Curvature

Position | Tangency | Curvature - Continuity

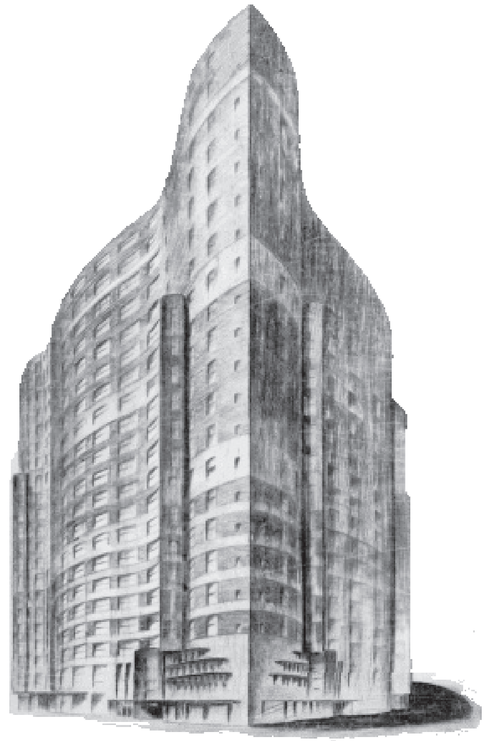
In Defense of the Curve

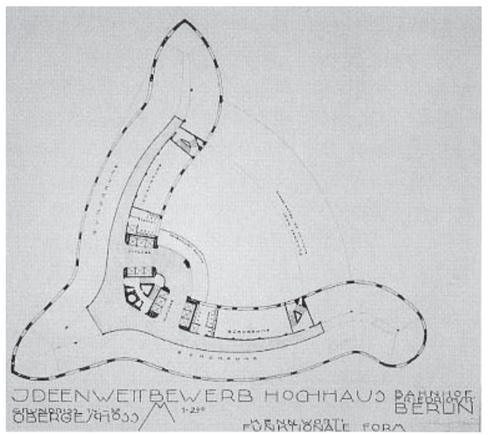
A Story of the Organic

HUGO HÄRING VS LUDWIG MIES VAN DER ROHE

In a conversation between Mies van der Rohe and Hugo Häring, Mies inquires, “our steel beams, they have been born straight haven’t they?” he then argues, “It takes a great deal of effort to bend them”.

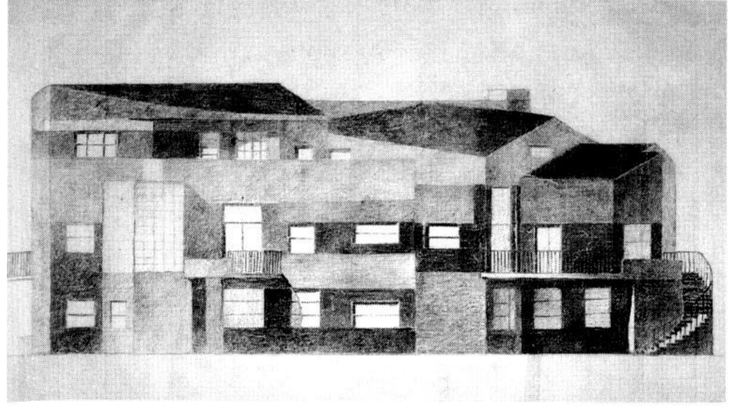
Mies van der Rohe “Mies Speaks: I Do Not Design Buildings.” Architectural Review, No. 862, December 1968: 452.

