1. Nov/2021/Paper_13/No.4

(a) Find the first three terms, in ascending powers of x^2, in the expansion of $\left(\frac{1}{2}-\frac{2}{3}x^2\right)^8$. Write your coefficients as rational numbers. [3]

(b) Find the coefficient of x^2 in the expansion of $\left(\frac{1}{2}-\frac{2}{3}x^2\right)^8\left(2x+\frac{1}{x}\right)^2$. [3]

2. Nov/2021/Paper_13/No.5

A geometric progression is such that its sum to 4 terms is 17 times its sum to 2 terms. It is given that the common ratio of this geometric progression is positive and not equal to 1.

(a) Find the common ratio of this geometric progression. [3]

(b) Given that the 6th term of the geometric progression is 64, find the first term. [2]

(c) Explain why this geometric progression does not have a sum to infinity. [1]

3. Nov/2021/Paper_22/No.2

(a) Expand $(2-3x)^4$, evaluating all of the coefficients. [4]

(b) The sum of the first three terms in ascending powers of x in the expansion of $(2-3x)^4\left(1+\frac{a}{x}\right)$ is $\frac{32}{x}+b+cx$, where a, b and c are integers. Find the values of each of a, b and c. [4]

4. Nov/2021/Paper_22/No.10

(a) The first three terms of an arithmetic progression are x, $5x-4$ and $8x+2$. Find x and the common difference. [4]

(b) The first three terms of a geometric progression are y, $5y-4$ and $8y+2$.

(i) Find the two possible values of y. [4]

(ii) For each of these values of y, find the corresponding value of the common ratio. [2]

5. Nov/2021/Paper_23/No.9

An arithmetic progression has first term a and common difference d. The third term is 13 and the tenth term is 41.

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

(b) Find the number of terms required to give a sum of 2555. [4]

(c) Given that S_n is the sum to n terms, show that $S_{2k} - S_k = 3k(1 + 2k)$. [4]

6. June/2021/Paper_11/No.4

The first 3 terms in the expansion of $(a+x)^3\left(1-\frac{x}{3}\right)^5$, in ascending powers of x, can be written in the form $27+bx+cx^2$, where a, b and c are integers. Find the values of a, b and c. [8]

7. June/2021/Paper_12/No.9

(a) The first three terms of an arithmetic progression are $-4, 8, 20$. Find the smallest number of terms for which the sum of this arithmetic progression is greater than 2000. [4]

(b) The 7th and 9th terms of a geometric progression are 27 and 243 respectively. Given that the geometric progression has a positive common ratio, find

(i) this common ratio, [2]

(ii) the 30th term, giving your answer as a power of 3. [2]

(c) Explain why the geometric progression $1, \sin\theta, \sin^2\theta, \ldots$ for $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$, where θ is in radians, has a sum to infinity. [2]

8. June/2021/Paper_14/No.3

(a) Find the first 3 terms in the expansion, in ascending powers of x, of $(a-3x)^{10}$, where a is a constant. [3]

(b) Given that a is positive and that the three terms found in **part (a)** can also be written as $p+qx+\frac{405}{256}x^2$, find the value of each of the constants a, p and q. [3]

9. June/2021/Paper_21/No.11

The 2nd, 8th and 44th terms of an arithmetic progression form the first three terms of a geometric progression. In the arithmetic progression, the first term is 1 and the common difference is positive.

(a) **(i)** Show that the common difference of the arithmetic progression is 5. [5]

(ii) Find the sum of the first 20 terms of the arithmetic progression. [2]

(b) **(i)** Find the 5th term of the geometric progression. [2]

(ii) Explain whether or not the sum to infinity of this geometric progression exists. [1]

10. June/2021/Paper_22/No.1

Using the binomial theorem, expand $(1+e^{2x})^4$, simplifying each term. [2]

11. June/2021/Paper_24/No.12

(a) The first term of an arithmetic progression is –5 and the fifth term is 7. Find the sum of the first 40 terms of this progression. [4]

(b) A geometric progression has third term of 8 and sixth term of 0.064. Find the sum to infinity of this progression. [4]