Higher Order Interpolation Formulas

# 3rd order cell based extrapolation

## Backward Extrapolation

Approximating several function values around we have

We may rewrite this as

Or

In matrix form we may write

Where

The only solution we seek is for which, by Cramer's rule is

Let's tackle these separately

The numerator is

Factoring terms we have

Therefore, is

Or

Factoring out the 1/2 we have

Factoring some more

Slightly simplifying we have

### Result

Or

## Forward Extrapolation

This is very similar to the backward extrapolation, the only difference here is that we are now looking for a different function location and we approximate closer to the end point. Approximating several function values around we have

We may rewrite this as

Or

In matrix form we may write

Where

The only solution we seek is for which, by Cramer's rule is

Let's tackle these separately. The matrix is the same, so we have

The numerator is

Factoring terms we have

Therefore, is

Dividing by 2 we have

Splitting, and slightly rearranging this, we have

Factoring more

Simplifying

### Result

Or

# 4th order interpolation

Here, let's approximate a function around

We may write this as

In matrix form we may write

Where

Our solution is

Let's look at these separately

Let's look at these separately...