1. Nov/2023/Paper_9709/11/No.1

(a) Expand $(1 + 3x)^6$ in ascending powers of x up to, and including, the term in x^2. [2]

(b) Hence find the coefficient of x^2 in the expansion of $(1 - 7x + x^2)(1 + 3x)^6$. [2]

2. Nov/2023/Paper_9709/11/No.7

The sum of the first two terms of a geometric progression is 15 and the sum to infinity is $\frac{125}{7}$. The common ratio of the progression is negative.

Find the third term of the progression. [7]

3. Nov/2023/Paper_9709/12/No.1

The coefficient of x^3 in the expansion of $(3 + 2ax)^5$ is six times the coefficient of x^2 in the expansion of $(2 + ax)^6$.

Find the value of the constant a. [4]

4. Nov/2023/Paper_9709/12/No.5

The first, second and third terms of a geometric progression are $\sin\theta$, $\cos\theta$ and $2 - \sin\theta$ respectively, where θ radians is an acute angle.

(a) Find the value of θ. [3]

(b) Using this value of θ, find the sum of the first 10 terms of the progression. Give the answer in the form $\dfrac{b}{\sqrt{c}-1}$, where b and c are integers to be found. [3]

5. Nov/2023/Paper_9709/13/No.4

(a) Expand the following in ascending powers of x up to and including the term in x^2.

(i) $(1 + 2x)^5$. [1]

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(ii) $(1 - ax)^6$, where a is a constant. [2]

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In the expansion of $(1 + 2x)^5(1 - ax)^6$, the coefficient of x^2 is -5.

(b) Find the possible values of a. [4]

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6. Nov/2023/Paper_9709/13/No.5

The first, second and third terms of a geometric progression are $2p + 6$, $5p$ and $8p + 2$ respectively.

(a) Find the possible values of the constant p. [3]

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(b) One of the values of p found in **(a)** is a negative fraction.

Use this value of p to find the sum to infinity of this progression. [4]

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7. March/2023/Paper_9709/12/No.4

The circumference round the trunk of a large tree is measured and found to be 5.00 m. After one year the circumference is measured again and found to be 5.02 m.

(a) Given that the circumferences at yearly intervals form an arithmetic progression, find the circumference 20 years after the first measurement. [2]

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(b) Given instead that the circumferences at yearly intervals form a geometric progression, find the circumference 20 years after the first measurement. [3]

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8. March/2023/Paper_9709/12/No.6

In the expansion of $\left(\frac{x}{a}+\frac{a}{x^2}\right)^7$, it is given that

$$\frac{\text{the coefficient of } x^4}{\text{the coefficient of } x} = 3.$$

Find the possible values of the constant a. [6]