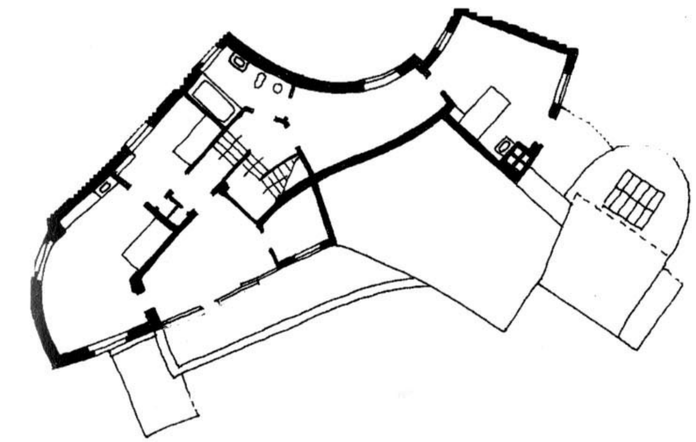


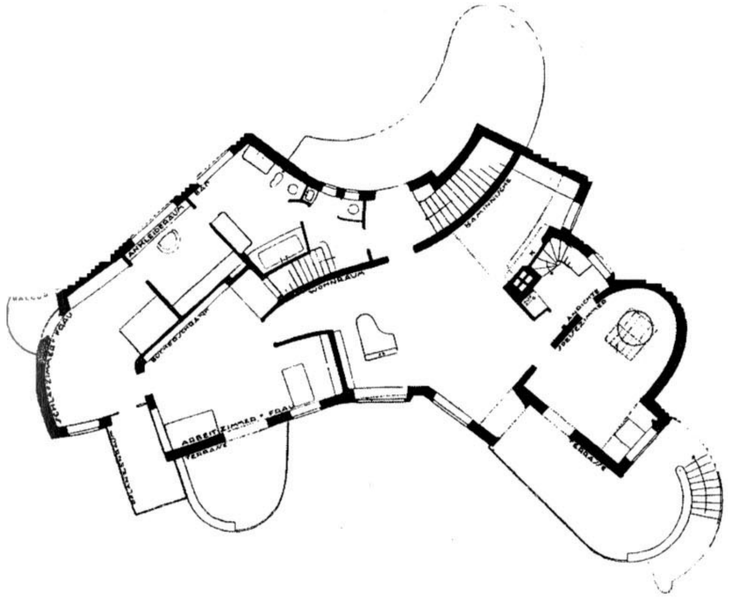


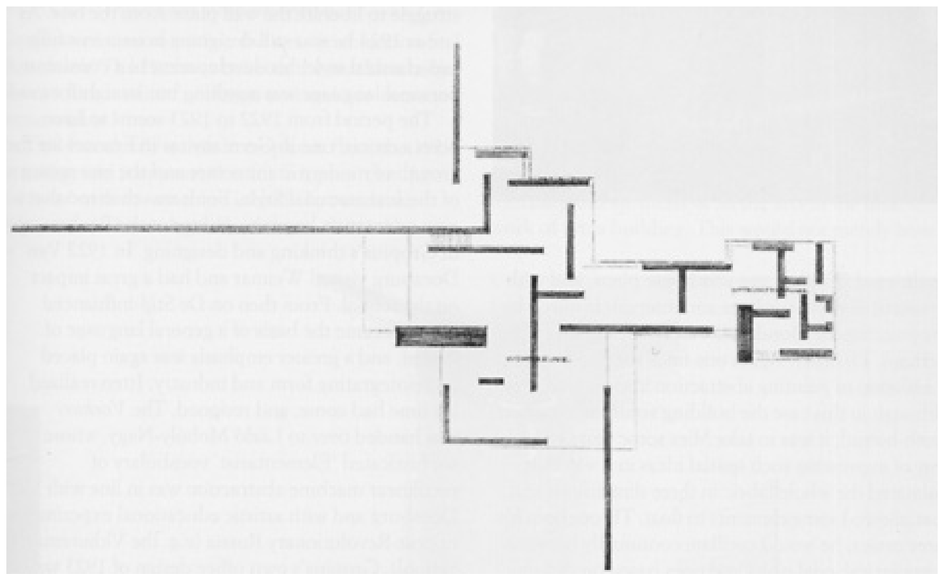
Hugo Häring, Friedrichstrasse Office Building, 1922, Competition Entry (left)

Ludwig Mies van der Rohe, Friedrichstrasse Office Building, 1922, Competition Entry (right)

