

Se q varia de 0 a 1, determine

$$P_0 = (0, 2)$$

$$P_1 = (1, -2)$$

$$P_2 = (3, 0)$$

$$P_3 = (4, 3)$$

a) determine a equação paramétrica de $x(t)$ e $y(t)$

$$P_0 = 0 / P_1 = 1 / P_2 = 3 / P_3 = 4$$

$$x(t) = (1-t)^3 \cdot p_0 + 3t \cdot (1-t)^2 \cdot p_1 + 3t^2 \cdot (1-t) \cdot p_2 + t^3 \cdot p_3$$

$$x(t) = (1-t)^3 \cdot 0 + 3t \cdot (1-t)^2 \cdot 1 + 3t^2 \cdot (1-t) \cdot 3 + t^3 \cdot 4$$

$$x(t) = 3t \cdot (1-t)^2 \cdot 1 + 3t^2 \cdot (1-t) \cdot 3 + t^3 \cdot 4$$

$$x(t) = 3t \cdot (1-2t+t^2) + 9t^2 \cdot (1-t) + 4t^3$$

$$x(t) = 3t - 6t^2 + 3t^3 + 9t^2 - 9t^3 + 4t^3$$

$$x(t) = 3t + 3t^2 - 2t^3$$

$$(1-t)^3 = 1^3 - 3 \cdot 1^2 \cdot t + 3 \cdot 1 \cdot t^2 - t^3$$

$$1 - 3t + 3t^2 - t^3$$

$$\Rightarrow (1-t)^3 = 1^3 - 3 \cdot 1^2 \cdot t + 3 \cdot 1 \cdot t^2 - t^3$$

$$(1-t)^3 = 1^3 - 3 \cdot 1^2 \cdot t + 3 \cdot 1 \cdot t^2 - t^3$$

$$1 - 3t + 3t^2 - t^3$$

$$y(t) = (1-t)^3 \cdot p_0 + 3t \cdot (1-t)^2 \cdot p_1 + 3t^2 \cdot (1-t) \cdot p_2 + t^3 \cdot p_3$$

$$y(t) = (1-t)^3 \cdot 2 + 3t \cdot (1-t)^2 \cdot (-2) + 3t^2 \cdot (1-t) \cdot 0 + t^3 \cdot 3$$

$$y(t) = 2(1-t)^3 - 6t(1-t)^2 + 3t^3$$

$$y(t) = 2(1-3t+3t^2-t^3) - 6t(1-2t+t^2) + 3t^3$$

$$y(t) = 2 - 6t + 6t^2 - 2t^3 - 6t + 12t^2 - 6t^3 + 3t^3$$

$$y(t) = 2 - 12t + 18t^2 - 5t^3$$

Lista 02

$$1) P_0 = (0, 2) \quad P_1 = (1, -2) \quad P_2 = (3, 0) \quad P_3 = (4, 3)$$

a) encontrar a equação paramétrica de $x(t)$ e $y(t)$.

$$P_k = (1-t)^3 \cdot p_0 + 3t \cdot (1-t)^2 \cdot p_1 + 3t^2 \cdot (1-t) \cdot p_2 + t^3 \cdot p_3$$

$$x(t) = (1-t)^3 \cdot 0 + 3t \cdot (1-t)^2 \cdot 1 + 3t^2 \cdot (1-t) \cdot 3 + t^3 \cdot 4$$

$$x(t) = 3t \cdot (1-t)^2 \cdot 1 + 3t^2 \cdot (1-t) \cdot 3 + t^3 \cdot 4$$

$$x(t) = 3t \cdot (1-2t+t^2) + 9t^2 \cdot (1-t) + 4t^3$$

$$x(t) = 3t - 6t^2 + 3t^3 + 9t^2 - 9t^3 + 4t^3$$

$$x(t) = 3t - 6t^2 + 9t^2 + 3t^3 - 9t^3 + 4t^3$$

$$x(t) = 3t + 3t^2 - 2t^3$$

$$1^3 - 3 \cdot 1^2 \cdot t + 3 \cdot 1 \cdot t^2 - t^3$$

$$y(t) = (1-t)^3 \cdot p_0 + 3t \cdot (1-t)^2 \cdot p_1 + 3t^2 \cdot (1-t) \cdot p_2 + t^3 \cdot p_3$$

$$y(t) = (1-t)^3 \cdot 2 + 3t \cdot (1-t)^2 \cdot (-2) + 3t^2 \cdot (1-t) \cdot 0 + t^3 \cdot 3$$

