A Solution to the Three-bar-linkage Mechanism Problem Based on MATLAB

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I. Introduction

This project is aimed at solving a three-bar-linkage problem. In the problem, there are three bars connected head to tail one after another. The bar lengths and their initial positions are given. At then, link L1 started to rotate with an angular acceleration of 3 rad/s^2 . We are then asked to find the angular velocities and angular accelerations of the three links and sketch the diagram of them with the help of our computers.

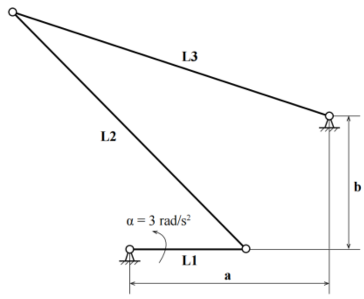

Figure 1 Diagram of the problem

II. Solutions

A. Link L1(solutions: $\boldsymbol{\omega_1 = (3t)\ rad/s^2, \alpha_1 = 3\ rad/s^2}$)

To solve this problem, I came out with the idea of relative-motion analysis in chapter 16.

$$\omega_1 = \alpha_1 \cdot t \quad \Rightarrow \quad \omega_1 = (3t)\ \mathrm{rad/s^2} \qquad (A-1)$$

$$V_A = V_O + \omega_1 \times r_{A/O} = \omega_1 \times r_{A/O} \quad \Rightarrow \quad V_A = V_A(t) \qquad (A-2)$$

Then, to find $r_{A/O}$, I set up an coordinate system with the origin point at O and calculated the coordinates of A, $(0.35\cos\theta, 0.35\sin\theta)$, in which $\theta = 1/2 \cdot \omega_1{}^2$.

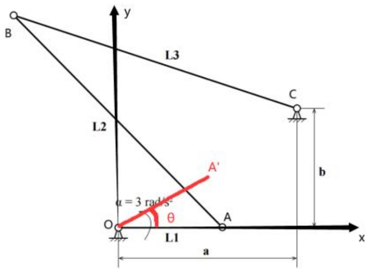

Figure 2 Set up an coordinate system

B. Link L2

After I've gotten all the information of point A(coordinates, angular velocity, linear velocity, angular acceleration), it's time to move on to solve the next point. Similarly, relative-motion analysis is applied.

$$V_B = V_A + \omega_2 \times r_{B/A} \quad \Rightarrow \quad V_B = V_B(t, \omega_2) \qquad (B-1)$$

But before that, we have to calculate the coordinates of point B. I assumed the coordinates to be (x,y), and calculated the explicit expression with the equation AB=BC=1m.

$$AB = AC = 1m \quad \Rightarrow \quad x = x(t), y = y(t) \qquad (B-2)$$

Here we need to pay attention to the solutions. Since it is binary quadratic equations, it can provide two roots. Explicit explanation is that we used the distance relation to find the coordinates of B, there exists two of them, and what we need to do is to choose the one with smaller x and larger y.

$$x = \min(\text{solutions}(x)), \qquad y = \max(\text{solutions}(y)) \qquad (B-3)$$

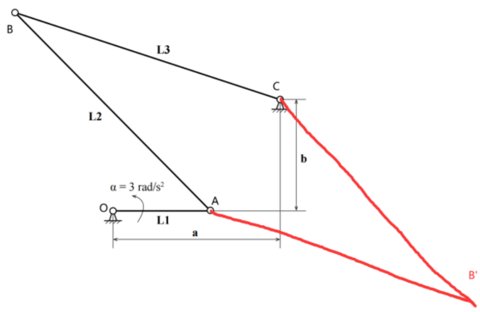

Figure 3 Two solutions of B(x,y)

C. *Link L3*

For link L3, I tried to solve it in an opposite direction.(i.e try to express the attributes of point B with symbols of point C).

$$\mathrm{V_B} = \mathrm{V_C} + \omega_3 \times \mathrm{r}_{B/C} = \omega_3 \times \mathrm{r_{B/C}} \;\Rightarrow\; \mathrm{V_B} = \mathrm{V_B}(\mathrm{t}, \omega_3) \qquad (\mathrm{C}-1)$$

