# Section Check In – Pure Mathematics: Sequences and Series

## Questions

1. Find the first 4 terms, in ascending powers of , of the binomial expansion of , giving each term in its simplest form.

2. Find the coefficient of  in the expansion of .

3.\* A sequence of numbers  is given by , .

 Find   and .

4.\* Find the binomial expansion of  in ascending powers of , as far as the term in . Give each coefficient in its simplest form and state the values of  for which the expansion is valid.

5. Find the coefficient of  in the expansion of .

6.\* Find .

7. (a) Write down the first 3 terms, in ascending powers of , of the binomial expansion of

 , where is a non-zero constant.

 (b) Given that in the expansion of , the coefficient of is nine times the coefficient

 of , find the value of .

8.\* The second and fifth terms of a geometric sequence are 32 and 0.5 respectively.

 For this series, find

 (a) the common ratio and the first term of the sequence,

 (b) the sum of the first five terms,

 (c) the sum to infinity giving your answer to three decimal places.

9.\* An athlete is training for the London marathon. He runs 7 miles on day 1 and then increases his run by 0.8 miles each day until he can run a complete marathon of 26.2 miles.

 (a) On which day of his training does he run the full 26.2 miles?

 (b) How many miles does he run over the whole training period?

10.\* A hat shop made a profit of £20 000 in 2015. A model for future trading predicts that profit will increase each year in a geometric sequence so that in 2016 the profit will be .

 (a) Give an expression for the expected profit in the year 2020.

 Given that 

 (b) find the year that the profit will first exceed £30 000,

 (c) find the total profit made by the hat shop in the years 2015 to 2020. Give your answer to the nearest hundred pounds.

**Extension**

If the first two terms of a sequence form an arithmetic sequence and also form a geometric sequence, find an expression for the common ratio of the geometric sequence in terms of the first term of the sequence and the common difference of the arithmetic sequence.

Is it possible for the first three terms of a sequence to form an arithmetic sequence and also form a geometric sequence? If so, what can you say about the common difference of the arithmetic sequence and the common ratio of the geometric sequence?

## Worked solutions

1. 

2. Relevant term is 

 Coefficient of  is 

3. , , , 

4. 

 

 . This is valid for 

5. 

 

 

Note: since you only need the coefficient of  you need not have worked out the terms in  or  and might have  at this stage

 

 

 Coefficient of  is 

6. , , 

 , , 

 

7. (a) 

 (b) , , 

Note:  also satisfies the equation but the question says that *a* is a non-zero constant so this solution is rejected.

8.  

 (a) , , , . 

 (b) 

 (c)  to 3 d.p.

9. , 

 (a) 

 

 

  days

 (b)  miles

10. (a) 

 (b) 

 

 

 

 6 years later will be the year 2021

 (c) , , 

 

 £143 100 to the nearest hundred

**Extension**

If the first two terms form an arithmetic and a geometric sequence

 

 

Therefore 

If the first three terms form an arithmetic and a geometric sequence

 and 

 so 



But  so 

So 



Therefore  so 



In this case, all terms of the sequence must be equal.

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