

## Newton interpolation scheme -forward finite difference

```

x0:= 0      //starting x value
h:= 0.5     //step
xn:= 2      //end x point

X:= x0, x0+h..2 //equidistant X (this must be satisfied!!!)
n:= length(X) //number of points
                //Y given
                X:= augment(X, Y)
                Y:=

$$X = \begin{pmatrix} 0 \\ 0.5 \\ 1 \\ 1.5 \\ 2 \end{pmatrix} \quad Y = \begin{pmatrix} 5.485 \\ 4.403 \\ 3.414 \\ 2.518 \\ 1.717 \end{pmatrix}$$

//Matrix A - the first two columns are X,Y
for i ∈ 1..n
    Ai 1 := Xi
    Ai 2 := Yi

// The rest of the A columns are forward finite differences
for j ∈ 2..n
    for i ∈ 1..n-j+1
        Ai j+1 := Ai+1 j - Ai j

A =

$$\begin{pmatrix} 0 & 5.485 - 1.082 & 0.093 & 0 & 0.002 \\ 0.5 & 4.403 - 0.989 & 0.093 & 0.002 & 0 \\ 1 & 3.414 - 0.896 & 0.095 & 0 & 0 \\ 1.5 & 2.518 - 0.801 & 0 & 0 & 0 \\ 2 & 1.717 & 0 & 0 & 0 \end{pmatrix}$$


nx:= 1      //starting point
m:= 2       //order of polynomial
            //- note the fin.dif. of order 2 are
            //close to each other (behaves like polynomial of order 2)
            //Try to put maximal order (4)

//Making the given polynomial (Newton forward finite difference)
for i ∈ 1..cols(A)
    ci := Anx i

yn:= c2    z:= 1
α:=  $\frac{x - A_{nx 1}}{h}$ 

for j ∈ 1..m
    z:= z ·  $\frac{(\alpha - j + 1)}{j}$ 
    yn:= yn + cj+2 · z

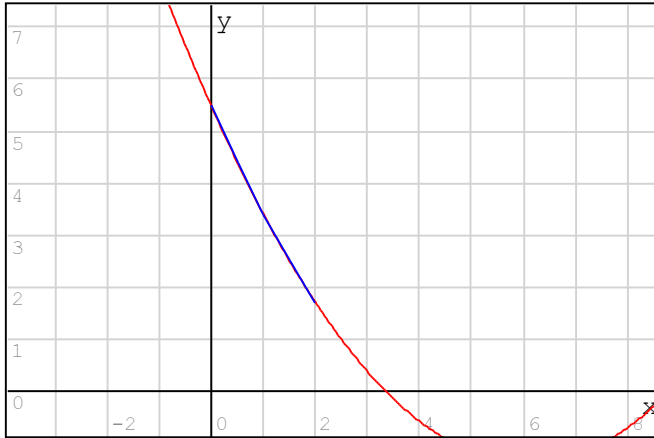
```

$y(x) := y_n$

//Symbolically given

$$y(x) \rightarrow \frac{1000 \cdot (274250 - 108200 \cdot x) + 4650000 \cdot x \cdot (-1 + 2 \cdot x)}{50000000}$$

//Plotting will show quite good interpolation



$\begin{cases} XY \\ y(x) \end{cases}$