Tapp 1.84: With a computer algebra system, implement the construction in the proof of Theorem 1.65 to graph a plane curve whose signed curvature function is:

(1) $\kappa(t)$ = -t

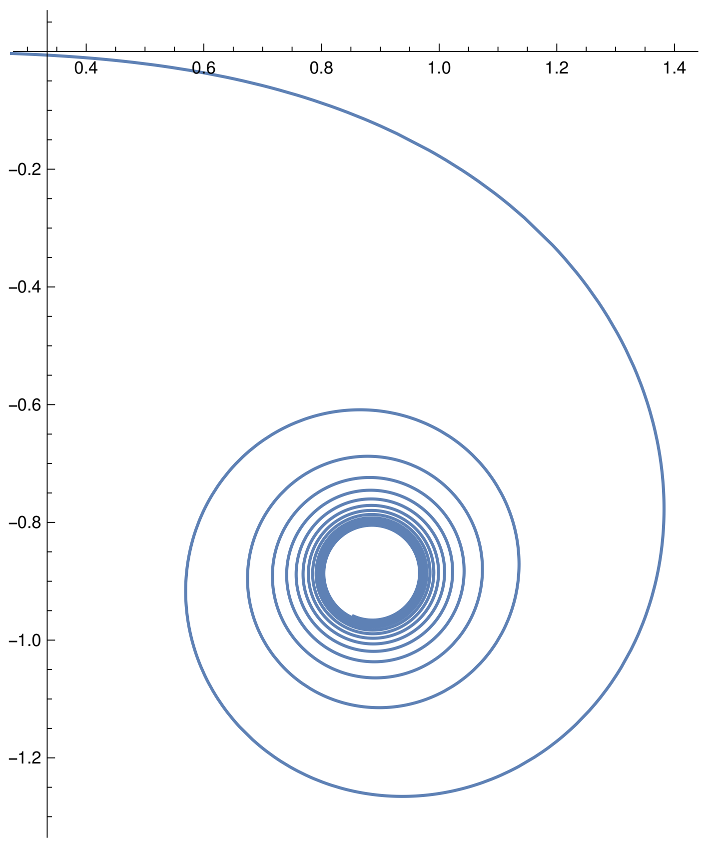
integrating κ give -(1.5)t^2

In[53]:=
```
θ[t_] := -0.5 * t^2
vx[t_] := Cos[θ[t]]
vy[t_] := Sin[θ[t]]

x[t_] := NIntegrate[vx[s], {s, 0, t}]
y[t_] := NIntegrate[vy[s], {s, 0, t}]
```

In[52]:=
```
ParametricPlot[
 {NIntegrate[vx[s], {s, 0, t}], NIntegrate[vy[s], {s, 0, t}]}, {t, 0, 4 π}]
```

Out[52]=



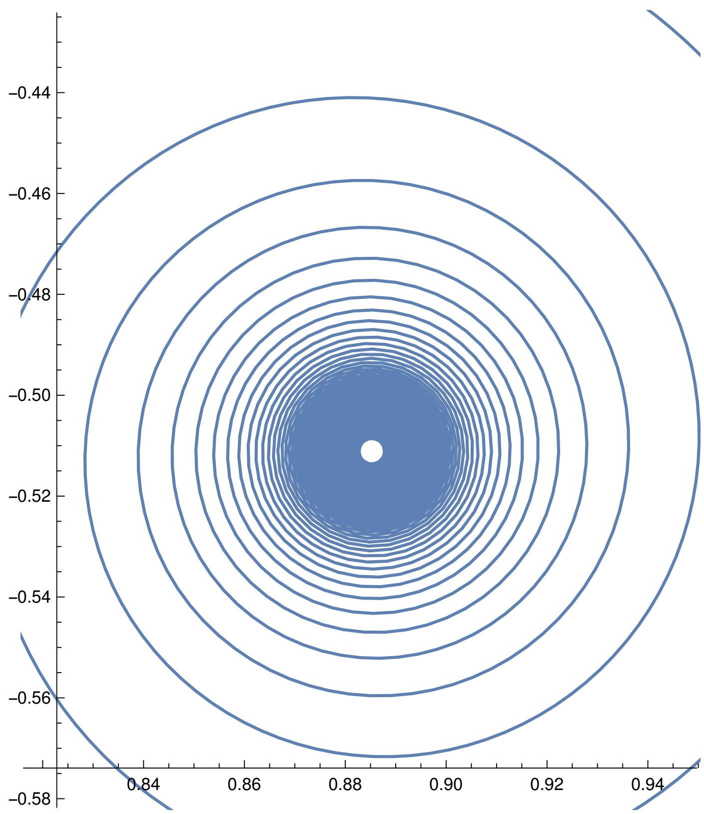
(2) $\kappa(t) = -2\,t^2$

Integrating κ gives -(2/3)t^3

In[8]:=
```
ClearAll[θ, vx, vy, x, y]
```

In[62]:=
```
θ[t_] := (-2 / 3) * t^3
vx[t_] := Cos[θ[t]]
vy[t_] := Sin[θ[t]]
ParametricPlot[
 {NIntegrate[vx[s], {s, 0, t}], NIntegrate[vy[s], {s, 0, t}]}, {t, 0, 4 π}]
```

Out[65]=



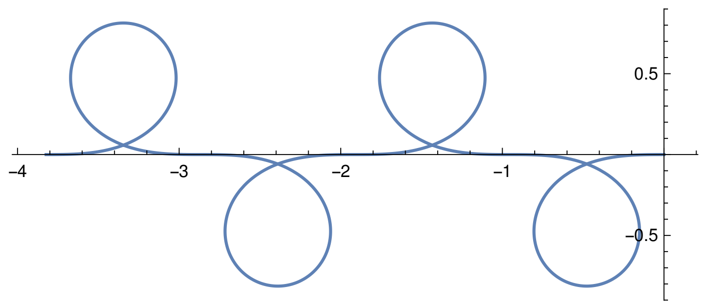
(3) κ(t) = c*sin(t) for several choices of c>0 and find a value of c for which the curve appears periodic

