```
clc

%1a
clear
gab= [0.528383,  0.758351, -0.381725, 3.32152;
    -0.150539,  0.526175,  0.836945, 3.00205;
    0.835553, -0.384763,  0.392184, 2.63034;
    0, 0, 0, 1];
Tb = [-3;5;-1;-4;2;3];
Rab = gab(1:3,1:3);
pab = gab(1:3,4);
pab_hat = hat(pab(1), pab(2), pab(3));
Adgab = [Rab, pab_hat*Rab ; zeros(3), Rab];
Ta = Adgab* Tb %twist in frame A
%1b
wb = [4; -3; 5; -1; 3; 2 ];
wa = inv(transpose(Adgab))* wb %Wrench in frame A


Ta =

  -17.1795
    7.4128
   14.2422
   -1.7420
    4.1653
   -2.9352


wa =

   -2.0702
    2.0040
    6.4574
   15.0974
  -23.4907
   11.6657


%2
clear
syms l0 l1 theta1 theta2 theta3
w(7:9)= [0; l1/sqrt((l0*l0)+(l1*l1)); l0/sqrt((l0*l0)+(l1*l1))];
q(1:3) = [0;0;l0];
q(4:6) =[0;0;l0];
q(7:9)= [0;0;0];
w(1:3)= [0;0;1];w(4:6)= [-1;0;0];
z=[];
for i =1:3:9
    z = [z, cross(-w(i: i+2),q(i: i+2)), w(i: i+2)];
end
z1 = z(1:6)'
z2 = transpose(z(7:12))
```

```
z3 = transpose(z(13:18))
%position
p_0 = [0;l1;l0]
%Reference Configuration
gst_0 = [eye(3), p_0; 0,0,0, 1]
z1_hat = [hat(z1(4),z1(5),z1(6)), z1(1:3); 0,0,0,1];
z2_hat = [hat(z2(4),z2(5),z2(6)), z2(1:3); 0,0,0,1];
z3_hat = [hat(z3(4),z3(5),z3(6)), z3(1:3); 0,0,0,1];
%orientation
gst_theta =
 expm(z1_hat*theta1)*expm(z2_hat*theta2)*expm(z3_hat*theta3)*gst_0


z1 =

 0
 0
 0
 0
 0
 1


z2 =

   0
 -l0
   0
  -1
   0
   0


z3 =

                      0
                      0
                      0
                      0
 l1/(l0^2 + l1^2)^(1/2)
 l0/(l0^2 + l1^2)^(1/2)


p_0 =

  0
 l1
 l0


gst_0 =

[ 1, 0, 0,  0]
[ 0, 1, 0, l1]
```

```
[ 0, 0, 1, l0]
[ 0, 0, 0,  1]


gst_theta =

[ (exp(-theta1*1i)/2 + exp(theta1*1i)/2)*(exp(-theta3*1i)/2 +
 exp(theta3*1i)/2) - ((l0*exp(-theta3*1i)*(l0^2 + l1^2)^(1/2)*1i
 - l0*exp(theta3*1i)*(l0^2 + l1^2)^(1/2)*1i)*(exp(-theta2*1i)/2 +
 exp(theta2*1i)/2)*((exp(-theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2))/
(2*(l0^2 + l1^2)) + ((l1*exp(-theta3*1i)*(l0^2 + l1^2)^(1/2)*1i
 - l1*exp(theta3*1i)*(l0^2 + l1^2)^(1/2)*1i)*((exp(-
theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2)*((exp(-theta2*1i)*1i)/2
 - (exp(theta2*1i)*1i)/2))/(2*(l0^2 + l1^2)), - ((l0*exp(-
theta3*1i) - l0*exp(theta3*1i))*(exp(-theta1*1i)/2 +
 exp(theta1*1i)/2)*1i)/(2*(l0^2 + l1^2)^(1/2)) - ((exp(-
theta2*1i)/2 + exp(theta2*1i)/2)*((exp(-theta1*1i)*1i)/2 -
 (exp(theta1*1i)*1i)/2)*(l0^2*exp(-theta3*1i) + l0^2*exp(theta3*1i)
 + 2*l1^2))/(2*(l0^2 + l1^2)) + (((exp(-theta1*1i)*1i)/2
 - (exp(theta1*1i)*1i)/2)*((exp(-theta2*1i)*1i)/2 -
 (exp(theta2*1i)*1i)/2)*(- 2*l0*l1 + l0*l1*exp(-theta3*1i)
 + l0*l1*exp(theta3*1i)))/(2*(l0^2 + l1^2)), ((l1*exp(-
theta3*1i) - l1*exp(theta3*1i))*(exp(-theta1*1i)/2 +
 exp(theta1*1i)/2)*1i)/(2*(l0^2 + l1^2)^(1/2)) - (((exp(-
theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2)*((exp(-theta2*1i)*1i)/2 -
 (exp(theta2*1i)*1i)/2)*(l1^2*exp(-theta3*1i) + l1^2*exp(theta3*1i)
 + 2*l0^2))/(2*(l0^2 + l1^2)) + ((exp(-theta2*1i)/2 +
 exp(theta2*1i)/2)*((exp(-theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2)*(-
 2*l0*l1 + l0*l1*exp(-theta3*1i) + l0*l1*exp(theta3*1i)))/(2*(l0^2
 + l1^2)), - l1*(((l0*exp(-theta3*1i) - l0*exp(theta3*1i))*(exp(-
theta1*1i)/2 + exp(theta1*1i)/2)*1i)/(2*(l0^2 + l1^2)^(1/2))
 + ((exp(-theta2*1i)/2 + exp(theta2*1i)/2)*((exp(-
theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2)*(l0^2*exp(-
theta3*1i) + l0^2*exp(theta3*1i) + 2*l1^2))/(2*(l0^2 + l1^2))
 - (((exp(-theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2)*((exp(-
theta2*1i)*1i)/2 - (exp(theta2*1i)*1i)/2)*(- 2*l0*l1 +
 l0*l1*exp(-theta3*1i) + l0*l1*exp(theta3*1i)))/(2*(l0^2 +
 l1^2))) + l0*(((l1*exp(-theta3*1i) - l1*exp(theta3*1i))*(exp(-
theta1*1i)/2 + exp(theta1*1i)/2)*1i)/(2*(l0^2 + l1^2)^(1/2))
