

## Newton's Divided Difference

### Assessment

Create an R function named `NDD` which accepts a list as input. The list will contain the two vectors for the data points, one for the independent variable and another for the dependent variable. It should use Newton's Divided Difference to solve for the  $n^{\text{th}}$  order polynomial that will fit the data points.

The function must return the following variables in a list, with the following labels:

- `coefficients`: the vector of coefficients ( $b_0, b_1, b_2, \dots, b_n$ );
- `polynomial_string`: the string version of the polynomial;
- `polynomial_function`: the function version of the polynomial.

The function must return `NA` if the length of the independent variable vector is not equal to the length of the dependent variable vector.

As an example, the output for the particular data points coded in R will be the following:

```
> x = c(8, 9, 11, 12)
> y = c(0.9031, 0.9542, 1.0414, 1.0792)
> NDD(list(x, y))
$coefficients
[1] 0.9031000000 0.0511000000 -0.0025000000 0.0001416667

$polynomial_string
[1] "function(x) 0.9031 + 0.0511 *(x- 8 ) + -0.0025 *(x- 8 ) *(x- 9 ) +
0.000141666666666651 *(x- 8 ) *(x- 9 ) *(x- 11 )"

$polynomial_function
function (x)
0.9031 + 0.0511 * (x - 8) + -0.0025 * (x - 8) * (x - 9) + 0.000141666666666651 *
(x - 8) * (x - 9) * (x - 11)
<environment: 0x7407238>
```

### Word Problem

The following data define the sea-level concentration of dissolved oxygen for freshwater as a function of temperature:

$T^{\circ}\text{C}$	0	8	16	24	32	40
$\text{o, mg/L}$	14.621	11.843	9.870	8.418	7.305	6.413

- Solve for the function that will model the data using linear regression (You can use your previous exercise).
- Solve for the function that will model the data using polynomial regression of degree five (You can use your previous exercise).
- Solve for the function that will model the data using Newton's divided difference (You can use your code)
- Estimate  $\text{o}(27^{\circ}\text{C})$  using the three functions.
- Plot the three functions and the data points in a graph.
- Compare the three functions using the graph.