Integrating csin(t) gives -ccos(t)

```
ClearAll[θ, vx, vy, x, y]
c = π
θ[t_] := -c * Cos[t]
vx[t_] := Cos[θ[t]]
vy[t_] := Sin[θ[t]]
ParametricPlot[
 {NIntegrate[vx[s], {s, 0, t}], NIntegrate[vy[s], {s, 0, t}]}, {t, 0, 4 π}]
```

Out[75]= π

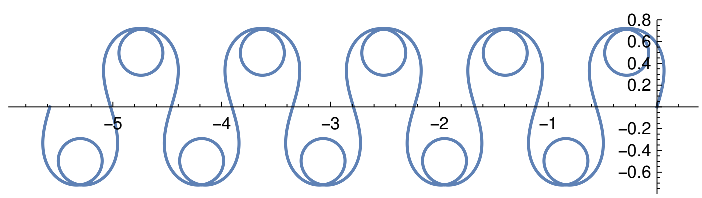
Out[79]=




```
In[112]:= ClearAll[θ, vx, vy, x, y]
c = 5
θ[t_] := -c * Cos[t]
vx[t_] := Cos[θ[t]]
vy[t_] := Sin[θ[t]]
ParametricPlot[
 {NIntegrate[vx[s], {s, 0, t}], NIntegrate[vy[s], {s, 0, t}]}, {t, 0, 10 π}]
```

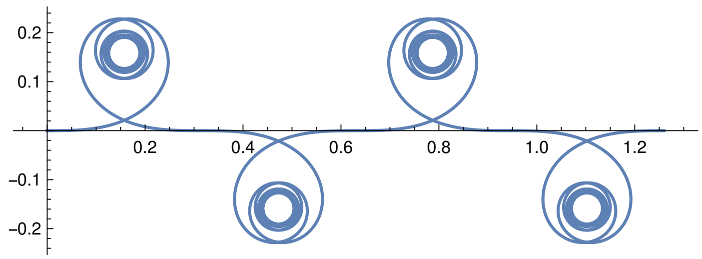
Out[113]= 5

Out[117]=



In[124]:=
```
ClearAll[θ, vx, vy, x, y]
c = 10 * π
θ[t_] := -c * Cos[t]
vx[t_] := Cos[θ[t]]
vy[t_] := Sin[θ[t]]
ParametricPlot[
 {NIntegrate[vx[s], {s, 0, t}], NIntegrate[vy[s], {s, 0, t}]}, {t, 0, 4 π}]
```

Out[125]= 10 π

Out[129]=


I’m not sure what is meant by a periodic curve. Each of these looks periodic (in the sense that it repeats in space) despite being different values and vastly different shapes. None of these curves appear closed.

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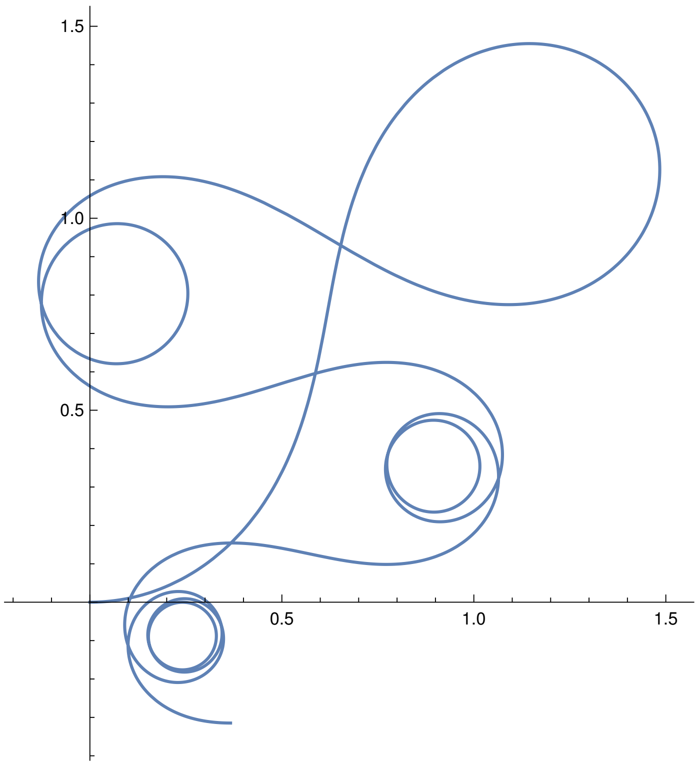
(4) $\kappa(t) = t * \sin(t)$

Integrating tsin (t) gives sin (t) + tcos (t)

In[92]:=
```
ClearAll[θ, vx, vy, x, y]
θ[t_] := Sin[t] + t * Cos[t]
vx[t_] := Cos[θ[t]]
vy[t_] := Sin[θ[t]]
ParametricPlot[
 {NIntegrate[vx[s], {s, 0, t}], NIntegrate[vy[s], {s, 0, t}]}, {t, 0, 4 π}]
```

Out[96]=



(5) $\kappa(t) = e^t$

integrating e^t gives e^t

In[107]:=
```
ClearAll[θ, vx, vy, x, y]
θ[t_] := Exp[t]
vx[t_] := Cos[θ[t]]
vy[t_] := Sin[θ[t]]
ParametricPlot[
 {NIntegrate[vx[s], {s, 0, t}], NIntegrate[vy[s], {s, 0, t}]}, {t, 0, 2 π}]
```

Out[111]=