 - (((exp(-theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2)*((exp(-
theta2*1i)*1i)/2 - (exp(theta2*1i)*1i)/2)*(l1^2*exp(-theta3*1i)
 + l1^2*exp(theta3*1i) + 2*l0^2))/(2*(l0^2 + l1^2)) + ((exp(-
theta2*1i)/2 + exp(theta2*1i)/2)*((exp(-theta1*1i)*1i)/2 -
 (exp(theta1*1i)*1i)/2)*(- 2*l0*l1 + l0*l1*exp(-theta3*1i) +
 l0*l1*exp(theta3*1i)))/(2*(l0^2 + l1^2))) - exp(theta3)*((exp(-
theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2)*(l0*exp(-theta2*1i)*(1/4 -
 1i/4) + l0*exp(theta2*1i)*(1/4 + 1i/4) - (l0*exp(theta2))/2)]
[           (exp(-theta3*1i)/2 + exp(theta3*1i)/2)*((exp(-
theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2) + ((l0*exp(-
theta3*1i)*(l0^2 + l1^2)^(1/2)*1i - l0*exp(theta3*1i)*(l0^2 +
 l1^2)^(1/2)*1i)*(exp(-theta1*1i)/2 + exp(theta1*1i)/2)*(exp(-
theta2*1i)/2 + exp(theta2*1i)/2))/(2*(l0^2 + l1^2)) - ((l1*exp(-
theta3*1i)*(l0^2 + l1^2)^(1/2)*1i - l1*exp(theta3*1i)*(l0^2 +
 l1^2)^(1/2)*1i)*(exp(-theta1*1i)/2 + exp(theta1*1i)/2)*((exp(-
```

```
theta2*1i)*1i)/2 - (exp(theta2*1i)*1i)/2))/(2*(l0^2 + l1^2)),
           - ((l0*exp(-theta3*1i) - l0*exp(theta3*1i))*((exp(-
theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2)*1i)/(2*(l0^2 + l1^2)^(1/2))
 + ((exp(-theta1*1i)/2 + exp(theta1*1i)/2)*(exp(-theta2*1i)/2 +
 exp(theta2*1i)/2)*(l0^2*exp(-theta3*1i) + l0^2*exp(theta3*1i)
 + 2*l1^2))/(2*(l0^2 + l1^2)) - ((exp(-theta1*1i)/2 +
 exp(theta1*1i)/2)*((exp(-theta2*1i)*1i)/2 - (exp(theta2*1i)*1i)/2)*(-
 2*l0*l1 + l0*l1*exp(-theta3*1i) + l0*l1*exp(theta3*1i)))/(2*(l0^2 +
 l1^2)),           ((l1*exp(-theta3*1i) - l1*exp(theta3*1i))*((exp(-
theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2)*1i)/(2*(l0^2 +
 l1^2)^(1/2)) + ((exp(-theta1*1i)/2 + exp(theta1*1i)/2)*((exp(-
theta2*1i)*1i)/2 - (exp(theta2*1i)*1i)/2)*(l1^2*exp(-
theta3*1i) + l1^2*exp(theta3*1i) + 2*l0^2))/(2*(l0^2 + l1^2))
 - ((exp(-theta1*1i)/2 + exp(theta1*1i)/2)*(exp(-theta2*1i)/2
 + exp(theta2*1i)/2)*(- 2*l0*l1 + l0*l1*exp(-theta3*1i) +
 l0*l1*exp(theta3*1i)))/(2*(l0^2 + l1^2)),
         - l1*(((l0*exp(-theta3*1i) - l0*exp(theta3*1i))*((exp(-
theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2)*1i)/(2*(l0^2 + l1^2)^(1/2))
 - ((exp(-theta1*1i)/2 + exp(theta1*1i)/2)*(exp(-theta2*1i)/2 +
 exp(theta2*1i)/2)*(l0^2*exp(-theta3*1i) + l0^2*exp(theta3*1i)
 + 2*l1^2))/(2*(l0^2 + l1^2)) + ((exp(-theta1*1i)/2 +
 exp(theta1*1i)/2)*((exp(-theta2*1i)*1i)/2 - (exp(theta2*1i)*1i)/2)*(-
 2*l0*l1 + l0*l1*exp(-theta3*1i) + l0*l1*exp(theta3*1i)))/(2*(l0^2
 + l1^2))) + l0*(((l1*exp(-theta3*1i) - l1*exp(theta3*1i))*((exp(-
theta1*1i)*1i)/2 - (exp(theta1*1i)*1i)/2)*1i)/(2*(l0^2 + l1^2)^(1/2))
 + ((exp(-theta1*1i)/2 + exp(theta1*1i)/2)*((exp(-theta2*1i)*1i)/2 -
 (exp(theta2*1i)*1i)/2)*(l1^2*exp(-theta3*1i) + l1^2*exp(theta3*1i)
 + 2*l0^2))/(2*(l0^2 + l1^2)) - ((exp(-theta1*1i)/2 +
 exp(theta1*1i)/2)*(exp(-theta2*1i)/2 + exp(theta2*1i)/2)*(- 2*l0*l1
 + l0*l1*exp(-theta3*1i) + l0*l1*exp(theta3*1i)))/(2*(l0^2 + l1^2)))
 + exp(theta3)*(exp(-theta1*1i)/2 + exp(theta1*1i)/2)*(l0*exp(-
theta2*1i)*(1/4 - 1i/4) + l0*exp(theta2*1i)*(1/4 + 1i/4) -
 (l0*exp(theta2))/2)]
[

                                                    - ((l1*exp(-
theta3*1i)*(l0^2 + l1^2)^(1/2)*1i - l1*exp(theta3*1i)*(l0^2
 + l1^2)^(1/2)*1i)*(exp(-theta2*1i)/2 + exp(theta2*1i)/2))/
(2*(l0^2 + l1^2)) - ((l0*exp(-theta3*1i)*(l0^2 + l1^2)^(1/2)*1i -
 l0*exp(theta3*1i)*(l0^2 + l1^2)^(1/2)*1i)*((exp(-theta2*1i)*1i)/2
 - (exp(theta2*1i)*1i)/2))/(2*(l0^2 + l1^2)),



 - (((exp(-theta2*1i)*1i)/2 - (exp(theta2*1i)*1i)/2)*(l0^2*exp(-
theta3*1i) + l0^2*exp(theta3*1i) + 2*l1^2))/(2*(l0^2 + l1^2)) -
 ((exp(-theta2*1i)/2 + exp(theta2*1i)/2)*(- 2*l0*l1 + l0*l1*exp(-
