

The Fibonacci numbers are important in many aspects of mathematics, computing and are often found in nature

$$F_n = \begin{cases} 0 & \text{if } n = 0; \\ 1 & \text{if } n = 1; \\ F_{n-1} + F_{n-2} & \text{if } n > 0. \end{cases} \quad (1)$$

The Fibonacci numbers are also intimately connected with the golden ratio, and are typically computed using recursion

A better way to compute **The Fibonacci numbers** is done using **eigenvalues and eigenvectors**

```
def fib(n):  
    lambda1 = (1 + sqrt(5))/2  
    lambda2 = (1 - sqrt(5))/2  
    return (lambda1**n - lambda2**n) / sqrt(5)  
def fib_approx(n)  
    # for practical range, percent error < 10^-6  
    return 1.618034**n / sqrt(5)
```

Figure 1: Bla