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EXPENSION OF POSITIVE INTEGER OR EXACT DECIMAL NUMBER-II

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ABSTRACT

In this paper it is shown that a number either positive integer or exact decimal number greater than or equals to one, with different power of a, b, c, d …… and common power ratio, m = $\frac{b}{a}$ = $\frac{c}{b}$ = $\frac{d}{c}$ *=…… or common power difference, m = b-a = c-b = d-c =….., can be expended up to infinity in term of value of m, a & x.*

Keywords: *Exact decimal number, Positive integer.*

1. INTRODUCTION

Vide International Journal of Mathematical Archive Ref. –11(9), 2020, 27-30 it has been proved that a number either positive integer or exact decimal number greater than one can presented by an infinite series by different positive integers or by different exact decimal numbers by formula

$$1 + \frac{a-1}{b} + \frac{a-1}{b}\,\frac{b-1}{c} + \frac{a-1}{b}\,\frac{b-1}{c}\,\frac{c-1}{d} + \ldots\ldots \infty = a$$

Instead of Numbers a, b, c, d……., x_1, x_2, x_3 ……x_n……, are taken which is expressed in term of power i.e $x_1 = x^a$, $x_2 = x^b$, $x_3 = x^c$….., these value have been put in above equation and it has been simplify.

Theorem 1: If x_1, x_2, x_3 ……x_n……. are positive integer or exact decimal number greater than or equals to one in term of $x_1 = x^a$, $x_2 = x^b$, $x_3 = x^c$….., where ratio of two successive power (m) = $\frac{b}{a}$ = $\frac{c}{b}$ = $\frac{d}{c}$ =…. Or difference of two successive power (m) = b-a = c-b = d-c = …….., then

First case: *m* = $\frac{b}{a} = \frac{c}{b} = \frac{d}{c}$ =…….

$$f(m,a,x) = \sum_{i=0}^{\infty} \prod_{n=0}^{i} x^{-a(m-1)m^n}\,(1 - x^{-a\,m^n})$$

Second case: *m = b-a = c-b = d-c =……..,*

$$f(m,a,x) = \sum_{i=0}^{\infty} \prod_{n=0}^{i} x^{-m}\left[1 - x^{-(a+mn)}\right]$$

For both case - $f(m,a,x) = x^a - 1$ where {m, a > zero (positive) & x ≥ 1}

Proof: Vide International Journal of Mathematical Archive Ref. – IJMA-11(9), 2020, 27-30 it has been proved that if a, b, c, d,….. are positive integer or exact decimal numbers greater than one then,

$$1 + \frac{a-1}{b} + \frac{a-1}{b}\,\frac{b-1}{c} + \frac{a-1}{b}\,\frac{b-1}{c}\,\frac{c-1}{d} + \ldots\ldots \infty = a$$

According to theory If x_1, x_2, x_3 …x_n…are positive integer or exact decimal number greater than or equals to one in term of $x_1 = x^a$, $x_2 = x^b$, $x_3 = x^c$………., where ratio of two successive power (m) = $\frac{b}{a} = \frac{c}{b} = \frac{d}{c}$ =…. Or difference of two successive power (m) = b - a = c - b = d - c,….., then

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For first case

$x_1 = x^a$, $x_2 = x^b$, $x_3 = x^c$ ……. and m = $\frac{b}{a} = \frac{c}{b} = \frac{d}{c}$

b = am, c = am^2, d = am^3, ……

Put the value of x_1, x_2, x_3,……… in above equation

$$1 + \frac{x^a-1}{x^b} + \frac{x^a-1}{x^b}\frac{x^b-1}{x^c} + \frac{x^a-1}{x^b}\frac{x^b-1}{x^c}\frac{x^c-1}{x^d} + \ldots\ldots\ldots\infty = x^a$$

Put the value of b, c, d…..

$$\frac{x^a-1}{x^{am}} + \frac{x^a-1}{x^{am}}\frac{x^{am}-1}{x^{am^2}} + \frac{x^a-1}{x^{am}}\frac{x^{am}-1}{x^{am^2}}\frac{x^{am^2}-1}{x^{am^3}} + \ldots\ldots\infty = x^a - 1$$

Above series can be written as

$$\sum_{i=0}^{\infty}\prod_{n=0}^{i}\frac{x^{am^n}-1}{x^{am^{n+1}}} = x^a - 1$$

$$\sum_{i=0}^{\infty}\prod_{n=0}^{i}\left[x^{(am^n-am^{n+1})} - x^{-am^{n+1}}\right] = x^a - 1$$

$$\sum_{i=0}^{\infty}\prod_{n=0}^{i}\left[x^{-am^n(m-1)} - x^{-am^n m}\frac{x^{am^n}}{x^{am^n}}\right] = x^a - 1$$

$$\sum_{i=0}^{\infty}\prod_{n=0}^{i}\left[x^{-am^n(m-1)} - \frac{x^{-am^n(m-1)}}{x^{am^n}}\right] = x^a - 1$$

$$\sum_{i=0}^{\infty}\prod_{n=0}^{i} x^{-am^n(m-1)}\left[1 - x^{-am^n}\right] = x^a - 1$$

Since series depend upon value of m, a, x, hence

$$f(m,a,x) = \sum_{i=0}^{\infty}\prod_{n=0}^{i} x^{-am^n(m-1)}\left(1 - x^{-am^n}\right) = x^a - 1$$

For second case

$x_1 = x^a$, $x_2 = x^b$, $x_3 = x^c$ …. and m = b-a = c-b = d-c = ………

b= $a+m$, c = $a+2m$, d= $a+3m$, ………..

Put the value of x_1, x_2, x_3,……… in above equation

$$1 + \frac{x^a-1}{x^b} + \frac{x^a-1}{x^b}\frac{x^b-1}{x^c} + \frac{x^a-1}{x^b}\frac{x^b-1}{x^c}\frac{x^c-1}{x^d} + \ldots\ldots\ldots\infty = x^a$$

Put the value of b, c, d…..

$$\frac{x^a-1}{x^{a+m}} + \frac{x^a-1}{x^{a+m}}\frac{x^{a+m}-1}{x^{a+2m}} + \frac{x^a-1}{x^{a+m}}\frac{x^{a+m}-1}{x^{a+2m}}\frac{x^{a+2m}-1}{x^{a+3m}} + \ldots\ldots\infty = x^a - 1$$

Above series can be written as

$$\sum_{i=0}^{\infty}\prod_{n=0}^{i}\frac{x^{a+mn}-1}{x^{a+m(n+1)}} = x^a - 1$$

$$\sum_{i=0}^{\infty}\prod_{n=0}^{i} x^{(a+mn-a-mn-m)} - x^{-(a+mn)}x^{-m} = x^a - 1$$

$$\sum_{i=0}^{\infty}\prod_{n=0}^{i} x^{-m} - x^{-(a+mn)}x^{-m} = x^a - 1$$

$$\sum_{i=0}^{\infty}\prod_{n=0}^{i} x^{-m}\left[1 - x^{-(a+mn)}\right] = x^a - 1$$

Since series depend upon value of m, a, x, hence

$$f(m,a,x) = \sum_{i=0}^{\infty}\prod_{n=0}^{i} x^{-m}\left[1 - x^{-(a+mn)}\right] = x^a - 1$$

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