theta3*1i) + l0*l1*exp(theta3*1i)))/(2*(l0^2 + l1^2)),



    ((exp(-theta2*1i)/2 + exp(theta2*1i)/2)*(l1^2*exp(-theta3*1i)
 + l1^2*exp(theta3*1i) + 2*l0^2))/(2*(l0^2 + l1^2)) + (((exp(-
theta2*1i)*1i)/2 - (exp(theta2*1i)*1i)/2)*(- 2*l0*l1 + l0*l1*exp(-
```

```
theta3*1i) + l0*l1*exp(theta3*1i)))/(2*(l0^2 + l1^2)),

                                    - exp(theta3)*(l0*exp(-theta2*1i)*(1/4
 + 1i/4) + l0*exp(theta2*1i)*(1/4 - 1i/4) - (l0*exp(theta2))/2) +
 l0*(((exp(-theta2*1i)/2 + exp(theta2*1i)/2)*(l1^2*exp(-theta3*1i)
 + l1^2*exp(theta3*1i) + 2*l0^2))/(2*(l0^2 + l1^2)) + (((exp(-
theta2*1i)*1i)/2 - (exp(theta2*1i)*1i)/2)*(- 2*l0*l1 + l0*l1*exp(-
theta3*1i) + l0*l1*exp(theta3*1i)))/(2*(l0^2 + l1^2))) - l1*((((exp(-
theta2*1i)*1i)/2 - (exp(theta2*1i)*1i)/2)*(l0^2*exp(-theta3*1i)
 + l0^2*exp(theta3*1i) + 2*l1^2))/(2*(l0^2 + l1^2)) + ((exp(-
theta2*1i)/2 + exp(theta2*1i)/2)*(- 2*l0*l1 + l0*l1*exp(-theta3*1i) +
 l0*l1*exp(theta3*1i)))/(2*(l0^2 + l1^2)))]
[

                                                                    0,

                                            0,

          0,

 exp(theta1)*exp(theta2)*exp(theta3)]
```

```
%3
clear
syms l1 l2
q(4:6) =[0;0;-l2];
q(7:9)= [0;0;0];
q(1:3) = [0,0,0];
w(1:3)= [0;0;1];w(4:6)= [0;-1;0]; w(7:9)=[0;-1;0];
z=[];
for i =1:3:9
    z = [z, cross(-w(i: i+2),q(i: i+2)), w(i: i+2)];
end
z1 = z(1:6)'
z2 = transpose(z(7:12))
z3 = z(13:18)'
p_0 = [0;0;0]
gst_0 = [eye(3), p_0; 0,0,0, 1]
z1_hat = [hat(z1(4),z1(5),z1(6)), z1(1:3); 0,0,0,1];
z2_hat = [hat(z2(4),z2(5),z2(6)), z2(1:3); 0,0,0,1];
z3_hat = [hat(z3(4),z3(5),z3(6)), z3(1:3); 0,0,0,1];
gst_theta = expm(z1_hat)*expm(z2_hat)*expm(z3_hat)*gst_0
```

```
z1 =

 0
 0
 0
 0
 0
 1


z2 =

 -l2
   0
   0
   0
  -1
   0


z3 =

  0
  0
  0
  0
 -1
  0


p_0 =
```

```
     0
     0
     0


gst_0 =

     1     0     0     0
     0     1     0     0
     0     0     1     0
     0     0     0     1


gst_theta =

[ cos(1)^3 - cos(1)*sin(1)^2, -sin(1),  -2*cos(1)^2*sin(1), -
cos(1)*exp(1)*((l2*exp(1))/2 - (l2*cos(1))/2 + (l2*sin(1))/2)]
[ cos(1)^2*sin(1) - sin(1)^3,  cos(1),  -2*cos(1)*sin(1)^2, -
exp(1)*sin(1)*((l2*exp(1))/2 - (l2*cos(1))/2 + (l2*sin(1))/2)]
[           2*cos(1)*sin(1),       0, cos(1)^2 - sin(1)^2,
 exp(1)*((l2*cos(1))/2 - (l2*exp(1))/2 + (l2*sin(1))/2)]
[                         0,       0,                   0,
                                                 exp(3)]


%4)

%5)
clear
syms l1 l2 l3 D th1 th2 th3 th4 th5 th6
q(7:9)= [0;l1;0];
q(10:12)= [0;0;D];
q(13:15)= [0;l1+l2;D];
q(16:18)= [0;0;D];
q(1:3) = [0,0,0];
q(4:6) =[0;0;0];
w(1:3) = [0;0;1];
w(4:6) = [1;0;0];
w(7:9) = [1;0;0];
w(10:12) = [0;1;0];
w(13:15) = [1;0;0];
w(16:18) = [0;1;0];
z=[];
for i =1:3:18
    z = [z, cross(-w(i: i+2),q(i: i+2)), w(i: i+2)];
end
z1 = z(1:6)'
z2 = transpose(z(7:12))
z3 = z(13:18)'
z4 = z(19:24)'
z5 = transpose(z(25:30))
z6 = z(31:36)'
 p_0 = [0;l1+l2+l3;D]
gst_0 = [eye(3), p_0; 0,0,0,1]
```

```
z1_hat = [hat(z1(4),z1(5),z1(6)), z1(1:3); 0,0,0,1];
z2_hat = [hat(z2(4),z2(5),z2(6)), z2(1:3); 0,0,0,1];
z3_hat = [hat(z3(4),z3(5),z3(6)), z3(1:3); 0,0,0,1];
z4_hat = [hat(z4(4),z4(5),z4(6)), z4(1:3); 0,0,0,1];
z5_hat = [hat(z5(4),z5(5),z5(6)), z5(1:3); 0,0,0,1];
z6_hat = [hat(z6(4),z6(5),z6(6)), z6(1:3); 0,0,0,1];
gst_theta =
 expm(z1_hat*th1)*expm(z2_hat*th2)*expm(z3_hat*th3)*expm(z4_hat*th4)*expm(z5_hat*t


z1 =

 0
 0
 0
 0
 0
 1


z2 =

 0
 0
 0
 1
 0
 0


z3 =

         0
         0
 -conj(l1)
         1
         0
         0


z4 =

 -conj(D)
        0
        0
        0
        1
        0


z5 =

         0
         D
```

```
 - l1 - l2
        1
        0
        0


z6 =

 -conj(D)
       0
