Punto cuspidale

In[1]:=
```
f[x_, x0_] := Piecewise[
  {
   {1 + 5 Sqrt[x - x0], x ≥ x0},
   {1 + 5 Sqrt[x0 - x], x < x0}
  }
 ]
```

In[2]:=
```
secante1[x_, x0_, Δ1_] := 1 - 5/Sqrt[-Δ1] * (x - x0); secante2[x_, x0_, Δ2_] := 1 + 5/Sqrt[Δ2] * (x - x0)
```

In[3]:=
```
Solve[
 secante1[x, 1, -0.3] == 1 + 5 Sqrt[1 - x],
 x
]
```

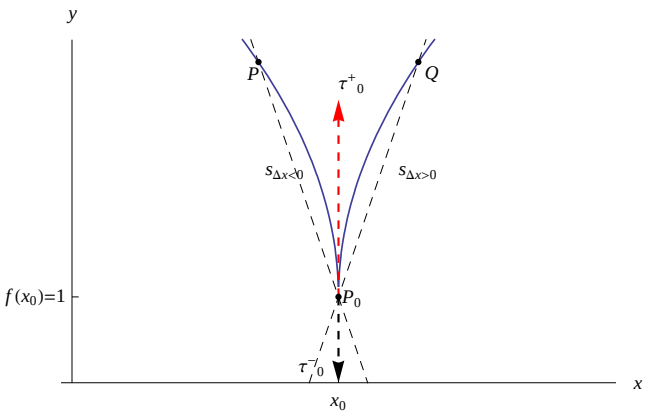
Out[3]=
```
{{x → 0.7}, {x → 1.}}
```

In[4]:=
```
Solve[
 secante2[x, 1, 0.3] == 1 + 5 Sqrt[x - 1],
 x
]
```

Out[4]=
```
{{x → 1.}, {x → 1.3}}
```

In[5]:=
```
cuspide = Plot[
  {
   f[x, 1],
   secante1[x, 1, -0.3],
   secante2[x, 1, 0.3]},
  {x, 0, 2},
  AxesLabel → {"x", "y"},
  PlotRange → {0, 4},
  PlotStyle → {
    {Thickness[0.003]},
    {Dashed, RGBColor[0, 0, 0], Thickness[0.001]},
    {Dashed, RGBColor[0, 0, 0], Thickness[0.001]}
   },
  Ticks → {
    {
     {1, "x₀"}
    },
    {
     {f[1, 1], "f(x₀)=1"}
    }
   },
  Epilog → {
    {
     Dashed,
     RGBColor[1, 0, 0],
     Thickness[0.004],
     Arrow[{{1, 1}, {1, 3.3}}]
    },
    {
     Dashed,
     RGBColor[0, 0, 0],
     Thickness[0.004],
     Arrow[{{1, 1}, {1, 0}}]
    },
    Point[{1, 1}],
    Point[{1.6, f[1.6, 1]}],
    Point[{0.7, f[0.7, 1]}],
    Point[{1.3, f[1.3, 1]}],
    Text["P", {0.68, 3.6}],
    Text["Q", {1.35, 3.6}],
    Text["P₀", {1.05, f[1, 1]}],
    Text["τ⁺₀", {1.05, f[1.25, 1]}],
    Text["τ⁻₀", {0.9, 0.2}],
    Text["sΔx<0", {0.8, 2.5}],
    Text["sΔx>0", {1.3, 2.5}]
   }
 ]
```

Out[5]=



In[6]:=
```
plot[Δ_] := Plot[
  {
   f[x, 1],
   secante1[x, 1, -Δ],
   secante2[x, 1, Δ]
  },
  {x, 0, 2},
  PlotRange → {0, 4},
  PlotStyle → {
    {Thickness[0.005]},
    {RGBColor[1, 0, 0], Thickness[0.003]},
    {RGBColor[1, 0, 0], Thickness[0.003]}
   },
  ImageSize → {
    500,
    500
   },
  AxesLabel → {"x", "y"},
  Ticks → {
    {
     {1, "x0"},
     {1 + Δ, "x0+Δx"},
     {1 - Δ, "x0-Δx"}
    },
    {
     {f[1, 1], "f(x0)"},
     {f[1 + Δ, 1], "f(x0+Δx)"}
    }
   },
  Epilog → {
    {PointSize[0.02], Point[{1, 1}]},
    {PointSize[0.02], Point[{1 + Δ, f[1 + Δ, 1]}]},
    {PointSize[0.02], Point[{1 - Δ, f[1 - Δ, 1]}]},
    Text["P0", {1.1, f[1, 1]}],
    Text["P", {1.1 + Δ, f[1 + Δ, 1] + 0.1}],
    Text["Q", {0.9 - Δ, f[1 - Δ, 1] + 0.1}],
    {
     Dashed,
     RGBColor[1, 0, 0],
     Thickness[0.004],
     Arrow[{{1, 1}, {1, 4}}]
    },
    {
     Dashed,
     RGBColor[0, 0, 0],
     Thickness[0.004],
     Arrow[{{1, 1}, {1, 0}}]
    }
   }
 ]
```

In[7]:=
```
rettatangente = Table[
  plot[Δ], {Δ, 0.3, 10^-12, -0.01}
 ];
```

In[8]:=
```
(*l'output di quest'ultimo comando va poi esportato in formato gif*)
```