

```

In[*]:= B[n_, i_] := Binomial[n, i] * (t^i) * (1 - t) ^ (n - i)
In[*]:= P = {{0, 0}, {2, -1}, {3, 3}, {-1, 4}, {-3, 0}, {-1, 0}}
n = Length[P] - 1
pl1 = Graphics[Line[P]];
c = Sum[P[[i + 1]] * B[n, i], {i, 0, n}]
pl2 = ParametricPlot[c, {t, 0, 1}];
Show[pl1, pl2]

```

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Out[*]=
{{0, 0}, {2, -1}, {3, 3}, {-1, 4}, {-3, 0}, {-1, 0}}

```

```

Out[*]=
5

```

```

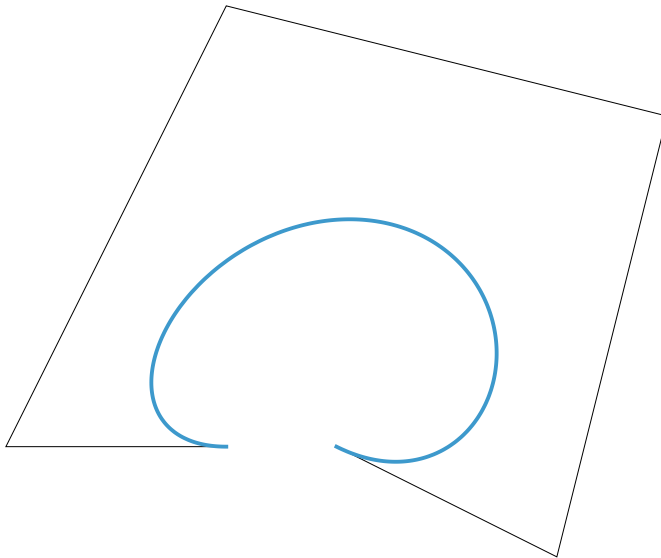
Out[*]=
{10 (1 - t)^4 t + 30 (1 - t)^3 t^2 - 10 (1 - t)^2 t^3 - 15 (1 - t) t^4 - t^5,
-5 (1 - t)^4 t + 30 (1 - t)^3 t^2 + 40 (1 - t)^2 t^3}

```

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Out[*]=

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In[*]:= A = {{Cos[α], -Sin[α]}, {Sin[α], Cos[α]}} /. {α → Pi / 6}
(*A={{4, -7},{7,4}}*)
p = {2, -4}

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Out[*]=
{{{\frac{\sqrt{3}}{2}, -\frac{1}{2}}, {\frac{1}{2}, \frac{\sqrt{3}}{2}}}}

```

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Out[*]=
{2, -4}

```

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In[*]:= MatrixForm[A]

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Out[*]//MatrixForm=
\left( \begin{array}{cc} \frac{\sqrt{3}}{2} & -\frac{1}{2} \\ \frac{1}{2} & \frac{\sqrt{3}}{2} \end{array} \right)

```

In[*]:= **t0 = 4 / 5**

Out[*]=

$$\frac{4}{5}$$

In[*]:= **kz = Simplify[Det[{D[c, t], D[c, {t, 2}]}] / Sqrt[(D[c, t].D[c, t])^3]
 kz0 = kz /. {t -> t0}**

Out[*]=

$$\frac{4 (9 - 60 t + 237 t^2 - 494 t^3 + 609 t^4 - 444 t^5 + 151 t^6)}{5 (5 - 56 t + 416 t^2 - 1600 t^3 + 3414 t^4 - 4088 t^5 + 2800 t^6 - 1168 t^7 + 281 t^8)^{3/2}}$$

Out[*]=

$$\frac{643\,012\,500}{882\,181 \sqrt{882\,181}}$$

In[*]:= **c1 = A.c + p**

Out[*]=

$$\left\{ 2 + \frac{1}{2} (5 (1-t)^4 t - 30 (1-t)^3 t^2 - 40 (1-t)^2 t^3) + \frac{1}{2} \sqrt{3} (10 (1-t)^4 t + 30 (1-t)^3 t^2 - 10 (1-t)^2 t^3 - 15 (1-t) t^4 - t^5), \right.$$

$$-4 + \frac{1}{2} \sqrt{3} (-5 (1-t)^4 t + 30 (1-t)^3 t^2 + 40 (1-t)^2 t^3) + \left. \frac{1}{2} (10 (1-t)^4 t + 30 (1-t)^3 t^2 - 10 (1-t)^2 t^3 - 15 (1-t) t^4 - t^5) \right\}$$

