Copyright (C) 2018, 2012, 2016 by Pearson Education Inc. All Rights Reserved, please visit www.pearsoned.com/permissions/

**EX.0.1.1 Sauer**

Rewrite the following polynomials in nested form. Evaluate with and without nested form at $x = 1/3$.

a. $p(x) = 6x^4 + x^3 + 5x^2 + x + 1$

b. $p(x) = -3x^4 + 4x^3 + 5x^2 - 5x + 1$

c. $p(x) = 2x^4 + x^3 - x^2 + 1$

Copyright (c) 2021, Julien Langou. All rights reserved, please visit https://creativecommons.org/licenses/by/4.0/

Horner's method

(a) $p(x) = 6x^4 + x^3 + 5x^2 + x + 1$

$= (6x^3 + x^2 + 5x + 1)x + 1$

$= ((6x^2 + x + 5)x + 1)x + 1$

$= (((6x+1)x + 5)x + 1)x + 1$

This is the answer ↑

4 additions 4 multiplications polynomial of degree 4

$p(\frac{1}{3}) = 6(\frac{1}{3})^4 + (\frac{1}{3})^3 + 5(\frac{1}{3})^2 + (\frac{1}{3}) + 1$

$= 2$

$p(\frac{1}{3}) = (((6(\frac{1}{3})+1)\frac{1}{3} + 5)\frac{1}{3} + 1)\frac{1}{3} + 1$

$= 2$

(b) $p(x) = -3x^4 + 4x^3 + 5x^2 - 5x + 1$

$= (-3x^3 + 4x^2 + 5x - 5)x + 1$

$= ((-3x^2 + 4x + 5)x - 5)x + 1$

$= (((-3x + 4) + 5)x - 5)x + 1$

nested form ↑

we find that $p(\frac{1}{3}) = 0$ with both formulae

(c) $p(x) = 2x^4 + x^3 - x^2 + 1$

$p(x) = (((2x+1)x - 1)x)x + 1$

nested form ↑

$p(\frac{1}{3}) = \frac{77}{81}$ with both formulae