```matlab
% ECE 4560 - Homework 11.1
% Caitlyn Caggia

l1 = 1; l2 = 0.5; l3 = 0.25;
l = [l1;l2;l3];
a = [pi/3; pi/4; pi/12];
adot = [pi/12; pi/8; 0];

%part a
syms l1 l2 l3 a1 a2 a3;
a = [a1; a2; a3];
ge = [l1*cos(a(1)) + l2*cos(a(1)+a(2)) + l3*cos(a(1)+a(2)+a(3));
      l1*sin(a(1)) + l2*sin(a(1)+a(2)) + l3*sin(a(1)+a(2)+a(3));
      a(1) + a(2) + a(3)];
Jac = jacobian(ge, a)

%part b
adot = [pi/12; pi/8; 0];
l1 = 1; l2 = 0.5; l3 = 0.25;
a1 = pi/3; a2 = pi/4; a3 = pi/12;
J11 = - l2*sin(a1+a2) - l1*sin(a1) - l3*sin(a1+a2+a3);
J12 = - l2*sin(a1+a2) - l3*sin(a1+a2+a3);
J13 = -l3*sin(a1+a2+a3);
J21 = l2*cos(a1 + a2) + l1*cos(a1) + l3*cos(a1 + a2 + a3);
J22 = l2*cos(a1 + a2) + l3*cos(a1 + a2 + a3);
J23 = l3*cos(a1 + a2 + a3);
J31 = 1;
J32 = 1;
J33 = 1;
Jac = [J11 J12 J13; J21 J22 J23; J31 J32 J33];

v = Jac * adot
disp('theta (v(3)) is positive so CCW rotation')

%part c
ge = [l1*cos(a1) + l2*cos(a1+a2) + l3*cos(a1+a2+a3);
      l1*sin(a1) + l2*sin(a1+a2) + l3*sin(a1+a2+a3);
      a1 + a2 + a3];
gc = SE2([ge(1); ge(2)], ge(3));
planarR3_display([a1; a2; a3], [l1; l2; l3])
velocityPlot(gc, v)


Jac =

[ - l2*sin(a1 + a2) - l1*sin(a1) - l3*sin(a1 + a2 + a3), - l2*sin(a1 +
 a2) - l3*sin(a1 + a2 + a3), -l3*sin(a1 + a2 + a3)]
[   l2*cos(a1 + a2) + l1*cos(a1) + l3*cos(a1 + a2 + a3),   l2*cos(a1 +
 a2) + l3*cos(a1 + a2 + a3),  l3*cos(a1 + a2 + a3)]
[                                                    1,
                       1,                      1]
```
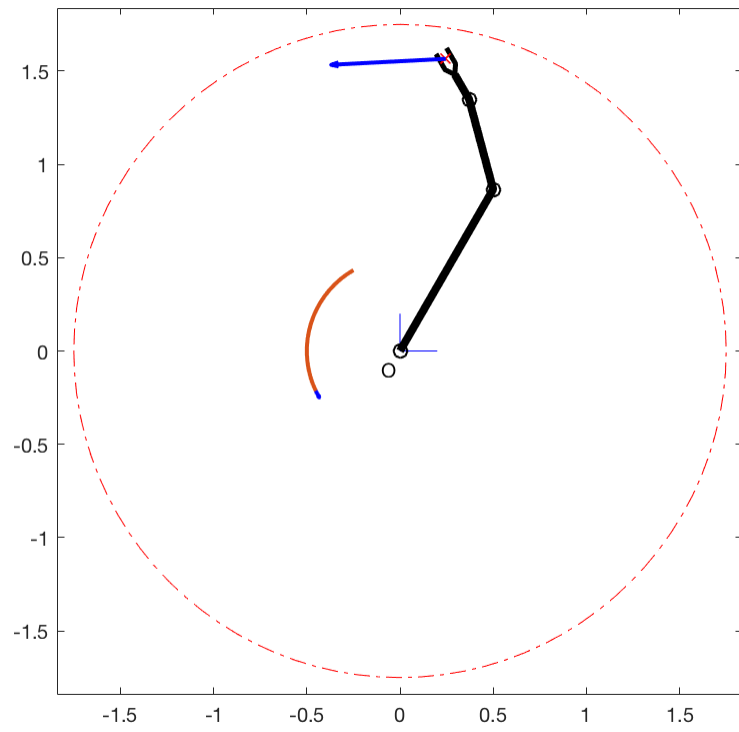
```
v =

   -0.6845
   -0.0356
    0.6545


theta (v(3)) is positive so CCW rotation
    AlignVertexCenters: 'off'
             Annotation: [1×1 matlab.graphics.eventdata.Annotation]
              AutoScale: 'off'
        AutoScaleFactor: 0.9000
           BeingDeleted: 'off'
             BusyAction: 'queue'
          ButtonDownFcn: ''
               Children: [0×0 GraphicsPlaceholder]
               Clipping: 'on'
                  Color: [0 0 1]
              CreateFcn: ''
              DeleteFcn: ''
            DisplayName: ''
       HandleVisibility: 'on'
                HitTest: 'on'
          Interruptible: 'on'
              LineStyle: '-'
              LineWidth: 2
                 Marker: 'none'
        MarkerEdgeColor: 'auto'
        MarkerFaceColor: 'none'
             MarkerSize: 6
            MaxHeadSize: 20
                 Parent: [1×1 Axes]
          PickableParts: 'visible'
               Selected: 'off'
     SelectionHighlight: 'on'
          ShowArrowHead: 'on'
                    Tag: ''
                   Type: 'quiver'
                  UData: 0.0192
            UDataSource: ''
          UIContextMenu: [0×0 GraphicsPlaceholder]
               UserData: []
                  VData: -0.0366
            VDataSource: ''
                Visible: 'on'
                  WData: []
            WDataSource: ''
                  XData: -0.4522
              XDataMode: 'manual'
            XDataSource: ''
                  YData: -0.2134
              YDataMode: 'manual'
            YDataSource: ''
                  ZData: []
```

`ZDataSource: ''`

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