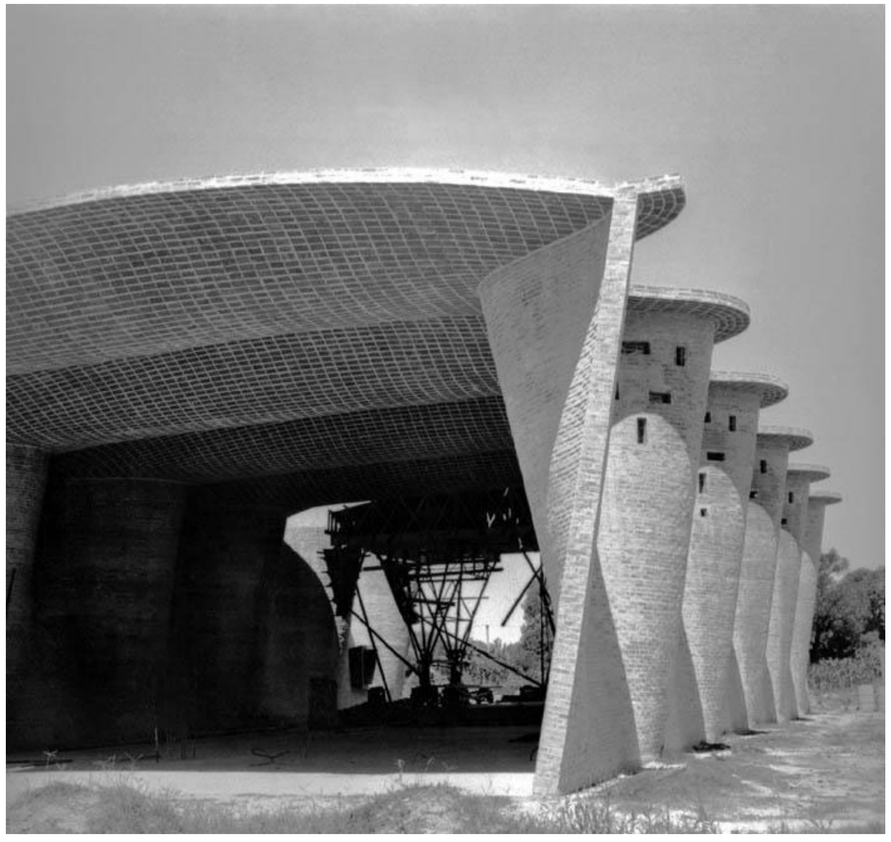




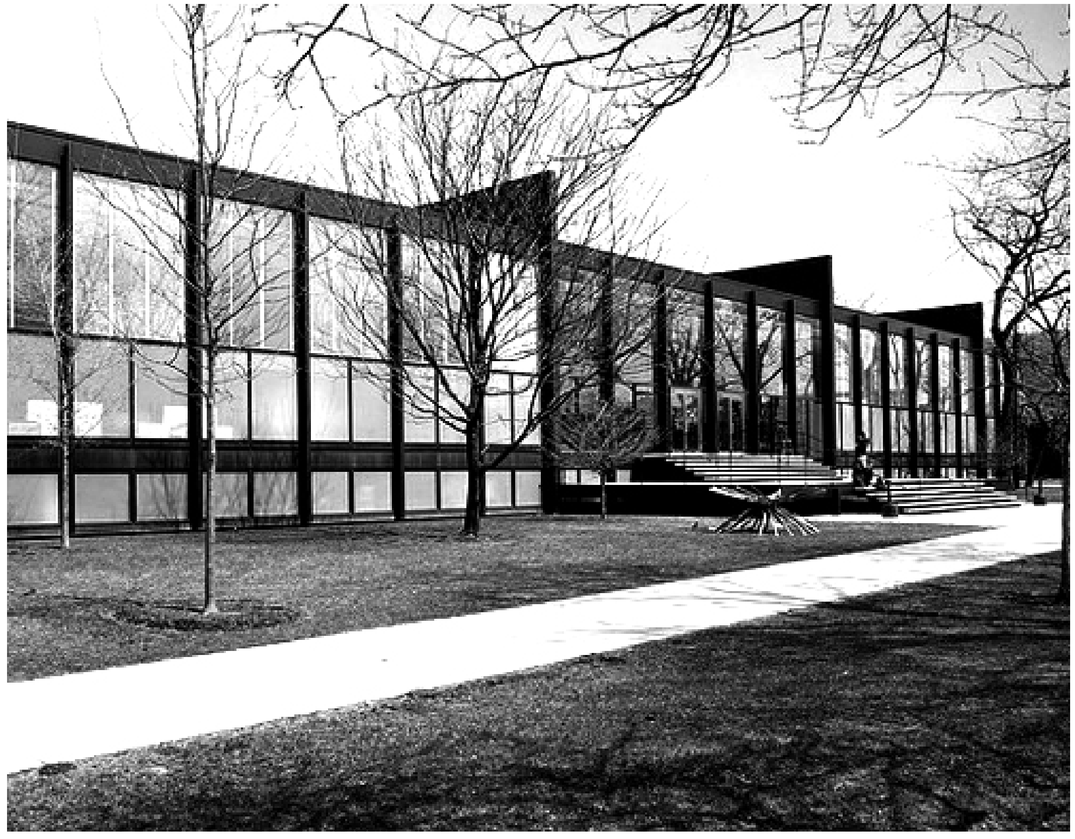




Hugo Häring, Country House, 1923/24, Elevation and Plans (left)
Ludwig Mies van der Rohe, Brick Country House, 1923, Plan (above)



