the sum or 528750 in a cumulative list.

[6]

**2.** 4th term = *a* + 3*d*
8th term = *a* + 7*d*
20th term = *a* + 19*d* (M2)

**Note:**  Award (M1) for each correct answer up to a maximum of [2 marks].

 *a* + 7*d* = 2(*a* + 3*d*)
*a* + 19*d* = 4000 (M1)

**Note:** Award (M1) for any one correct equation.

 *d* = 200 (A1)

[4]

**3.** (a) *u*1 + 3*d* = 12 (A1)(A1)
*u*1 + 9*d* = 42 (A1)(A1) (C4)

**Note:** Award (A1) for left hand side correct, (A1) for right hand side correct.

(b) 6*d* = 30 (A1)
*d* = 5 (A1)
*u*1 = –3 (M1)(A1) (C4)

**Note:** Follow through (ft) from candidate's equations.

[8]

**4.** (a) *u*1 = 59 *u*2 = 55 (A1)(A1) 2

(b) 63 – 4*n* = –13 –4*n* = –76 *n* = 19 (M1)(A1) or (G2) 2

(c) 63 – 4*k* + 63 – 4(*k* + 1) = 34
 –8*k* = –88 *k* = 11 (M1)(M1)(A1) 3

**Note:** Award (M1) for the terms 15 and 19.

[7]

**5.** (a) (i) *us* = *u1* + 4*d* = 20

*u12* = *u1* + 11*d* = 41 (M1)

**Note:** (M1) for both equations correct (or (M1) for 20 + 7d = 41)

 7*d* = 21

 *d* = 3 (A1) (C2)

(ii) *u1* + 12 = 20

*u1* = 8 (A1)(ft) (C1)

(b) *u84* = 8 + (84 – 1)3

 = 257 (A1)(ft) (C1)

(c) *S200* = 100(16 + 199  3) (M1)

 = 61300 (A1)(ft) (C2)

[6]

**6.** (a) *u*21 = 24 + (21 – 1)(16) (M1)(A1)

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

 *u*21 = 344 (A1) (C3)

 (b) *S*31 = [2(24) + (31 – l)(16)] (M1)(A1)(ft)

**Note:** Award (M1) for correct substituted formula, (A1)(ft)for correct substitutions. (ft) from their value for d.

 *S*31 = 8184 (A1)(ft) (C3)

[6]

**7.** (a) 8 (A1) (C1)

(b) 5 (A1)(ft) (C1)

(c) 18 (A1)(ft) (C1)

 (d) 3 **+** 5 × (*n* – 1) > 1000 (M1)

**Note:** Allow equality sign and equal to 1001

 *n* ***>*** 200.4 (A1)

**Note:** Accept n **=** 200.4 or 5n **=** 1002

 **OR**

 (M1) for attempt at listing, (A1) for 998 and 1003 seen. (M1)(A1)

 *n* **=** 201 (A1)(ft) (C3)

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

[6]