In[*]:= **P1 = Transpose[(A.Transpose[P])] + Table[p, {i, 1, Length[P]}]**

Out[*]=

$$\left\{ \{2, -4\}, \left\{ \frac{5}{2} + \sqrt{3}, -3 - \frac{\sqrt{3}}{2} \right\}, \left\{ \frac{1}{2} + \frac{3\sqrt{3}}{2}, -\frac{5}{2} + \frac{3\sqrt{3}}{2} \right\}, \right.$$

$$\left. \left\{ -\frac{\sqrt{3}}{2}, -\frac{9}{2} + 2\sqrt{3} \right\}, \left\{ 2 - \frac{3\sqrt{3}}{2}, -\frac{11}{2} \right\}, \left\{ 2 - \frac{\sqrt{3}}{2}, -\frac{9}{2} \right\} \right\}$$

In[*]:= **Together[c1 - Sum[P1[[i + 1]] * B[n, i], {i, 0, n}]**

Out[*]=

$$\{0, 0\}$$

In[*]:= **kz1 = Simplify[Det[{D[c1, t], D[c1, {t, 2}]}] / Sqrt[(D[c1, t].D[c1, t])^3]
 kz10 = kz1 /. {t -> t0}**

Out[*]=

$$\frac{4 (9 - 60 t + 237 t^2 - 494 t^3 + 609 t^4 - 444 t^5 + 151 t^6)}{5 (5 - 56 t + 416 t^2 - 1600 t^3 + 3414 t^4 - 4088 t^5 + 2800 t^6 - 1168 t^7 + 281 t^8)^{3/2}}$$