       0
       0
       1
       0


p_0 =

           0
 l1 + l2 + l3
           D


gst_0 =

[ 1, 0, 0,            0]
[ 0, 1, 0, l1 + l2 + l3]
[ 0, 0, 1,            D]
[ 0, 0, 0,            1]


gst_theta =

[ - ((((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)
 + (exp(-th1*1i)/2 + exp(th1*1i)/2)*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2)
 + ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2 +
 exp(th3*1i)/2)*((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)
 - ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2
 - (exp(th3*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 -
 (exp(th5*1i)*1i)/2))*((exp(-th6*1i)*1i)/2 - (exp(th6*1i)*1i)/2)
 - (((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-th1*1i)*1i)/2
 - (exp(th1*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th2*1i)*1i)/2 -
 (exp(th2*1i)*1i)/2))*((exp(-th4*1i)*1i)/2 - (exp(th4*1i)*1i)/2)
 - (exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th4*1i)/2 +
 exp(th4*1i)/2))*(exp(-th6*1i)/2 + exp(th6*1i)/2), (((exp(-th2*1i)/2
 + exp(th2*1i)/2)*((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-
```

```
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 +
 exp(th3*1i)/2)*((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 +
 exp(th4*1i)/2) + (exp(-th1*1i)/2 + exp(th1*1i)/2)*((exp(-
th4*1i)*1i)/2 - (exp(th4*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 -
 (exp(th5*1i)*1i)/2) - ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-
th3*1i)/2 + exp(th3*1i)/2)*((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)
 - ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2
 - (exp(th3*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2),
 ((((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-th1*1i)*1i)/2
 - (exp(th1*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)
 + (exp(-th1*1i)/2 + exp(th1*1i)/2)*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2)
 + ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2 +
 exp(th3*1i)/2)*((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)
 - ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2
 - (exp(th3*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 -
 (exp(th5*1i)*1i)/2))*(exp(-th6*1i)/2 + exp(th6*1i)/2) -
 (((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-th1*1i)*1i)/2 -
 (exp(th1*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2)
 + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-th1*1i)*1i)/2
 - (exp(th1*1i)*1i)/2)*((exp(-th2*1i)*1i)/2 -
 (exp(th2*1i)*1i)/2))*((exp(-th4*1i)*1i)/2 - (exp(th4*1i)*1i)/2)
 - (exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th4*1i)/2 +
 exp(th4*1i)/2))*((exp(-th6*1i)*1i)/2 - (exp(th6*1i)*1i)/2),
 exp(th6)*((((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)
 + (exp(-th1*1i)/2 + exp(th1*1i)/2)*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2))*(l1*exp(-th5*1i)*(1/4 - 1i/4) +
 l1*exp(th5*1i)*(1/4 + 1i/4) + l2*exp(-th5*1i)*(1/4 - 1i/4) +
 l2*exp(th5*1i)*(1/4 + 1i/4) + (D*exp(th5))/2 - (l1*exp(th5))/2 -
 (l2*exp(th5))/2 - D*exp(-th5*1i)*(1/4 + 1i/4) - D*exp(th5*1i)*(1/4
 - 1i/4)) + ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2
 + exp(th3*1i)/2)*((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)
 - ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2
 - (exp(th3*1i)*1i)/2))*(l1*exp(-th5*1i)*(1/4 + 1i/4) +
 l1*exp(th5*1i)*(1/4 - 1i/4) + l2*exp(-th5*1i)*(1/4 + 1i/4) +
 l2*exp(th5*1i)*(1/4 - 1i/4) - (D*exp(th5))/2 - (l1*exp(th5))/2 -
 (l2*exp(th5))/2 + D*exp(-th5*1i)*(1/4 - 1i/4) + D*exp(th5*1i)*(1/4 +
 1i/4)) + exp(th5)*(exp(th4)*((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*(exp(-th3*1i)*conj(l1)*(1/4
