Horner’s rule

1. Evaluate the polynomial $x^3 + 2x^2 + 4x + 1$ at the point 1.1 using Horner’s rule.

Answer: $1.1 + 2 = 3.1$

$3.1 \times 1.1 + 4 = 3.41 + 4 = 7.41$

$7.41 \times 1.1 + 1 = 8.151 + 1 = 9.151$

2. Evaluate the polynomial $x^4 + 5x + 2$ at the point 1.1 using Horner’s rule.

Answer: $1.1^3 + 5 = 1.331 + 5 = 6.331$

$6.331 \times 1.1 + 2 = 6.9641 + 2 = 8.9641$

3. Suppose that an array is pass as an argument for Horner's rule. Which entry is associated with each coefficient for each of the following functions?

```
double horner( double *coeffs, unsigned int n, double x ) {
    double result{ coeffs[0] };

    for ( unsigned int k{1}; k <= n; ++k ) {
        result = result*x + coeffs[k];
    }

    return result;
}

double horner( double *coeffs, unsigned int n, double x ) {
    double result{ coeffs[n] };

    for ( unsigned int k{n - 1}; k < n; --k ) {
        result = result*x + coeffs[k];
    }

    return result;
}

double horner( double *coeffs, unsigned int n, double x ) {
    double result{ coeffs[0] };

    for ( unsigned int k{1}; k < n; ++k ) {
        result = result*x + coeffs[k];
    }

    return result;
}

double horner( double *coeffs, unsigned int n, double x ) {
    double result{ coeffs[n - 1] };

    for ( unsigned int k{n - 2}; k < n; --k ) {
        result = result*x + coeffs[k];
    }

    return result;
}
```

Answer: In the first case, `array[k]` is the coefficient of x^k where n is the degree of the polynomial, in the second, `array[k]` is the coefficient of x^{n-k} where n is the degree of the polynomial, in the third, `array[k]` is the coefficient of x^k but the degree of the polynomial is $n - 1$, and in the fourth, `array[k]` is the coefficient of x^{n-k-1}, and again the degree of the polynomial is $n - 1$.