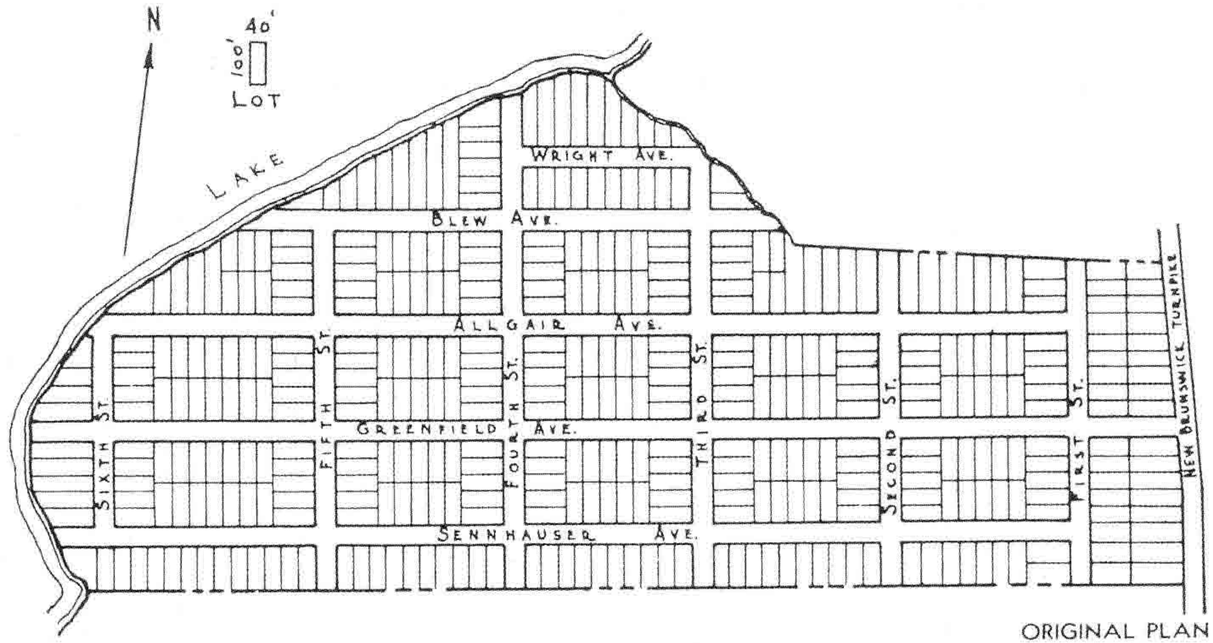
Courtesy of Vicente del Amo Hernández. Used with permission.



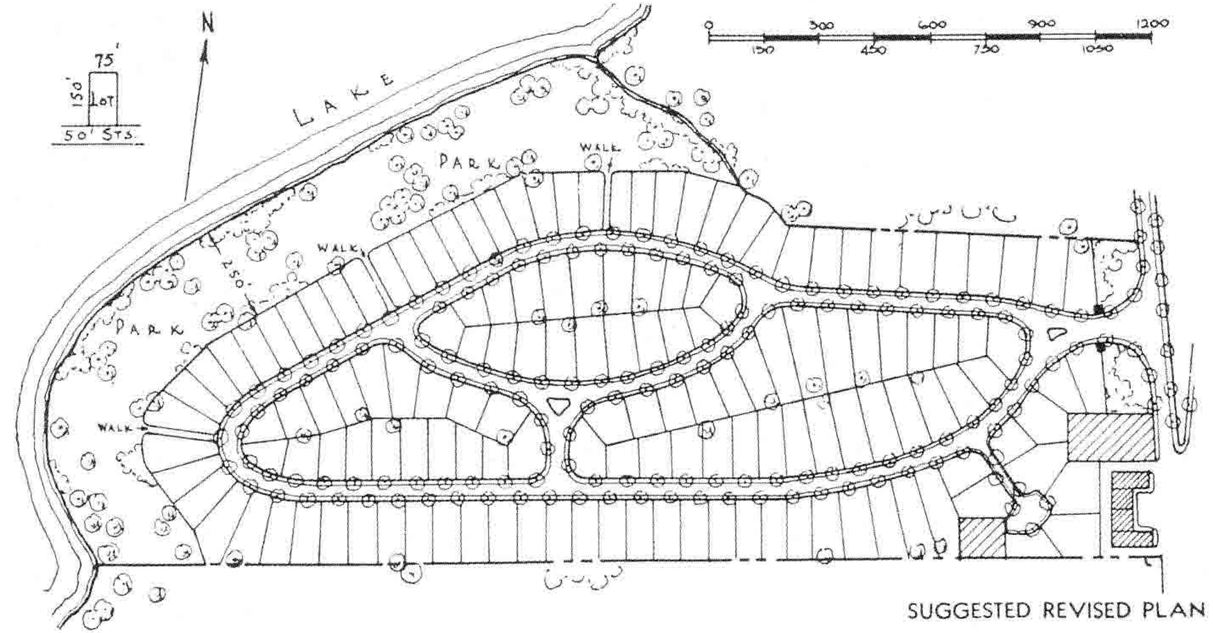
Photograph courtesy of Charles MacEachen on Flickr.