 + 1i/4) - (exp(th3)*conj(l1))/2 + exp(th3*1i)*conj(l1)*(1/4
 - 1i/4)) + ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*(exp(-th3*1i)*conj(l1)*(1/4
 - 1i/4) - (exp(th3)*conj(l1))/2 + exp(th3*1i)*conj(l1)*(1/4
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 + 1i/4))) - ((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th2*1i)*1i)/2 -
 (exp(th2*1i)*1i)/2))*(exp(-th4*1i)*conj(D)*(1/4 + 1i/4) +
 exp(th4*1i)*conj(D)*(1/4 - 1i/4) - (exp(th4)*conj(D))/2) + (exp(-
th1*1i)/2 + exp(th1*1i)/2)*(exp(-th4*1i)*conj(D)*(1/4 - 1i/4)
 + exp(th4*1i)*conj(D)*(1/4 + 1i/4) - (exp(th4)*conj(D))/2)))
 + ((((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)
 + (exp(-th1*1i)/2 + exp(th1*1i)/2)*((exp(-th4*1i)*1i)/2 -
 (exp(th4*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 - (exp(th5*1i)*1i)/2)
 - ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2 +
 exp(th3*1i)/2)*((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)
 - ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2))*(l1
 + l2 + l3) - ((((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)
 + (exp(-th1*1i)/2 + exp(th1*1i)/2)*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2)
 + ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2 +
 exp(th3*1i)/2)*((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)
 - ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2
 - (exp(th3*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 -
 (exp(th5*1i)*1i)/2))*(exp(-th6*1i)*conj(D)*(1/4 + 1i/4) +
 exp(th6*1i)*conj(D)*(1/4 - 1i/4) - (exp(th6)*conj(D))/2)
 + D*(((((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)
 + (exp(-th1*1i)/2 + exp(th1*1i)/2)*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2)
 + ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2 +
 exp(th3*1i)/2)*((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)
 - ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2
 - (exp(th3*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 -
 (exp(th5*1i)*1i)/2))*(exp(-th6*1i)/2 + exp(th6*1i)/2) -
 (((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-th1*1i)*1i)/2
 - (exp(th1*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2))*((exp(-th4*1i)*1i)/2 -
 (exp(th4*1i)*1i)/2) - (exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-
th4*1i)/2 + exp(th4*1i)/2))*((exp(-th6*1i)*1i)/2 -
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 (exp(th6*1i)*1i)/2)) - (((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th2*1i)*1i)/2 -
 (exp(th2*1i)*1i)/2))*((exp(-th4*1i)*1i)/2 - (exp(th4*1i)*1i)/2)
 - (exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th4*1i)/2 +
 exp(th4*1i)/2))*(exp(-th6*1i)*conj(D)*(1/4 - 1i/4) +
 exp(th6*1i)*conj(D)*(1/4 + 1i/4) - (exp(th6)*conj(D))/2)]
[                                                 ((((exp(-th1*1i)/2
 + exp(th1*1i)/2)*(exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-th1*1i)/2 +
 exp(th1*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2) -
 ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2)
 + ((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 +
 exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2) - (exp(-th1*1i)/2
 + exp(th1*1i)/2)*((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 -
 (exp(th5*1i)*1i)/2))*((exp(-th6*1i)*1i)/2 - (exp(th6*1i)*1i)/2)
 + (((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 +
 exp(th2*1i)/2)*((exp(-th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-
th1*1i)/2 + exp(th1*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2))*((exp(-th4*1i)*1i)/2 -
 (exp(th4*1i)*1i)/2) + (exp(-th4*1i)/2 + exp(th4*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2))*(exp(-th6*1i)/2 +
 exp(th6*1i)/2),                                  - (((exp(-th1*1i)/2