$$y(t) = (1-3t+3t^2-t^3) \cdot 2 + 3t \cdot (1-t)^2 \cdot (-2) + 3t^3$$

$$y(t) = 2 - 6t + 6t^2 - 2t^3 - 6t \cdot (1-t)^2 + 3t^3$$

$$y(t) = 2 - 6t + 6t^2 - 2t^3 - 6t(1-2t+t^2) + 3t^3$$

$$y(t) = 2 - 6t + 6t^2 - 2t^3 - 6t + 12t^2 - 6t^3 + 3t^3$$

$$y(t) = 2 - 6t - 6t + 6t^2 + 12t^2 - 2t^3 - 6t^3 + 3t^3$$

$$y(t) = 2 - 12t + 18t^2 - 5t^3$$

b) determinar a equação paramétrica de $x(t)$ e $y(t)$

b) determinar pontos da curva em $t=0.1$ e $t=0.6$.

$$x(t) = 3t + 3t^2 - 2t^3$$

$$y(t) = 2 - 12t + 18t^2 - 5t^3$$

$$x(0.1) = 3 \cdot 0.1 + 3 \cdot 0.1^2 - 2 \cdot 0.1^3$$

$$y(0.1) = 2 - 12 \cdot 0.1 + 18 \cdot 0.1^2 - 5 \cdot 0.1^3$$

$$x(0.1) = 0.3 + 0.03 - 0.002$$

$$y(0.1) = 2 - 1.2 + 0.18 - 0.005$$

$$x(0.1) = 0.328$$

$$y(0.1) = 0.975$$

$$x(t) = 3t + 3t^2 - 2t^3$$

$$y(t) = 2 - 12t + 18t^2 - 5t^3$$

$$x(0.6) = 3 \cdot 0.6 + 3 \cdot 0.6^2 - 2 \cdot 0.6^3$$

$$y(0.6) = 2 - 12 \cdot 0.6 + 18 \cdot 0.6^2 - 5 \cdot 0.6^3$$

$$x(0.6) = 1.8 + 1.08 - 0.432$$

$$y(0.6) = 2 - 7.2 + 6.48 - 1.08$$

$$x(0.6) = 3.31$$

$$y(0.6) = 0.2$$

2) Remover o ponto $(0,2)$: (logo $P_0 = (1,-2)$, $P_1 = (3,0)$ e $P_2 = (4,3)$)

a) qual o novo grau da curva?

$$P_k = (1-t)^2 \cdot p_0 + 2t \cdot (1-t) \cdot p_1 + t^2 \cdot p_2$$

$$x(t) = (1-t)^2 \cdot 1 + 2t \cdot (1-t) \cdot 3 + t^2 \cdot 4$$

$$x(t) = (1-t)^2 + 6t \cdot (1-t) + 4t^2$$

$$x(t) = 1 - 2t + t^2 + 6t - 6t^2 + 4t^2$$

$$x(t) = 1 - 2t + 6t + t^2 - 6t^2 + 4t^2$$

$$x(t) = 1 + 4t - t^2$$

$$y(t) = (1-t)^2 \cdot p_0 + 2t \cdot (1-t) \cdot p_1 + t^2 \cdot p_2$$

$$y(t) = (1-t)^2 \cdot (-2) + 2t \cdot (1-t) \cdot 0 + t^2 \cdot 3$$

$$y(t) = (1 - 2t + t^2) \cdot (-2) + 3t^2$$

$$y(t) = -2 + 4t - 2t^2 + 3t^2$$

$$y(t) = -2 + 4t + t^2$$

b) determinar ordenada do novo ponto $P_2 = (4, y_2)$

$$5) P_0 = (0, 0, 3) \quad P_1 = (0, 4, 0) \quad P_2 = (2, 0, 0)$$

$$P_k = (1-t)^2 \cdot p_0 + 2t \cdot (1-t) \cdot p_1 + p_2 \cdot t^2$$

$$x(t) = (1-t)^2 \cdot p_0 + 2t \cdot (1-t) \cdot p_1 + p_2 \cdot t^2$$

$$x(t) = \cancel{(1-t)^2 \cdot 0} + \cancel{2t \cdot (1-t) \cdot 0} + 2 \cdot t^2$$

