MATH 305   Polynomials – Nested Form

If exact arithmetic is used to evaluate the polynomial

$$f(x) = 2.753\,x^3 - 2.958\,x^2 + 3.169\,x - 4.675 \tag{1}$$

at $x = 1.077$, the result is $-1.2538\,8953\,5651$. In *nested form*, the same polynomial is

$$f(x) = ((2.753\,x - 2.958)\,x + 3.169)\,x - 4.675\,. \tag{2}$$

- How many multiplications are there in form (1)? How many additions/subtractions?
- How many multiplications are there in form (2)? How many additions/subtractions?

1. Evaluate the polynomial (2) at $x = 1.077$ using

   (a) exact arithmetic,

   (b) 3-digit chopping arithmetic[1]
   Answer: -1.32 (Yes, that *is* the answer you're supposed to get.)

   (c) 3-digit rounding arithmetic[2]
   Answer: -1.25 (Yes, that *is* the answer you're supposed to get.)

2. Determine the absolute error and the percent error in the results from (b) and (c).

3. Use Maple to evaluate the polynomial at $x = 1.077$.

Write the following polynomials in nested form.

1. $f(x) = x^7 - 6x^6 + 3x^4 - 2x^3 + 12x + 5$
   answer: $f(x) = ((((x - 6)x^2 + 3)x - 2)x^2 + 12)x + 5$

2. $f(x) = 8x^2 - 4x^5 + 2x^6 - 9 + x^8$
   answer: $f(x) = (((x^2 + 2)x - 4)x^3 + 8)x^2 - 9$

[1] Be careful! How is 1.077 stored on a 3-digit chopping computer?
[2] Be careful! How is 1.077 stored on a 3-digit rounding computer?