 + exp(th1*1i)/2)*(exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-th1*1i)/2 +
 exp(th1*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2) -
 ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 - (exp(th5*1i)*1i)/2)
 + ((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 +
 exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2) - (exp(-th1*1i)/2
 + exp(th1*1i)/2)*((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2),
                                                - ((((exp(-th1*1i)/2
 + exp(th1*1i)/2)*(exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-th1*1i)/2 +
 exp(th1*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2) -
 ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2)
 + ((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 +
 exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2) - (exp(-th1*1i)/2
 + exp(th1*1i)/2)*((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 -
 (exp(th5*1i)*1i)/2))*(exp(-th6*1i)/2 + exp(th6*1i)/2) + (((exp(-
th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-th1*1i)/2 +
 exp(th1*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2))*((exp(-th4*1i)*1i)/2 -
 (exp(th4*1i)*1i)/2) + (exp(-th4*1i)/2 + exp(th4*1i)/2)*((exp(-
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th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2))*((exp(-th6*1i)*1i)/2 -
 (exp(th6*1i)*1i)/2),


        ((((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 +
 exp(th2*1i)/2)*((exp(-th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-
th1*1i)/2 + exp(th1*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)
 - ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2)
 + ((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 +
 exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2) - (exp(-th1*1i)/2
 + exp(th1*1i)/2)*((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*((exp(-th5*1i)*1i)/2
 - (exp(th5*1i)*1i)/2))*(exp(-th6*1i)*conj(D)*(1/4 + 1i/4)
 + exp(th6*1i)*conj(D)*(1/4 - 1i/4) - (exp(th6)*conj(D))/2)
 - ((((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 +
 exp(th2*1i)/2)*((exp(-th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-
th1*1i)/2 + exp(th1*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)
 - ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 - (exp(th5*1i)*1i)/2)
 - ((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 +
 exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2) - (exp(-th1*1i)/2
 + exp(th1*1i)/2)*((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*(exp(-th5*1i)/2 +
 exp(th5*1i)/2))*(l1 + l2 + l3) - exp(th6)*((((exp(-th1*1i)/2
 + exp(th1*1i)/2)*(exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-th1*1i)/2 +
 exp(th1*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2) -
 ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2))*(l1*exp(-th5*1i)*(1/4 - 1i/4) +
 l1*exp(th5*1i)*(1/4 + 1i/4) + l2*exp(-th5*1i)*(1/4 - 1i/4) +
 l2*exp(th5*1i)*(1/4 + 1i/4) + (D*exp(th5))/2 - (l1*exp(th5))/2 -
 (l2*exp(th5))/2 - D*exp(-th5*1i)*(1/4 + 1i/4) - D*exp(th5*1i)*(1/4
 - 1i/4)) + ((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 +
 exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2) - (exp(-th1*1i)/2
 + exp(th1*1i)/2)*((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*(l1*exp(-th5*1i)*(1/4 + 1i/4)
 + l1*exp(th5*1i)*(1/4 - 1i/4) + l2*exp(-th5*1i)*(1/4 + 1i/4) +
 l2*exp(th5*1i)*(1/4 - 1i/4) - (D*exp(th5))/2 - (l1*exp(th5))/2 -
 (l2*exp(th5))/2 + D*exp(-th5*1i)*(1/4 - 1i/4) + D*exp(th5*1i)*(1/4 +
 1i/4)) - exp(th5)*(((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2
 + exp(th2*1i)/2)*((exp(-th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-