Finally I equals two expressions of $\mathrm{V_B}$ and and solved these sets of equations with the help of MATLAB:

$$\begin{cases} \mathrm{V_{Bx}}(\mathrm{t}, \omega_2) = \mathrm{V_{Bx}}(\mathrm{t}, \omega_3) \\ \mathrm{V_{By}}(\mathrm{t}, \omega_2) = \mathrm{V_{By}}(\mathrm{t}, \omega_3) \end{cases} \Rightarrow \begin{cases} \omega_2 = \omega_2(\mathrm{t}) \\ \omega_3 = \omega_3(\mathrm{t}) \end{cases} \qquad (C-2)$$

As for the angular acceleration, a simple differentiating procedure is used.

$$\begin{cases} \alpha_1 = \dfrac{d(\omega_1)}{dt} = \alpha_1(t) \\ \alpha_2 = \dfrac{d(\omega_2)}{dt} = \alpha_2(t) \\ \alpha_3 = \dfrac{d(\omega_3)}{dt} = \alpha_3(t) \end{cases} \qquad (C-3)$$

III. Results

I draw the diagrams of the angular velocities and angular accelerations of the three bars separately, which are shown below.

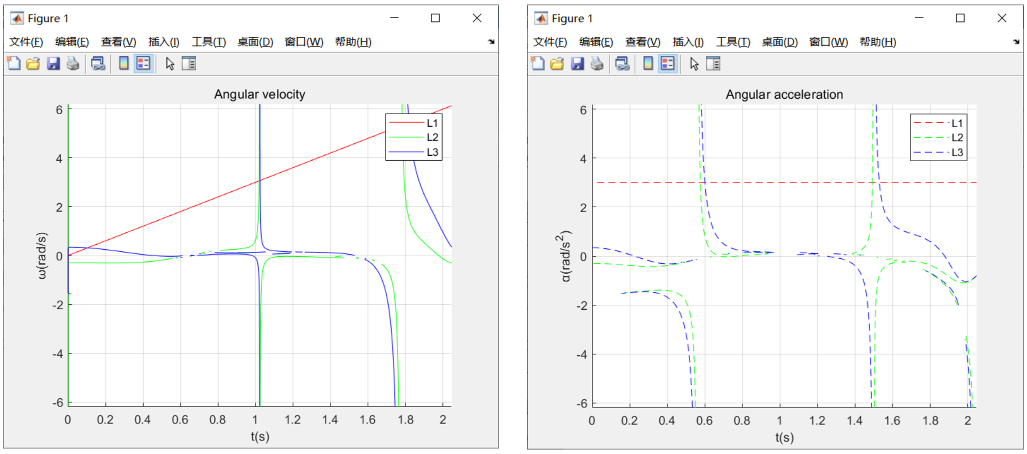

Figure 4 Angular velocity and angular acceleration of three bars

IV. Discussion

The diagram above may not be correct since there are isolated dashed lines there. But I cannot tell you whether or not it is wrong. I have to admire the strong calculating ability of computer, without it, I cannot even generate a single solution.

V. Appendix

A. Code

```
% Author Yuchen Song
% 2021-6-23 10:26
clc;clear;
syms t x y o2 o3; l1=0.35; l2=1; l3=1;
tmax = sqrt(4*pi/3); o1 = 3*t;
omega1 = [0, 0, o1]; omega2 = [0, 0, o2]; omega3 = [0, 0, o3];
theta = 1.5*t*t;
A = [l1*cos(theta), l1*sin(theta), 0];
rOA = A-0;
vA = cross(omega1, rOA);
B = [x, y, 0];
C = [0.6, 0.4, 0];
y = (0.17+(0.7*cos(theta)-1.2)*x)/(0.8-0.7*sin(theta));
x = solve(0.36+x*x-1.2*x+0.16+y*y-0.8*y==1);
x = x(2);
rAB = B-A; rBC = C-B;
vB1 = vA + cross(omega2, rAB);
vB2 = cross(omega3, rBC);
eqns2 = [vB1(1)==vB2(1), vB1(2)==vB2(2)];
vars2 = [o2, o3];
[o2, o3] = solve(eqns2, vars2);
alpha1 = 3+0*t; alpha2 = diff(o2, t); alpha3 = diff(o3, t);
alpha2 = subs(alpha2); alpha3 = subs(alpha3);
o2 = subs(o2); o3 = subs(o3);

%plotting
hold;
grid on;
span = [0,tmax];
po1 = ezplot(o1,span);
set(po1,'Color','r');
po2 = ezplot(o2,span);
set(po2,'Color','g');
po3 = ezplot(o3,span);
set(po3,'Color','b');

pa1 = ezplot(alpha1,span);
set(pa1,'linestyle','--','Color','r');
pa2 = ezplot(alpha2,span);
set(pa2,'linestyle','--','Color','g');
pa3 = ezplot(alpha3,span);
set(pa3,'linestyle','--','Color','b');
title('Angular velocity & acceleration');
xlabel('t(s)');
ylabel('ω(rad/s) or α(rad/s^2)');
legend('L1ω','L2ω','L3ω','L1α','L2α','L3α');
```

