1. Nov/2023/Paper_0606/11/No.9

(a) The first three terms of an arithmetic progression are $-3\tan\frac{\theta}{2}$, $-\tan\frac{\theta}{2}$, $\tan\frac{\theta}{2}$, where $0 < \theta < \frac{\pi}{2}$.

(i) Given that the 12th term of this progression is equal to $\frac{19\sqrt{3}}{3}$, find the exact value of θ. [4]

(ii) Hence find the exact value of the sum to ten terms of this progression. [2]

(b) The first three terms of a geometric progression are $\frac{1}{16}\operatorname{cosec}^4\phi$, $\frac{1}{4}\operatorname{cosec}^2\phi$, 1, where $-\frac{\pi}{2} < \phi < \frac{\pi}{2}$.

(i) Given that the sum of the 3rd and 4th terms of this progression is equal to 4, find the possible values of ϕ. [4]

(ii) Determine whether or not this progression has a sum to infinity. [2]

2. Nov/2023/Paper_0606/12/No.4

(a) It is given that the first four terms, in ascending powers of x, in the expansion of $\left(1-\frac{x}{2}\right)^n$ can be written in the form $1-8x+px^2+qx^3$, where n, p and q are integers. Find the values of n, p and q. [5]

(b) Find the term independent of x in the expansion of $\left(\frac{2}{x^2}+\frac{x}{3}\right)^6$, giving your answer as a rational number. [2]

3. Nov/2023/Paper_0606/13/No.8

The first three terms, in descending powers of x, in the expansion of $\left(2x^2 - \frac{1}{4x}\right)^n$ can be written in the form $256x^{16} + ax^{13} + bx^c$, where n, a, b and c are integers. Find the values of n, a, b and c. [6]

4. Nov/2023/Paper_0606/21/No.4

In this question a and b are integers.

Three terms in the expansion of $(2+ax)^5(1+bx)$ are $32+112x-240x^2$. Find the values of a and b. [7]

5. Nov/2023/Paper_0606/22/No.9

(a) An arithmetic progression has twelve terms. The sum of the first three terms is -36 and the sum of the last three terms is 72. Find the first term and the common difference. [5]

(b) The first three terms of a geometric progression are 1, 1.2 and 1.44. Find the smallest value of n such that the sum of the first n terms is greater than 500. [5]

6. Nov/2023/Paper_0606/23/No.10

(a) In an arithmetic progression the 5th term is 11. The 7th term is three times the 2nd term. Find the 1st term and the common difference. [4]

(b) A different arithmetic progression (AP) and a geometric progression (GP) have the following properties.

- The 1st terms of the AP and GP are both 3.
- The 2nd term of the AP is the same as the 3rd term of the GP.
- The 6th term of the AP is the same as the 5th term of the GP.
- The common ratio of the GP is greater than 1.

Find the common difference of the AP and the common ratio of the GP. [6]

7. March/2023/Paper_0606/12/No.3

Find the coefficient of x^8 in the expansion of $\left(1-x^2\right)\left(2x-\frac{1}{x}\right)^{10}$. [5]

8. March/2023/Paper_0606/22/No.6

(a) A geometric progression has first term 64 and common ratio 0.5.

(i) Find the 10th term. [2]

(ii) Find the sum of the first 10 terms. [2]

(iii) Find the sum to infinity. [1]

9. June/2023/Paper_0606/11/No.9

(a) The first three terms of an arithmetic progression are $\ln q$, $\ln q^4$ and $\ln q^7$, where q is a positive constant. The sum to n terms of this progression is $4845 \ln q$. Find the value of n. [3]

(b) The first three terms of a geometric progression are p^{3x}, p^x and p^{-x}, where p is a positive integer. Find the nth term of this progression giving your answer in the form $p^{(a+bn)x}$. [3]

(c) The first three terms of a different geometric progression are $\frac{4}{3}\cos^2 3\theta$, $\frac{16}{9}\cos^4 3\theta$ and $\frac{64}{27}\cos^6 3\theta$, for $0 < \theta < \frac{\pi}{3}$. Find the set of values of θ for which this progression has a sum to infinity. [5]

10. June/2023/Paper_0606/12/No.10

(a) The first three terms of an arithmetic progression are $(2x+1)$, $4(2x+1)$ and $7(2x+1)$, where $x \neq -\frac{1}{2}$.

(i) Show that the sum to n terms can be written in the form $\frac{n}{2}(2x+1)(An+B)$, where A and B are integers to be found. [2]

(ii) Given that the sum to n terms is $(54n+37)(2x+1)$, find the value of n. [2]

(iii) Given also that the sum to n terms in **part (ii)** is equal to 1017.5, find the value of x. [2]

(b) The first three terms of a geometric progression are $(2y+1)$, $3(2y+1)^2$ and $9(2y+1)^3$, where $y \neq -\frac{1}{2}$.

Given that the nth term of the progression is equal to 4 times the $(n+2)$th term, find the possible values of y, giving your answers as fractions. [4]

(c) The first three terms of a different geometric progression are $\sin\theta$, $2\sin^3\theta$ and $4\sin^5\theta$, for $0 < \theta < \frac{\pi}{2}$. Find the values of θ for which the progression has a sum to infinity. [3]

11. June/2023/Paper_0606/13/No.5

(a) Find the first three terms in the expansion of $\left(x^2 - \frac{4}{x^2}\right)^{10}$ in descending powers of x. Give each term in its simplest form. [3]

(b) Hence find the coefficient of x^{16} in the expansion of $\left(x^2 - \frac{4}{x^2}\right)^{10}\left(x^2 + \frac{2}{x^2}\right)^2$. [3]

12. June/2023/Paper_0606/21/No.10

In the expansion of $\left(ax+\dfrac{b}{x^2}\right)^9$, where a and b are constants with $a > 0$, the term independent of x is $-145\,152$ and the coefficient of x^6 is -6912. Show that $a^2b = -12$ and find the value of a and the value of b. [7]

13. June/2023/Paper_0606/22/No.6

(a) **(i)** Find the first three terms in the expansion of $\left(1+\frac{x}{7}\right)^5$, in ascending powers of x. Simplify the coefficient of each term. [2]

(ii) The expansion of $7(1+x)^n\left(1+\frac{x}{7}\right)^5$, where n is a positive integer, is written in ascending powers of x. The first two terms in the expansion are $7+89x$. Find the value of n. [2]

(b) In the expansion of $(k-2x)^8$, where k is a constant, the coefficient of x^4 divided by the coefficient of x^2 is $\frac{5}{8}$. The coefficient of x is positive. Form an equation and hence find the value of k. [5]

14. June/2023/Paper_0606/23/No.10

An arithmetic progression, A, has first term a and common difference d.
The 2nd, 14th and 17th terms of A form the first three terms of a convergent geometric progression, G, with common ratio r.

(a) **(i)** Given that $d \neq 0$, find two expressions for r in terms of a and d and hence show that $a = -17d$. [6]

(ii) Find the value of r. [2]

(b) The first term of the geometric progression, G, is q and the sum to infinity is $\frac{256}{3}$.

Find the sum of the first 20 terms of the **arithmetic** progression, A. [7]