Newton interpolation scheme -bacward 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!!!)

$n := \text{length}(X)$ //number of points

//Y given

$$X = \begin{pmatrix} 0 \\ 0.5 \\ 1 \\ 1.5 \\ 2 \end{pmatrix} \quad Y := \begin{pmatrix} 5.485 \\ 4.403 \\ 3.414 \\ 2.518 \\ 1.717 \end{pmatrix} \quad XY := \text{augment}(X, Y)$$

//Matrix A - the first two columns are X,Y

```
for i ∈ 1 .. n
  | A_{i,1} := X_i
  | A_{i,2} := Y_i
```

// The rest of the A columns are backward finite diferences

```
for j ∈ 2 .. n
  for i ∈ j .. n
    A_{i,j+1} := A_{i,j} - A_{i-1,j}
```

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

$nx := 5$ //starting point (pay attention - the last point!)
//in this case we are going from the bottom of the table

$m := 2$ //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 backward finite difference)

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for i ∈ 1 .. cols(A)
  c_i := A_{nx,i}
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$yn := c_2$ $z := 1$

$$\alpha := \frac{x - A_{nx,1}}{h}$$

for j ∈ 1 .. m

$$z := z \cdot \frac{(\alpha + j - 1)}{j}$$

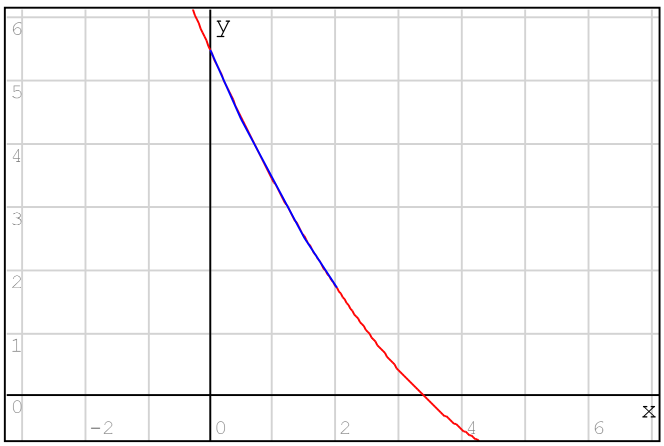
$$yn := yn + c_{j+2} \cdot z$$

$y(x) := yn$

//Symbolically given

$$y(x) \rightarrow \frac{200 \cdot (858500 - 801000 \cdot (-2 + x)) + 9500000 \cdot (-2 + x) \cdot (1 + 2 \cdot (-2 + x))}{100000000}$$

//Plotting will show quite good interpolation



XY
y(x)