B. Variables

variables	value
$\omega_1(t)$	3*t
$\omega_2(t)$	(21*t*(6*tan((3*t^2)/4) + 2*tan((3*t^2)/4)^2 - (5*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) - (tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) + (5*tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) - 2))/(42*tan((3*t^2)/4) + 14*tan((3*t^2)/4)^2 + (25*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) - (7*tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) + (95*tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*tan((3*t^2)/4)^2*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) - 14)
$\omega_3(t)$	-(105*t*((x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100)/((7*sin((3*t^2)/2))/10 - 4/5) + (tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(5*(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208)) - (tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5)))/(42*tan((3*t^2)/4) + 14*tan((3*t^2)/4)^2 + (25*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) - (7*tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) + (95*tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*tan((3*t^2)/4)^2*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) - 14)
$\alpha_1(t)$	3
$\alpha_2(t)$	(21*(6*tan((3*t^2)/4) + 2*tan((3*t^2)/4)^2 - (5*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) - (tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) + (5*tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) - 2))/(42*tan((3*t^2)/4) + 14*tan((3*t^2)/4)^2 + (25*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) - (7*tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) + (95*tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*tan((3*t^2)/4)^2*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25

	+ 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) - 14) + (21*t*(9*t*(tan((3*t^2)/4)^2 + 1) + 6*t*tan((3*t^2)/4)*(tan((3*t^2)/4)^2 + 1) - (3*t*(tan((3*t^2)/4)^2 + 1)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(2*(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208)) + (15*t*tan((3*t^2)/4)*(tan((3*t^2)/4)^2 + 1)*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5)))/(42*tan((3*t^2)/4) + 14*tan((3*t^2)/4)^2 + (25*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) - (7*tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) + (95*tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*tan((3*t^2)/4)^2*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) - 14) - (21*t*(63*t*(tan((3*t^2)/4)^2 + 1) + 42*t*tan((3*t^2)/4)*(tan((3*t^2)/4)^2 + 1) - (21*t*(tan((3*t^2)/4)^2 + 1)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(2*(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208)) + (285*t*tan((3*t^2)/4)*(tan((3*t^2)/4)^2 + 1)*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (12*t*tan((3*t^2)/4)*(tan((3*t^2)/4)^2 + 1)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208))*(6*tan((3*t^2)/4) + 2*tan((3*t^2)/4)^2 - (5*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) - (tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) + (5*tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) - 2))/(42*tan((3*t^2)/4) + 14*tan((3*t^2)/4)^2 + (25*x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/4)/((7*sin((3*t^2)/2))/10 - 4/5) + (420*cos((3*t^2)/2) - 1344*sin((3*t^2)/2) + 1176*sin((3*t^2)/2)^2 + 160*((3136*cos((3*t^2)/2)^2)/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 + (4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 + 13231/25)^(1/2) - 140*sin((3*t^2)/2)*((3136*cos((3*t^2)/2)^2)/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 + (4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 + 13231/25)^(1/2) - 784*cos((3*t^2)/2)*sin((3*t^2)/2) + 816)/(49*cos((3*t^2)/2)^2 - 168*cos((3*t^2)/2) + 49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) + 208) - (7*tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((3136*cos((3*t^2)/2)^2)/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 + (4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((3136*cos((3*t^2)/2)^2)/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 + (4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*cos((3*t^2)/2)^2 - 168*cos((3*t^2)/2) + 49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) + 208) + (95*tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*tan((3*t^2)/4)^2*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((3136*cos((3*t^2)/2)^2)/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 + (4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((3136*cos((3*t^2)/2)^2)/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 + (4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*cos((3*t^2)/2)^2 - 168*cos((3*t^2)/2) + 49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) + 208) - 14)^2
$\alpha_3(t)$	(105*t*((x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100)/((7*sin((3*t^2)/2))/10 - 4/5) + (tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(5*(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208)) - (tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5))*(63*t*(tan((3*t^2)/4)^2 + 1) + 42*t*tan((3*t^2)/4)*(tan((3*t^2)/4)^2 + 1) - (21*t*(tan((3*t^2)/4)^2 + 1)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(2*(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208)) + (285*t*tan((3*t^2)/4)*(tan((3*t^2)/4)^2 + 1)*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (12*t*tan((3*t^2)/4)*(tan((3*t^2)/4)^2 + 1)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208)))/(42*tan((3*t^2)/4) + 14*tan((3*t^2)/4)^2 + (25*x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/4)/((7*sin((3*t^2)/2))/10 - 4/5) + (420*cos((3*t^2)/2) - 1344*sin((3*t^2)/2) + 1176*sin((3*t^2)/2)^2 + 160*((3136*cos((3*t^2)/2)^2)/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 + (4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 + 13231/25)^(1/2) -