$$x(t) = 2t^2$$

$$p_3 = (0, 0, 3)$$

$$t=0$$

$$y(t) = (1-t)^2 \cdot p_0 + 2t \cdot (1-t) \cdot p_1 + p_2 \cdot t^2$$

$$y(t) = \cancel{(1-t)^2 \cdot 0} + 2t \cdot (1-t) \cdot 4 + \cancel{0 \cdot t^2}$$

$$y(t) = 2t \cdot (1-t) \cdot 4 = 8t(1-t)$$

$$y(t) = 8t - 8t^2$$

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$z(t) = (1-t)^2 \cdot p_0 + 2t \cdot (1-t) \cdot p_1 + p_2 \cdot t^2$$

$$z(t) = (1-t)^2 \cdot 3 + \cancel{2t \cdot (1-t) \cdot 0} + \cancel{0 \cdot t^2}$$

$$z(t) = 3(1-t)^2 = 1^2 - 2 \cdot 1 \cdot t + t^2$$

$$z(t) = 3(1 - 2t + t^2) = 3 - 6t + 3t^2$$

$$x(t) = 2t^2$$

$$x(0) = 2 \cdot 0^2$$

$$x(0) = 0$$

$$y(t) = 8t - 8t^2$$

$$y(0) = 8 \cdot 0 - 8 \cdot 0^2$$

$$y(0) = 0$$

$$z(t) = 3 - 6t + 3t^2$$

$$z(0) = 3 - \cancel{6 \cdot 0} + \cancel{3 \cdot 0^2}$$

$$z(0) = 3$$

$$t=0,5$$

$$x(0,5) = 2 \cdot 0,5^2$$

$$x(0,5) = 2 \cdot 0,25$$

$$x(0,5) = 0,5$$

$$y(0,5) = 8t - 8t^2 \rightarrow 8 \cdot 0,25$$

$$y(0,5) = 8 \cdot 0,5 - 8 \cdot 0,5^2$$

$$y(0,5) = 4 - 2 = 2$$

$$z(0,5) = 3 - 6t + 3t^2 \rightarrow 0,25$$

$$z(0,5) = 3 - 6 \cdot 0,5 + 3 \cdot 0,5^2$$

$$z(0,5) = 3 - 3 + 0,75$$

$$z(0,5) = 0,75$$

$$1) \quad p_0 = (0, 2) \quad p_1 = (1, -2) \quad p_2 = (3, 0) \quad p_3 = (4, 3)$$

a) encontrar a equação paramétrica de $x(t)$ e $y(t)$.

$$p_k = (1-t)^3 \cdot p_0 + 3t \cdot (1-t)^2 \cdot p_1 + 3t^2(1-t) \cdot p_2 + p_3 \cdot t^3$$

$$x(t) = \cancel{(1-t)^3 \cdot 0} + 3t \cdot (1-t)^2 \cdot 1 + 3t^2(1-t) \cdot 3 + 4 \cdot t^3$$

$$x(t) = 3t(1-t)^2 + 9t^2(1-t) + 4t^3$$

$$x(t) = 3t(1 - 2t + t^2) + 9t^2 - 9t^3 + 4t^3$$

$$x(t) = 3t - 6t^2 + 3t^3 + 9t^2 - 9t^3 + 4t^3$$

$$(1-t)^3 = 1^3 - 3 \cdot 1^2 \cdot t + 3 \cdot 1 \cdot t^2 - t^3 = 1 - 3t + 3t^2 - t^3$$

$$x(t) = 3t - 6t^2 + 4t^3 + 3t - 4t + 4t^3$$

$$x(t) = 3t + 3t^2 - 2t^3$$

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$y(t) = (1-t)^3 \cdot p_0 + 3t(1-t)^2 \cdot p_1 + 3t^2 \cdot (1-t) \cdot p_2 + p_3 \cdot t^3$$

$$y(t) = (1-t)^3 \cdot 2 + 3t(1-t)^2 \cdot (-2) + 3t^2 \cdot \cancel{(1-t)} \cdot \overset{0}{0} + 3 \cdot t^3$$

$$y(t) = (1-t)^3 \cdot 2 + 3t(1-t)^2 \cdot (-2) + 3t^3$$

$$y(t) = (1 - 3t + 3t^2 - t^3) \cdot 2 + 3t \cdot (1 - 2t + t^2) \cdot (-2) + 3t^3$$

$$y(t) = 2(1 - 3t + 3t^2 - t^3) - 6t(1 - 2t + t^2) + 3t^3$$

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