Eladio Dieste, Church of Christ the Worker, 1958-60 (left)

Ludwig Mies van der Rohe, S. R. Crown Hall, 1956 (right)



ORIGINAL PLAN



SUGGESTED REVISED PLAN

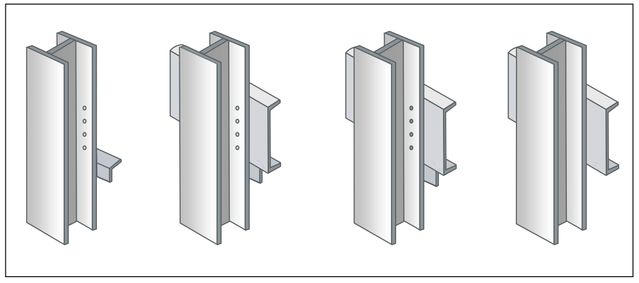
These images are in the public domain.

Source: Federal Housing Administration. *Planning Profitable Neighborhoods*, Technical Bulletin No. 7. Washington, D.C., Government Printing Office, 1938.

Gerrit Rietveld, Red-Blue Chair, 1917–19.

Photograph courtesy of defining Design on Flickr.

Drawing of Gerrit Rietveld, Detail Connection, Red-Blue Chair, 1917-19
removed due to copyright restrictions.
Source: Kuper, M., and I. Van Zijl. *Gerrit Rietveld 1888–1964: The Complete Works*. Princeton Architectural Press, 1993.
See page 10 of "In Defense of the Curve: Provoked by Reason" for a reference image.



Drawing of Mies van der Rohe, Plug weld procedure: connection prepared, beam placed, plug weld, connection finished.

Image by MIT OpenCourseWare.

Photograph of Thonet bending forms incorporating a metal strip
removed due to copyright restrictions.
Source: Von Vegesack, Alexander. *Thonet: Classic Furniture in Bent Wood and Tubular Steel*. Rizzoli, 1997.
See page 11 of "In Defense of the Curve: Provoked by Reason" for a reference image.

Michael Thonet, No. 14 Chair, 1859–60.

Photograph courtesy of Holger.Ellgaard on Wikimedia Commons.

Photograph of Adolf Loos, Café Museum Chair, 1908
removed due to copyright restrictions.
See page 12 of "In Defense of the Curve: Provoked by Reason" for a reference image.

Photographs of Charles and Ray Eames, Leg Splint, 1941 (left);
Charles and Ray Eames, Body Splint, 1941 (upper right);
Leg Splint Demonstration, 1941 (lower right)

removed due to copyright restrictions.

Source: Neuhart, John, and Marilyn Neuhart. *Eames Design*. 1st ed. Abrams, 1989.

