

FREE

India's #1 Learning Platform

Start Complete Exam Preparation

Trusted by 1,86,00,449+ Students

Daily Live  
MasterClassesPractice  
Question BankMock Tests  
& Quizzes

Download App



## Question

[View this Question Online >](#)

The solution to the recurrence equation  $T(2^k) = 3T(2^{k-1}) + 1$ ,  $T(1) = 1$  is:

This question was previously asked in

**NVS TGT Mathematic 2019 Shift 1  
Official Paper**

[Attempt Online](#)[View all NVS TGT Papers >](#)

1.  $2^{\log_3 k}$

2.  $2^k$

3.  $\frac{3^{k+1}-1}{2}$

4.  $3^{\log_2 k}$

**Answer** (Detailed Solution Below)

Option 3 :  $\frac{3^{k+1}-1}{2}$

## Crack NVS with India's Super Teachers

**FREE** Demo Classes Available\*

Explore Supercoaching For FREE



### Detailed Solution

#### Concept:

A **recurrence relation** is an equation that recursively defines a sequence or multidimensional array of values, once one or more initial terms of the same function are given; each further term of the sequence or array is defined as a function of the preceding terms of the same function.

#### Calculation:

We have

$$T(2^k) = 3T(2^{k-1}) + 1$$

$$= 3^2T(2^{k-2}) + 1 + 3$$

$$= 3^3T(2^{k-3}) + 1 + 3 + 9$$

..... k steps of recursion

$$= 3^kT(2^{k-k}) + (1 + 3 + 9 + 27 + \dots + 3^{k-1})$$

$$= 3^k + \left(\frac{3^k - 1}{2}\right)$$

$$= \left(\frac{3^{k+1} - 1}{2}\right)$$

$\therefore$  The solution to the recurrence equation  $T(2^k) = 3T(2^{k-1}) + 1$  is  $\left(\frac{3^{k+1} - 1}{2}\right)$

**Hence,** the correct answer is option **3)**