# Infinite Series - Class XI

## Past Year JEE Questions

### Questions

**Quetion: 01**

If the expansion in powers of $x$ of the function $\frac{1}{(1-ax)(1-bx)}$ is $a_0 + a_1 x + a_2 x^2 + a_3 x^3 \ldots.$ then $a_n$ is

A. $\frac{b^n - a^n}{b-a}$

B. $\frac{a^n - b^n}{b-a}$

C. $\frac{a^{n+1} - b^{n+1}}{b-a}$

D. $\frac{b^{n+1} - a^{n+1}}{b-a}$

### Solutions

**Solution: 01**

#### Explanation

$\frac{1}{(1-ax)(1-bx)}$

= $(1-ax)^{-1}(1-bx)^{-1}$

= $\left[1 + (-1)(-ax) + \frac{(-1)(-2)}{1.2}(-ax)^2 + \ldots\right]$ -

$\left[1 + (-1)(-bx) + \frac{(-1)(-2)}{1.2}(-bx)^2 + \ldots\right]$

= $\left[1 + ax + a^2x^2 + \ldots + a^{n-1}x^{n-1} + a^n x^n + \ldots\right]$ -

$\left[1 + bx + b^2x^2 + \ldots + b^{n-1}x^{n-1} + b^n x^n + \ldots\right]$

Coefficient of $x^n$ =

$a^n + a^{n-1}b + a^{n-2}b^2 + \ldots + b^n$

= $a^n\left[1 + \frac{b}{a} + \frac{b^2}{a^2} + \ldots + \frac{b^n}{a^n}\right]$

= $a^n\left[\frac{\left(\frac{b}{a}\right)^{n+1} - 1}{\frac{b}{a} - 1}\right]$

= $a^n\left[\frac{b^{n+1} - a^{n+1}}{a^{n+1}\left(\frac{b-a}{a}\right)}\right]$

= $\frac{b^{n+1} - a^{n+1}}{b-a}$