

$$dist = \|P - c(t)\|$$

$$((u_1 - (a_x * (1 - t)^3 + 3b_x * (1 - t)^2 * t + 3c_x * (1 - t) * t^2 + d_x * t^3))^2) =$$

$$\begin{aligned} & a_x^2 t^6 - 6a_x^2 t^5 + 15a_x^2 t^4 - 20a_x^2 t^3 + 15a_x^2 t^2 - 6a_x^2 t + a_x^2 - 6a_x b_x t^6 + 30a_x b_x t^5 - \\ & 60a_x b_x t^4 + 60a_x b_x t^3 - 30a_x b_x t^2 + 6a_x b_x t + 6a_x c_x t^6 - 24a_x c_x t^5 + 36a_x c_x t^4 - \\ & 24a_x c_x t^3 + 6a_x c_x t^2 - 2a_x d_x t^6 + 6a_x d_x t^5 - 6a_x d_x t^4 + 2a_x d_x t^3 + 2a_x t^3 u_1 - 6a_x t^2 u_1 + \\ & 6a_x t u_1 - 2a_x u_1 + 9b_x^2 t^6 - 36b_x^2 t^5 + 54b_x^2 t^4 - 36b_x^2 t^3 + 9b_x^2 t^2 - 18b_x c_x t^6 + 54b_x c_x t^5 - \\ & 54b_x c_x t^4 + 18b_x c_x t^3 + 6b_x d_x t^6 - 12b_x d_x t^5 + 6b_x d_x t^4 - 6b_x t^3 u_1 + 12b_x t^2 u_1 - 6b_x t u_1 + \\ & 9c_x^2 t^6 - 18c_x^2 t^5 + 9c_x^2 t^4 - 6c_x d_x t^6 + 6c_x d_x t^5 + 6c_x t^3 u_1 - 6c_x t^2 u_1 + d_x^2 t^6 - 2d_x t^3 u_1 + u_1^2 \end{aligned}$$

$$\begin{aligned} & \rightarrow \\ & t^6(a_x^2 - 6a_x b_x + 6a_x c_x - 2a_x d_x + 9b_x^2 - 18b_x c_x + 6b_x d_x + 9c_x^2 - 6c_x d_x + d_x^2) \\ & t^5(-6a_x^2 + 30a_x b_x - 24a_x c_x + 6a_x d_x - 36b_x^2 + 54b_x c_x - 12b_x d_x - 18c_x^2 + 6c_x d_x) \\ & t^4(15a_x^2 - 60a_x b_x + 36a_x c_x - 6a_x d_x + 54b_x^2 - 54b_x c_x + 6b_x d_x + 9c_x^2) \\ & t^3(-20a_x^2 + 60a_x b_x - 24a_x c_x + 2a_x d_x + 2a_x u_1 - 36b_x^2 + 18b_x c_x - 6b_x u_1 + 6c_x u_1 - \\ & 2d_x u_1) \\ & t^2(15a_x^2 - 30a_x b_x + 6a_x c_x - 6a_x u_1 + 9b_x^2 + 12b_x u_1 - 6c_x u_1) \\ & t(-6a_x^2 + 6a_x b_x + 6a_x u_1 - 6b_x u_1) \\ & a_x^2 - 2a_x u_1 + u_1^2 \end{aligned}$$

$$((u_2 - (a_y * (1 - t)^3 + 3b_y * (1 - t)^2 * t + 3c_y * (1 - t) * t^2 + d_y * t^3))^2) =$$

$$\begin{aligned} & a_y^2 t^6 - 6a_y^2 t^5 + 15a_y^2 t^4 - 20a_y^2 t^3 + 15a_y^2 t^2 - 6a_y^2 t + a_y^2 - 6a_y b_y t^6 + 30a_y b_y t^5 - \\ & 60a_y b_y t^4 + 60a_y b_y t^3 - 30a_y b_y t^2 + 6a_y b_y t + 6a_y c_y t^6 - 24a_y c_y t^5 + 36a_y c_y t^4 - \\ & 24a_y c_y t^3 + 6a_y c_y t^2 - 2a_y d_y t^6 + 6a_y d_y t^5 - 6a_y d_y t^4 + 2a_y d_y t^3 + 2a_y t^3 u_2 - 6a_y t^2 u_2 + \\ & 6a_y t u_2 - 2a_y u_2 + 9b_y^2 t^6 - 36b_y^2 t^5 + 54b_y^2 t^4 - 36b_y^2 t^3 + 9b_y^2 t^2 - 18b_y c_y t^6 + 54b_y c_y t^5 - \\ & 54b_y c_y t^4 + 18b_y c_y t^3 + 6b_y d_y t^6 - 12b_y d_y t^5 + 6b_y d_y t^4 - 6b_y t^3 u_2 + 12b_y t^2 u_2 - 6b_y t u_2 + \\ & 9c_y^2 t^6 - 18c_y^2 t^5 + 9c_y^2 t^4 - 6c_y d_y t^6 + 6c_y d_y t^5 + 6c_y t^3 u_2 - 6c_y t^2 u_2 + d_y^2 t^6 - 2d_y t^3 u_2 + u_2^2 \end{aligned}$$

Para achar minimos, derivar a funcao da distancia e igualar a zero:

$$\begin{aligned} & 6t^5(a_x^2 - 6a_x b_x + 6a_x c_x - 2a_x d_x + 9b_x^2 - 18b_x c_x + 6b_x d_x + 9c_x^2 - 6c_x d_x + d_x^2) \\ & 5t^4(-6a_x^2 + 30a_x b_x - 24a_x c_x + 6a_x d_x - 36b_x^2 + 54b_x c_x - 12b_x d_x - 18c_x^2 + 6c_x d_x) \\ & 4t^3(15a_x^2 - 60a_x b_x + 36a_x c_x - 6a_x d_x + 54b_x^2 - 54b_x c_x + 6b_x d_x + 9c_x^2) \\ & 3t^2(-20a_x^2 + 60a_x b_x - 24a_x c_x + 2a_x d_x + 2a_x u_1 - 36b_x^2 + 18b_x c_x - 6b_x u_1 + 6c_x u_1 - \\ & 2d_x u_1) \end{aligned}$$

$$\frac{2t(15a_x^2 - 30a_xb_x + 6a_xc_x - 6a_xu_1 + 9b_x^2 + 12b_xu_1 - 6c_xu_1)}{(-6a_x^2 + 6a_xb_x + 6a_xu_1 - 6b_xu_1)}$$