

19.3 1)

$$\alpha) P(x) - Q(x) = (x^2 - x + 1) - (x^3 + x^2 - x) = \cancel{x^2} - \cancel{x} + 1 - x^3 - \cancel{x^2} + \cancel{x} = -x^3 + 1$$

$$\beta) P(x)Q(x) + x^3 = (x^2 - x + 1)(x^3 + x^2 - x) + x^3 = \\ = x^5 + \cancel{x^4} - \cancel{x^3} - \cancel{x^4} - \cancel{x^3} + x^2 + \cancel{x^3} + x^2 - x + \cancel{x^3} = x^5 + 2x^2 - x$$

$$\gamma) [P(x)]^2 + Q(x) = (x^2 - x + 1)^2 + (x^3 + x^2 - x) = \\ = (x^2)^2 + (-x)^2 + 12 + 2x^2 \cdot (-x) + 2 \cdot x^2 + 2 \cdot (-x) \cdot 1 + x^3 + x^2 - x = \\ = x^4 + x^2 + 1 - 2x^3 + 2x^2 - 2x + x^3 + x^2 - x = x^4 - x^3 + 4x^2 - 3x + 1$$

19.3 2)

$$\alpha) P(x) + Q(x) = (2x^2 + 3x - 4) + (x^3 - 2x^2 - 3x + 1) = \\ = \cancel{2x^2} + \cancel{3x} - 4 + x^3 - \cancel{2x^2} - \cancel{3x} + 1 = x^3 - 3$$

$$\beta) P(x)Q(x) = (2x^2 + 3x - 4)(x^3 - 2x^2 - 3x + 1) = \\ = 2x^5 - 4x^4 - 6x^3 + 2x^2 + 3x^4 - 6x^3 - 9x^2 + 3x - 4x^3 + 8x^2 + 12x - 4 = \\ = 2x^5 - x^4 - 16x^3 + x^2 + 15x - 4$$

$$\gamma) [P(x)]^2 - 3Q(x) = (2x^2 + 3x - 4)^2 - 3(x^3 - 2x^2 - 3x + 1) = \\ = (2x^2)^2 + (3x)^2 + (-4)^2 + 2(2x^2) \cdot (3x) + 2(2x^2)(-4) + 2(3x)(-4) - 3x^3 + 6x^2 + 9x - 3 = \\ = 4x^4 + 9x^2 + 16 + 12x^3 - 16x^2 - 24x - 3x^3 + 6x^2 + 9x - 3 = 4x^4 + 9x^3 - x^2 - 15x + 13$$

19.3 3)

$$\alpha) 2P(x) - 3Q(x) = 2(x^2 - 1) - 3(x^3 + 1) = 2x^2 - 2 - 3x^3 - 3 = -3x^3 + 2x^2 - 5$$

$$\beta) [P(x) + 2x][Q(x) - x] = [x^2 - 1 + 2x][x^3 + 1 - x] = \\ = (x^2 + 2x - 1)(x^3 - x + 1) = x^5 - x^3 + x^2 + 2x^4 - 2x^2 + 2x - x^3 + x - 1 = \\ = x^5 + 2x^4 - 2x^3 - x^2 + 3x - 1$$

$$\gamma) [P(x) + x + 1]^2 - [Q(x)]^2 = [(x^2 - 1) + x + 1]^2 - (x^3 + 1)^2 = \\ = (x^2 + x)^2 - (x^3 + 1)^2 = (x^2)^2 + 2x^2 \cdot x + x^2 - ((x^3)^2 + 2x^3 + 1) = \\ = x^4 + \cancel{2x^3} + x^2 - x^6 - \cancel{2x^3} - 1 = -x^6 + x^4 + x^2 - 1$$