Out[*]=

$$\frac{643\,012\,500}{882\,181 \sqrt{882\,181}}$$

In[*]:= **kz0 == kz10 * Norm[A[[1]]]**

Out[*]=
 True

```

In[*]:= c0 = c /. {t -> t0}
n0 = {{0, -1}, {1, 0}}.Normalize[D[c, t] /. {t -> t0}]
kz0
R0 = 1 / kz0
S0 = c0 + n0 * R0
k = S0 + R0 * {Cos[s], Sin[s]}
Out[*]=

$$\left\{ -\frac{4984}{3125}, \frac{604}{625} \right\}$$

Out[*]=

$$\left\{ \frac{865}{\sqrt{882181}}, -\frac{366}{\sqrt{882181}} \right\}$$

Out[*]=

$$\frac{643012500}{882181 \sqrt{882181}}$$

Out[*]=

$$\frac{882181 \sqrt{882181}}{643012500}$$

Out[*]=

$$\left\{ -\frac{262441211}{643012500}, \frac{49754839}{107168750} \right\}$$

Out[*]=

$$\left\{ -\frac{262441211}{643012500} + \frac{882181 \sqrt{882181} \cos[s]}{643012500}, \frac{49754839}{107168750} + \frac{882181 \sqrt{882181} \sin[s]}{643012500} \right\}$$

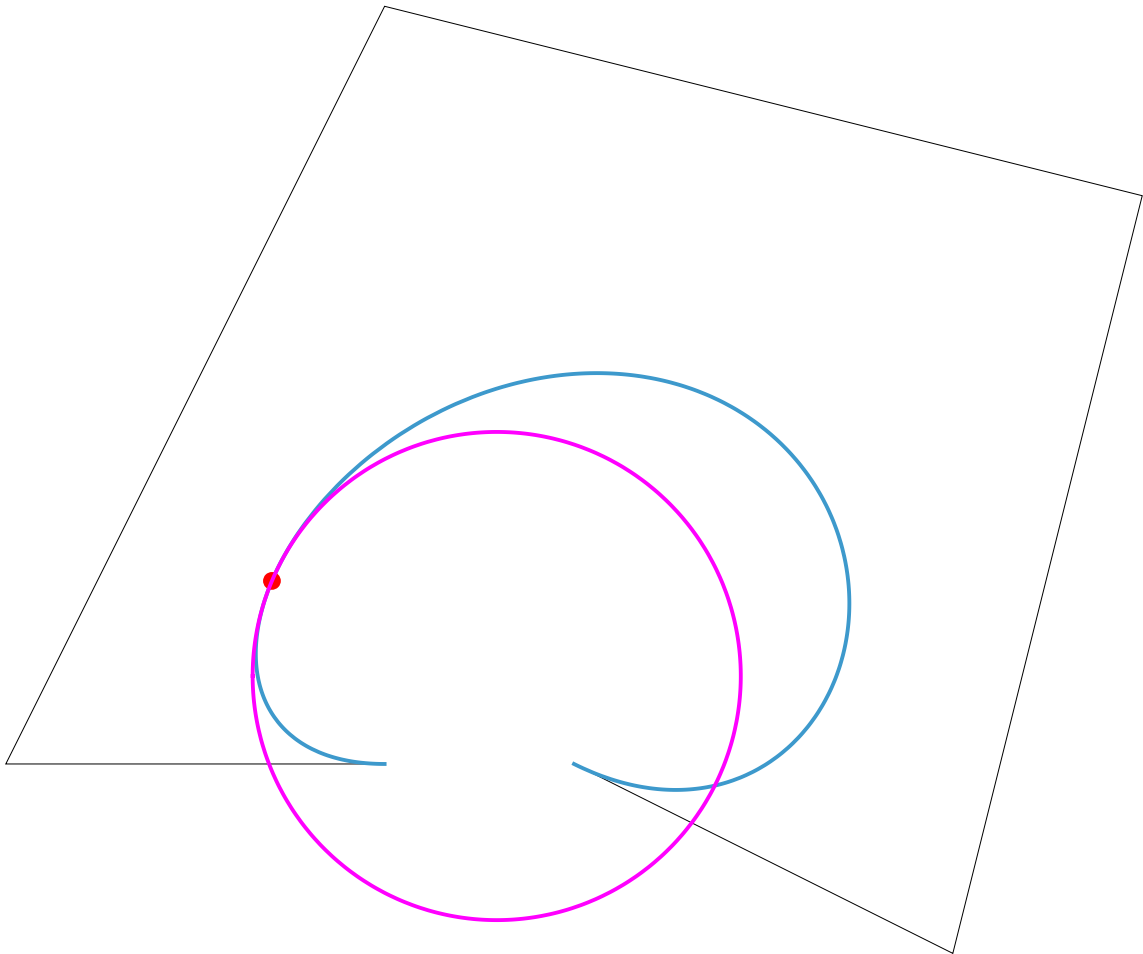

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```

In[*]:= pl3 = Graphics[{PointSize[0.015], Red, Point[c0]}];
pl4 = ParametricPlot[k, {s, -Pi, Pi}, PlotStyle -> Magenta];
Show[pl1, pl2, pl3, pl4]

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Out[*]=



