BONUS 1 (HC4a)

$p(x) = 1.01x^5 - 5.26x^3 - 0.0173x^2 + 0.839x - 1.91$

$x = 2.44$

$n = 3 \rightarrow 3sf$

direct evaluation:

$x = 2.44$

$x^2 = 2.44 \times 2.44 = 5.9536 \overset{3sf}{\approx} 5.95$

$x^3 = 5.95 \times 2.44 = 14.518 \overset{3sf}{\approx} 14.5$

$x^4 = 14.5 \times 2.44 = 35.38 \overset{3sf}{\approx} 35.4$

$x^5 = 35.4 \times 2.44 = 86.376 \overset{3sf}{\approx} 86.4$

$1.01x^5 = 1.01 \times 86.4 = 87.264 \overset{3sf}{\approx} 87.3$

$-5.26x^3 = -5.26 \times 14.5 = -76.27 \overset{3sf}{\approx} -76.3$

$-0.0173x^2 = -0.0173 \times 5.95 = 0.102935 \overset{3sf}{\approx} -0.103$

$0.839x = 0.839 \times 2.44 = 2.04716 \overset{3sf}{\approx} 2.05$

$87.3 - 76.3 - 0.103 + 2.05 - 1.91 = 11.037$

$\overset{3sf}{\approx}$

$\underline{\underline{11.0}}$

exact value $= 10.97481$

absolute error: $|11 - 10.97481| = 0.02519$

$\overset{3sf}{\approx} 0.0252$

or 2.52×10^{-2}

relative error: $\dfrac{|11 - 10.97481|}{|10.97481|} = 0.00229525\ldots$

$\overset{3sf}{\approx} 0.00230$

or 2.30×10^{-3}

or 0.23%

<u>nested (Horner) form</u>:

$1.01x^5 - 5.26x^3 - 0.0173x^2 + 0.839x - 1.91 =$

$= (1.01x^4 - 5.26x^2 - 0.0173x + 0.839)\cdot x - 1.91 =$

$= ((1.01x^3 - 5.26x - 0.0173)\cdot x + 0.839)\cdot x - 1.91 =$

$= (((1.01x^2 - 5.26)\cdot x - 0.0173)\cdot x + 0.839)\cdot x - 1.91 =$

$= ((((1.01x)\cdot x - 5.26)\cdot x - 0.0173)\cdot x + 0.839)\cdot x - 1.91 =$

$= ((((1.01 \times 2.44)\cdot 2.44 - 5.26)\cdot 2.44 - 0.0173)\cdot 2.44 + 0.839)\cdot 2.44 - 1.91 =$

$= ((((2.4644)\cdot 2.44 - 5.26)\cdot 2.44 - 0.0173)\cdot 2.44 + 0.839)\cdot 2.44 - 1.91 \overset{3sf}{\approx}$

$\overset{3sf}{\approx} (((2.46\cdot 2.44 - 5.26)\cdot 2.44 - 0.0173)\cdot 2.44 + 0.839)\cdot 2.44 - 1.91 =$

$= ((0.7424\cdot 2.44 - 0.0173)\cdot 2.44 + 0.839)\cdot 2.44 - 1.91 \overset{3sf}{\approx}$

$\overset{3sf}{\approx} ((0.742\cdot 2.44 - 0.0173)\cdot 2.44 + 0.839)\cdot 2.44 - 1.91 =$

$= ((1.81048 - 0.0173)\cdot 2.44 + 0.839)\cdot 2.44 - 1.91 \overset{3sf}{\approx}$

$\overset{3sf}{\approx} ((1.81 - 0.0173)\cdot 2.44 + 0.839)\cdot 2.44 - 1.91 =$

$= (1.7927\cdot 2.44 + 0.839)\cdot 2.44 - 1.91 \overset{3sf}{\approx}$

$\overset{3sf}{\approx} (1.79\cdot 2.44 + 0.839)\cdot 2.44 - 1.91 =$

$= (4.3676 + 0.839)\cdot 2.44 - 1.91 \overset{3sf}{\approx}$

$\overset{3sf}{\approx} (4.37 + 0.839)\cdot 2.44 - 1.91 =$

$= 5.209\cdot 2.44 - 1.91 \overset{3sf}{\approx} 5.21\cdot 2.44 - 1.91 =$

$= 12.7124 - 1.91 \overset{3sf}{\approx} 12.7 - 1.91 = 10.79 \overset{3sf}{\approx} \underline{\underline{10.8}}$

exact value $= 10.97481$

absolute error: $|10.8 - 10.97481| = 0.17481$

$\overset{3sf}{\approx} 0.175$

or $1.75 \cdot 10^{-1}$

relative error: $\dfrac{|10.8 - 10.97481|}{|10.97481|} = 0.0159283$

$\overset{3sf}{\approx} 0.0160$

or 1.60×10^{-2}

or $1.60\ \%$

From my findings, using nested (Horner) form result in bigger error. This is because I had to round more often in comparison to direct evaluation.