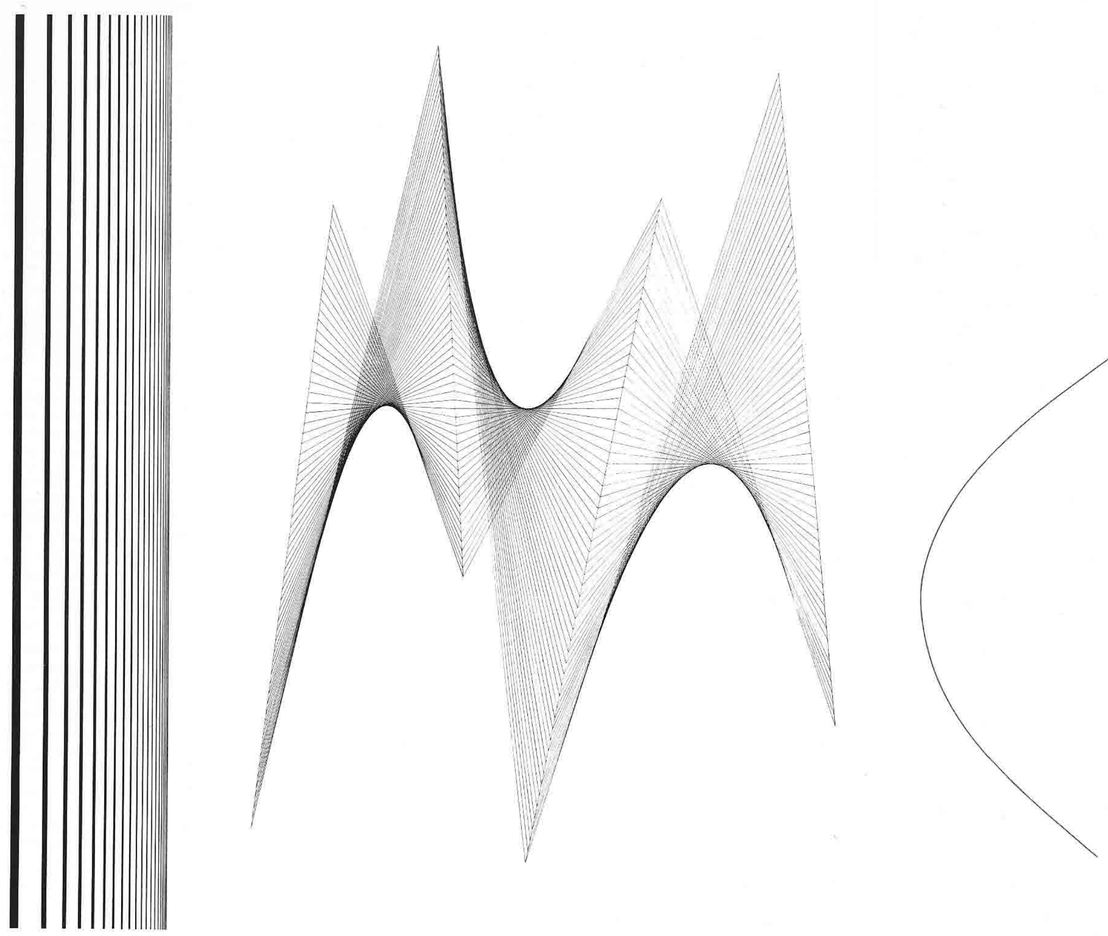
See page 13 of "In Defense of the Curve: Provoked by Reason" for a reference image.

Photographs of Charles Eames casting fiberglass (left);
Charles and Ray Eames, LCW Chair, 1945, Plywood Process (upper right);
Charles and Ray Eames, Plastic Armchair, 1950–53, Fiberglass Process (lower right)

removed due to copyright restrictions.

Source: Neuhart, John, and Marilyn Neuhart. *Eames Design*. 1st ed. Abrams, 1989.

See page 14 of "In Defense of the Curve: Provoked by Reason" for a reference image.



Ludwig Mies van der Rohe, Drafting exercise for first-year students at the Armour Institute, 1938

