Series and Binomial Expansion – 2021 AS Nov

1. Nov/2021/Paper_9709/11/No.1

(a) Expand $\left(1-\frac{1}{2x}\right)^2$. [1]

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(b) Find the first four terms in the expansion, in ascending powers of x, of $(1+2x)^6$. [2]

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(c) Hence find the coefficient of x in the expansion of $\left(1-\frac{1}{2x}\right)^2(1+2x)^6$. [2]

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2. Nov/2021/Paper_9709/11/No.4

The first term of an arithmetic progression is a and the common difference is -4. The first term of a geometric progression is $5a$ and the common ratio is $-\frac{1}{4}$. The sum to infinity of the geometric progression is equal to the sum of the first eight terms of the arithmetic progression.

(a) Find the value of a. [4]

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The kth term of the arithmetic progression is zero.

(b) Find the value of k. [2]

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3. Nov/2021/Paper_9709/12/No.5

The first, third and fifth terms of an arithmetic progression are $2\cos x$, $-6\sqrt{3}\sin x$ and $10\cos x$ respectively, where $\frac{1}{2}\pi < x < \pi$.

(a) Find the exact value of x. [3]

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(b) Hence find the exact sum of the first 25 terms of the progression. [3]

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4. Nov/2021/Paper_9709/12/No.6

The second term of a geometric progression is 54 and the sum to infinity of the progression is 243. The common ratio is greater than $\frac{1}{2}$.

Find the tenth term, giving your answer in exact form. [5]

5. Nov/2021/Paper_9709/12/No.8

(a) It is given that in the expansion of $(4 + 2x)(2 - ax)^5$, the coefficient of x^2 is -15.

Find the possible values of a. [4]

(b) It is given instead that in the expansion of $(4 + 2x)(2 - ax)^5$, the coefficient of x^2 is k. It is also given that there is only one value of a which leads to this value of k.

Find the values of k and a. [4]

(a) Find the first three terms, in ascending powers of x, in the expansion of $(1 + ax)^6$. [1]

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(b) Given that the coefficient of x^2 in the expansion of $(1 - 3x)(1 + ax)^6$ is -3, find the possible values of the constant a. [4]

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7. Nov/2021/Paper_9709/13/No.4

The first term of an arithmetic progression is 84 and the common difference is −3.

(a) Find the smallest value of n for which the nth term is negative. [2]

It is given that the sum of the first $2k$ terms of this progression is equal to the sum of the first k terms.

(b) Find the value of k. [3]