```

In[*]:= kz
rychlost = Sqrt[(D[c1, t].D[c1, t])]

```

Out[*]=

$$\frac{4 (9 - 60 t + 237 t^2 - 494 t^3 + 609 t^4 - 444 t^5 + 151 t^6)}{5 (5 - 56 t + 416 t^2 - 1600 t^3 + 3414 t^4 - 4088 t^5 + 2800 t^6 - 1168 t^7 + 281 t^8)^{3/2}}$$

Out[*]=

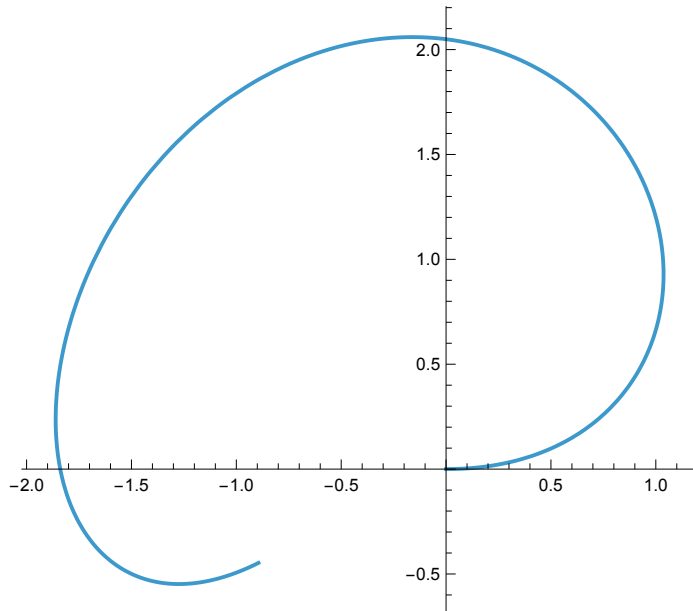
$$\sqrt{\left(\left(\frac{1}{2} \sqrt{3} (-5 (1-t)^4 + 80 (1-t)^3 t + 30 (1-t)^2 t^2 - 80 (1-t) t^3) + \frac{1}{2} (10 (1-t)^4 + 20 (1-t)^3 t - 120 (1-t)^2 t^2 - 40 (1-t) t^3 + 10 t^4)\right)^2 + \left(\frac{1}{2} (5 (1-t)^4 - 80 (1-t)^3 t - 30 (1-t)^2 t^2 + 80 (1-t) t^3) + \frac{1}{2} \sqrt{3} (10 (1-t)^4 + 20 (1-t)^3 t - 120 (1-t)^2 t^2 - 40 (1-t) t^3 + 10 t^4)\right)^2\right)}$$

```

In[*]:= x[s_] = kz /. {t -> s}; r[s_] = rychlost /. {t -> s};
sol =
  NDSolve[{x'[s] == r[s] * Cos[alpha[s]], y'[s] == r[s] * Sin[alpha[s]], alpha'[s] == x[s] * r[s],
    x[0] == 0, y[0] == 0, alpha[0] == 0}, {x[s], y[s], alpha[s]}, {s, 0, 1}];
res = {x[s], y[s]} /. sol[[1]];
pl5 = ParametricPlot[res, {s, 0, 1}]

```

Out[*]=

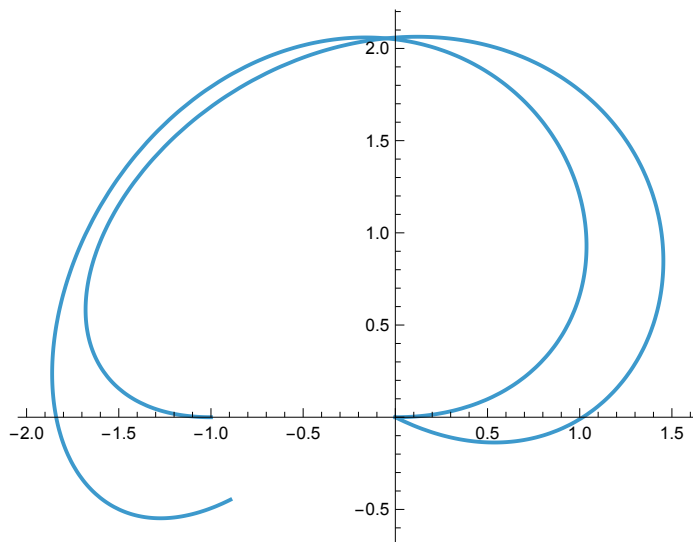


```

In[*]:= Show[pl2, pl5, PlotRange -> All]

```

Out[*]=



Out[*]=

0.2

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In[*]:= N[kz0]

```

Out[*]=

0.776038

```
In[*]:=  
  eps = 0.002  
  v0 = c0 - (c /. {t -> (t0 - eps)});  
  v1 = (c /. {t -> (t0 + eps)}) - c0;  
  kz0dhad = ArcSin[Det[{v0, v1}] / (Norm[v0] * Norm[v1])] * 2 / (Norm[v0] + Norm[v1])  
Out[*]=  
  0.002  
Out[*]=  
  0.776065
```