th1*1i)/2 + exp(th1*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)*conj(D)*(1/4 +
 1i/4) + exp(th4*1i)*conj(D)*(1/4 - 1i/4) - (exp(th4)*conj(D))/2)
 - exp(th4)*((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2
 + exp(th2*1i)/2)*(exp(-th3*1i)*conj(l1)*(1/4 + 1i/4) -
 (exp(th3)*conj(l1))/2 + exp(th3*1i)*conj(l1)*(1/4 - 1i/4))
 + (exp(-th1*1i)/2 + exp(th1*1i)/2)*((exp(-th2*1i)*1i)/2 -
 (exp(th2*1i)*1i)/2)*(exp(-th3*1i)*conj(l1)*(1/4 - 1i/4) -
 (exp(th3)*conj(l1))/2 + exp(th3*1i)*conj(l1)*(1/4 + 1i/4))) + ((exp(-
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th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*(exp(-th4*1i)*conj(D)*(1/4 -
 1i/4) + exp(th4*1i)*conj(D)*(1/4 + 1i/4) - (exp(th4)*conj(D))/2)))
 - D*(((((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 +
 exp(th2*1i)/2)*((exp(-th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-
th1*1i)/2 + exp(th1*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)
 - ((exp(-th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2)*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2)
 + ((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 +
 exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2) - (exp(-th1*1i)/2
 + exp(th1*1i)/2)*((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 -
 (exp(th5*1i)*1i)/2))*(exp(-th6*1i)/2 + exp(th6*1i)/2) - (((exp(-
th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-th1*1i)/2 +
 exp(th1*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2))*((exp(-th4*1i)*1i)/2 - (exp(th4*1i)*1i)/2)
 + (exp(-th4*1i)/2 + exp(th4*1i)/2)*((exp(-th1*1i)*1i)/2 -
 (exp(th1*1i)*1i)/2))*((exp(-th6*1i)*1i)/2 - (exp(th6*1i)*1i)/2))
 + (((exp(-th1*1i)/2 + exp(th1*1i)/2)*(exp(-th2*1i)/2 +
 exp(th2*1i)/2)*((exp(-th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-
th1*1i)/2 + exp(th1*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2))*((exp(-th4*1i)*1i)/2 -
 (exp(th4*1i)*1i)/2) + (exp(-th4*1i)/2 + exp(th4*1i)/2)*((exp(-
th1*1i)*1i)/2 - (exp(th1*1i)*1i)/2))*(exp(-th6*1i)*conj(D)*(1/4 -
 1i/4) + exp(th6*1i)*conj(D)*(1/4 + 1i/4) - (exp(th6)*conj(D))/2)]
[

                ((exp(-th6*1i)*1i)/2 - (exp(th6*1i)*1i)/2)*(((exp(-
th2*1i)/2 + exp(th2*1i)/2)*((exp(-th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2)
 + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-th2*1i)*1i)/2 -
 (exp(th2*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 - (exp(th5*1i)*1i)/2) -
 ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)
 - ((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)*(exp(-th5*1i)/2
 + exp(th5*1i)/2)) - ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2
 + exp(th3*1i)/2) - ((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*(exp(-th6*1i)/2 +
 exp(th6*1i)/2)*((exp(-th4*1i)*1i)/2 - (exp(th4*1i)*1i)/2),

     ((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2)
 + ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)
 - ((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2
 - (exp(th3*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)*((exp(-
th5*1i)*1i)/2 - (exp(th5*1i)*1i)/2),
```

```
                              - (exp(-th6*1i)/2 + exp(th6*1i)/2)*(((exp(-
th2*1i)/2 + exp(th2*1i)/2)*((exp(-th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2)
 + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-th2*1i)*1i)/2 -
 (exp(th2*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 - (exp(th5*1i)*1i)/2) -
 ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)
 - ((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)*(exp(-th5*1i)/2
 + exp(th5*1i)/2)) - ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2