	140*sin((3*t^2)/2)*((3136*cos((3*t^2)/2)^2)/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 + (4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 + 13231/25)^(1/2) - 784*cos((3*t^2)/2)*sin((3*t^2)/2) + 816)/(49*cos((3*t^2)/2)^2 - 168*cos((3*t^2)/2) + 49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) + 208) - (7*tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((3136*cos((3*t^2)/2)^2)/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 + (4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((3136*cos((3*t^2)/2)^2)/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 + (4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*cos((3*t^2)/2)^2 - 168*cos((3*t^2)/2) + 49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) + 208) + (95*tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*tan((3*t^2)/4)^2*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((3136*cos((3*t^2)/2)^2)/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 + (4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((3136*cos((3*t^2)/2)^2)/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 + (4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*cos((3*t^2)/2)^2 - 168*cos((3*t^2)/2) + 49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) + 208) - 14)^2 - (105*t*((3*t*(tan((3*t^2)/4)^2 + 1)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(10*(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208)) - (3*t*tan((3*t^2)/4)*(tan((3*t^2)/4)^2 + 1)*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5)))/(42*tan((3*t^2)/4) + 14*tan((3*t^2)/4)^2 + (25*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) - (7*tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) + (95*tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*tan((3*t^2)/4)^2*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) - 14) - (105*((x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100)/((7*sin((3*t^2)/2))/10 - 4/5) + (tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(5*(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208)) - (tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5)))/(42*tan((3*t^2)/4) + 14*tan((3*t^2)/4)^2 + (25*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) - (7*tan((3*t^2)/4)*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) + (95*tan((3*t^2)/4)^2*(x*((7*cos((3*t^2)/2))/10 - 6/5) + 17/100))/((7*sin((3*t^2)/2))/10 - 4/5) + (4*tan((3*t^2)/4)^2*(105*cos((3*t^2)/2) - 336*sin((3*t^2)/2) + 294*sin((3*t^2)/2)^2 + 40*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 35*sin((3*t^2)/2)*((4116*sin((3*t^2)/2)^2)/25 - (6328*sin((3*t^2)/2))/25 - (9492*cos((3*t^2)/2))/25 - (2352*cos((3*t^2)/2)*sin((3*t^2)/2))/25 + (3136*cos((3*t^2)/2)^2)/25 + 13231/25)^(1/2) - 196*cos((3*t^2)/2)*sin((3*t^2)/2) + 204))/(49*sin((3*t^2)/2)^2 - 112*sin((3*t^2)/2) - 168*cos((3*t^2)/2) + 49*cos((3*t^2)/2)^2 + 208) - 14)