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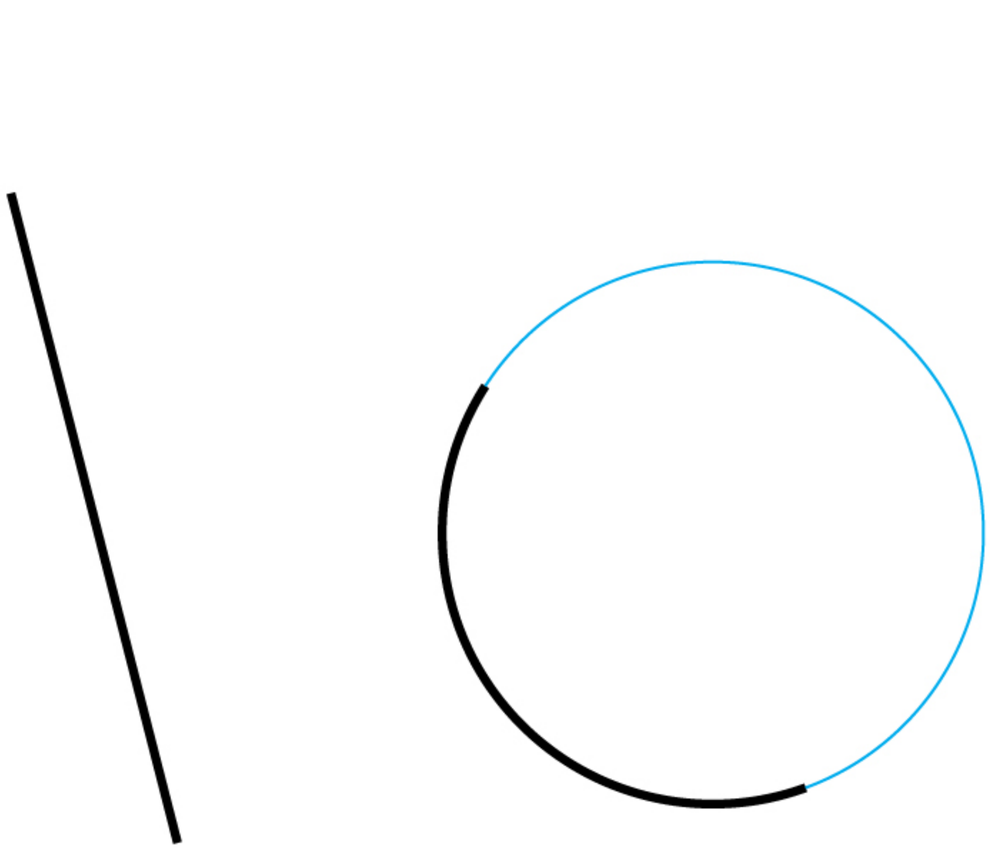
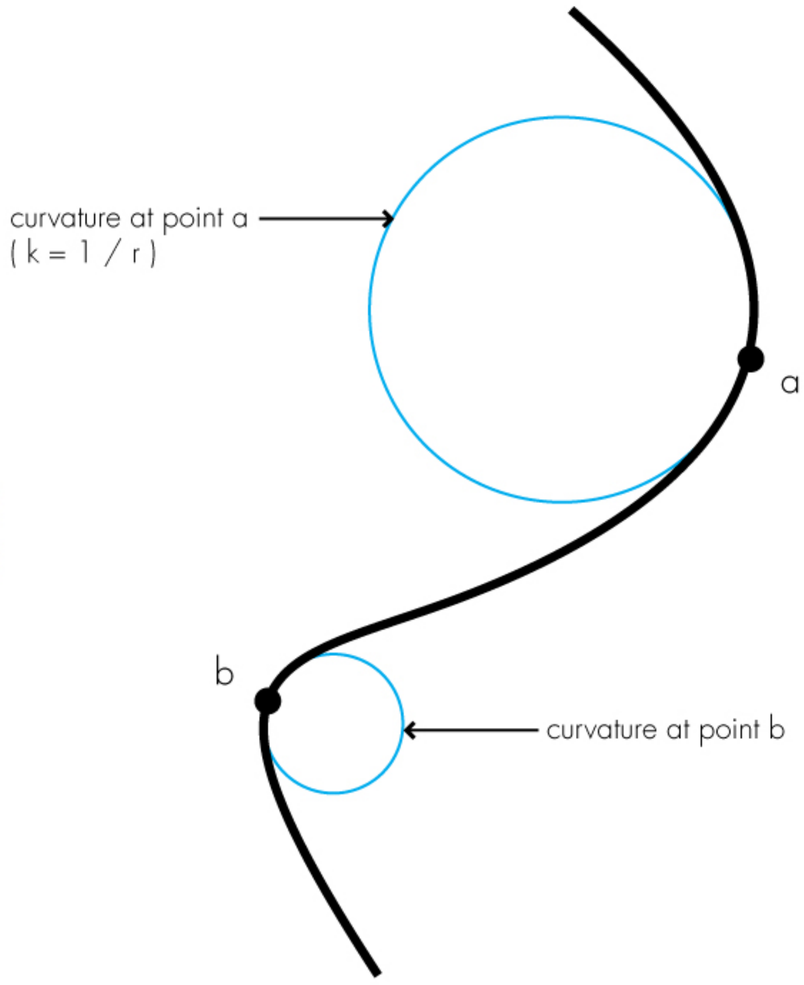
Curvature Calculations / Calculus