 + exp(th3*1i)/2) - ((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*((exp(-th4*1i)*1i)/2 -
 (exp(th4*1i)*1i)/2)*((exp(-th6*1i)*1i)/2 - (exp(th6*1i)*1i)/2),
```

```
              (((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-th3*1i)*1i)/2
 - (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2))*(exp(-th5*1i)/2 + exp(th5*1i)/2)
 + ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)
 - ((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2
 - (exp(th3*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)*((exp(-
th5*1i)*1i)/2 - (exp(th5*1i)*1i)/2))*(l1 + l2 + l3) - D*((exp(-
th6*1i)/2 + exp(th6*1i)/2)*(((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 +
 exp(th3*1i)/2)*((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2))*((exp(-
th5*1i)*1i)/2 - (exp(th5*1i)*1i)/2) - ((exp(-th2*1i)/2 +
 exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2) - ((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)*(exp(-th5*1i)/2
 + exp(th5*1i)/2)) + ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2
```

```
 + exp(th3*1i)/2) - ((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*((exp(-th4*1i)*1i)/2 -
 (exp(th4*1i)*1i)/2)*((exp(-th6*1i)*1i)/2 - (exp(th6*1i)*1i)/2)) -
 exp(th6)*(exp(th5)*(((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2
 + exp(th3*1i)/2) - ((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*(exp(-th4*1i)*conj(D)*(1/4 +
 1i/4) + exp(th4*1i)*conj(D)*(1/4 - 1i/4) - (exp(th4)*conj(D))/2)
 - exp(th4)*((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-
th3*1i)*conj(l1)*(1/4 - 1i/4) - (exp(th3)*conj(l1))/2 +
 exp(th3*1i)*conj(l1)*(1/4 + 1i/4)) - ((exp(-th2*1i)*1i)/2
 - (exp(th2*1i)*1i)/2)*(exp(-th3*1i)*conj(l1)*(1/4 + 1i/4) -
 (exp(th3)*conj(l1))/2 + exp(th3*1i)*conj(l1)*(1/4 - 1i/4))))
 + ((exp(-th2*1i)/2 + exp(th2*1i)/2)*((exp(-th3*1i)*1i)/2 -
 (exp(th3*1i)*1i)/2) + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-
th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2))*(l1*exp(-th5*1i)*(1/4 + 1i/4)
 + l1*exp(th5*1i)*(1/4 - 1i/4) + l2*exp(-th5*1i)*(1/4 + 1i/4) +
 l2*exp(th5*1i)*(1/4 - 1i/4) - (D*exp(th5))/2 - (l1*exp(th5))/2 -
 (l2*exp(th5))/2 + D*exp(-th5*1i)*(1/4 - 1i/4) + D*exp(th5*1i)*(1/4
 + 1i/4)) - ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2 +
 exp(th3*1i)/2) - ((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*(exp(-th4*1i)/2 +
 exp(th4*1i)/2)*(l1*exp(-th5*1i)*(1/4 - 1i/4) + l1*exp(th5*1i)*(1/4
 + 1i/4) + l2*exp(-th5*1i)*(1/4 - 1i/4) + l2*exp(th5*1i)*(1/4 +
 1i/4) + (D*exp(th5))/2 - (l1*exp(th5))/2 - (l2*exp(th5))/2 - D*exp(-
th5*1i)*(1/4 + 1i/4) - D*exp(th5*1i)*(1/4 - 1i/4))) + (((exp(-
th2*1i)/2 + exp(th2*1i)/2)*((exp(-th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2)
 + (exp(-th3*1i)/2 + exp(th3*1i)/2)*((exp(-th2*1i)*1i)/2 -
 (exp(th2*1i)*1i)/2))*((exp(-th5*1i)*1i)/2 - (exp(th5*1i)*1i)/2) -
 ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2 + exp(th3*1i)/2)
 - ((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-th3*1i)*1i)/2
 - (exp(th3*1i)*1i)/2))*(exp(-th4*1i)/2 + exp(th4*1i)/2)*(exp(-
th5*1i)/2 + exp(th5*1i)/2))*(exp(-th6*1i)*conj(D)*(1/4 + 1i/4)
 + exp(th6*1i)*conj(D)*(1/4 - 1i/4) - (exp(th6)*conj(D))/2)
 - ((exp(-th2*1i)/2 + exp(th2*1i)/2)*(exp(-th3*1i)/2 +
 exp(th3*1i)/2) - ((exp(-th2*1i)*1i)/2 - (exp(th2*1i)*1i)/2)*((exp(-
th3*1i)*1i)/2 - (exp(th3*1i)*1i)/2))*((exp(-th4*1i)*1i)/2
 - (exp(th4*1i)*1i)/2)*(exp(-th6*1i)*conj(D)*(1/4 - 1i/4) +
 exp(th6*1i)*conj(D)*(1/4 + 1i/4) - (exp(th6)*conj(D))/2)]
[
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0,

0,

0,

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exp(th1)*exp(th2)*exp(th3)*exp(th4)*exp(th5)*exp(th6)]
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