Bezier curves

Quadratic

In[1]:= `Bezier2[t_] := (1 - t)^2 Qa + 2 t (1 - t) Qc + t^2 Qb`

In[2]:= `Solve[Bezier2[0] == xa && Bezier2[`$\frac{1}{2}$`] == xc && Bezier2[1] == xb, {Qa, Qb, Qc}]`

Out[2]= $\left\{\left\{Qa \to xa, \ Qb \to xb, \ Qc \to \frac{1}{2}(-xa - xb + 4\,xc)\right\}\right\}$

Cubic

In[3]:= `Bezier3[t_] := (1 - t)^3 Qa + 3 t (1 - t)^2 Qc + 3 t^2 (1 - t) Qd + t^3 Qb`

In[4]:= `Solve[Bezier3[0] == xa && Bezier3[`$\frac{1}{3}$`] == xc &&`

`Bezier3[`$\frac{2}{3}$`] == xd && Bezier3[1] == xb, {Qa, Qb, Qc, Qd}]`

Out[4]= $\left\{\left\{Qa \to xa, \ Qb \to xb, \ Qc \to \frac{1}{6}(-5\,xa + 2\,xb + 18\,xc - 9\,xd), \ Qd \to \frac{1}{6}(2\,xa - 5\,xb - 9\,xc + 18\,xd)\right\}\right\}$

Convert "t" to "ξ"

In[5]:= `ξa = -1 (* t = 0 *)`

Out[5]= -1

In[6]:= `ξb = 1 (* t = 1 *)`

Out[6]= 1

In[7]:= `L = 2 (* length of Lin on natural space *)`

Out[7]= 2

In[8]:= `ξc = ξa +`$\frac{L}{3}$`  (* t = 1/3 *)`

Out[8]= $-\frac{1}{3}$

In[9]:= `ξd = ξb -`$\frac{L}{3}$`  (* t = 2/3 *)`

Out[9]= $\frac{1}{3}$

Plots

In[10]:=
```
DynamicModule[{p = {{0, 0}, {1, 1}, {2, 0}}}, LocatorPane[
    Dynamic[p], Dynamic@
     ParametricPlot[
      {Bezier2[t] /. {Qa → p[[1]][[1]], Qc → p[[2]][[1]], Qb → p[[3]][[1]]},
       Bezier2[t] /. {Qa → p[[1]][[2]], Qc → p[[2]][[2]], Qb → p[[3]][[2]]}}, {t, 0, 1},
      Epilog → {Red, PointSize[0.02], Point[p], Orange, Line[p]},
      PlotRange → {{0, 2}, {0, 1.1}}
     ]]]
```

Out[10]=
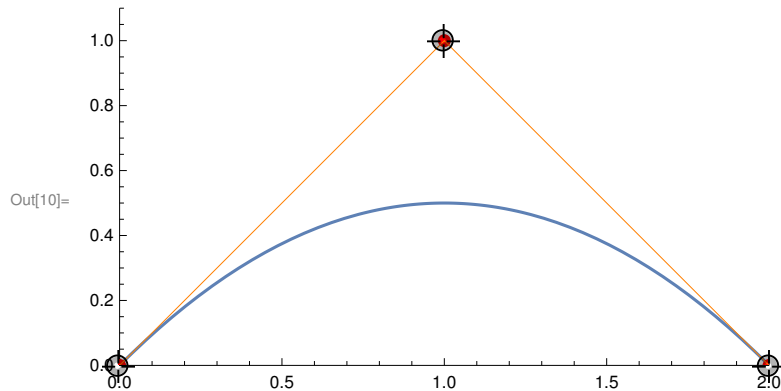
In[11]:=
```
DynamicModule[{p = {{0, 0}, {1/2, 1}, {3/2, 1}, {2, 0}}}, LocatorPane[
    Dynamic[p], Dynamic@
     ParametricPlot[
      {Bezier3[t] /. {Qa → p[[1]][[1]], Qc → p[[2]][[1]], Qd → p[[3]][[1]], Qb → p[[4]][[1]]},
       Bezier3[t] /. {Qa → p[[1]][[2]], Qc → p[[2]][[2]], Qd → p[[3]][[2]], Qb → p[[4]][[2]]}}, {t, 0, 1},
      Epilog → {Red, PointSize[0.02], Point[p], Orange, Line[p]},
      PlotRange → {{0, 2}, {0, 1.1}}
     ]]
```

Out[11]=