CURVATURE
curvature in planar curves



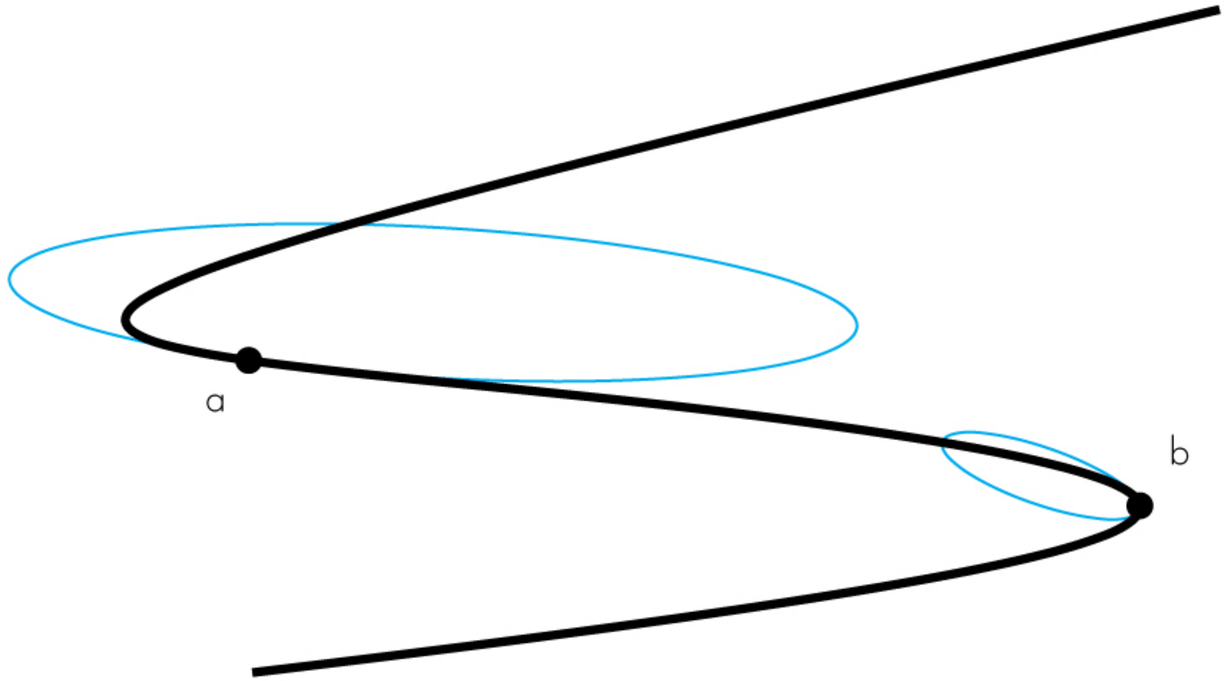
ZERO

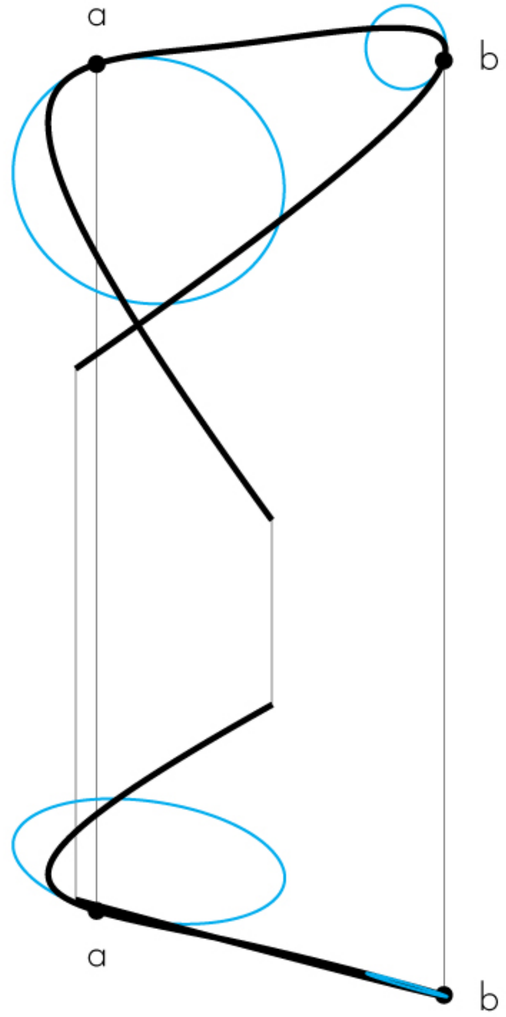
CONSTANT



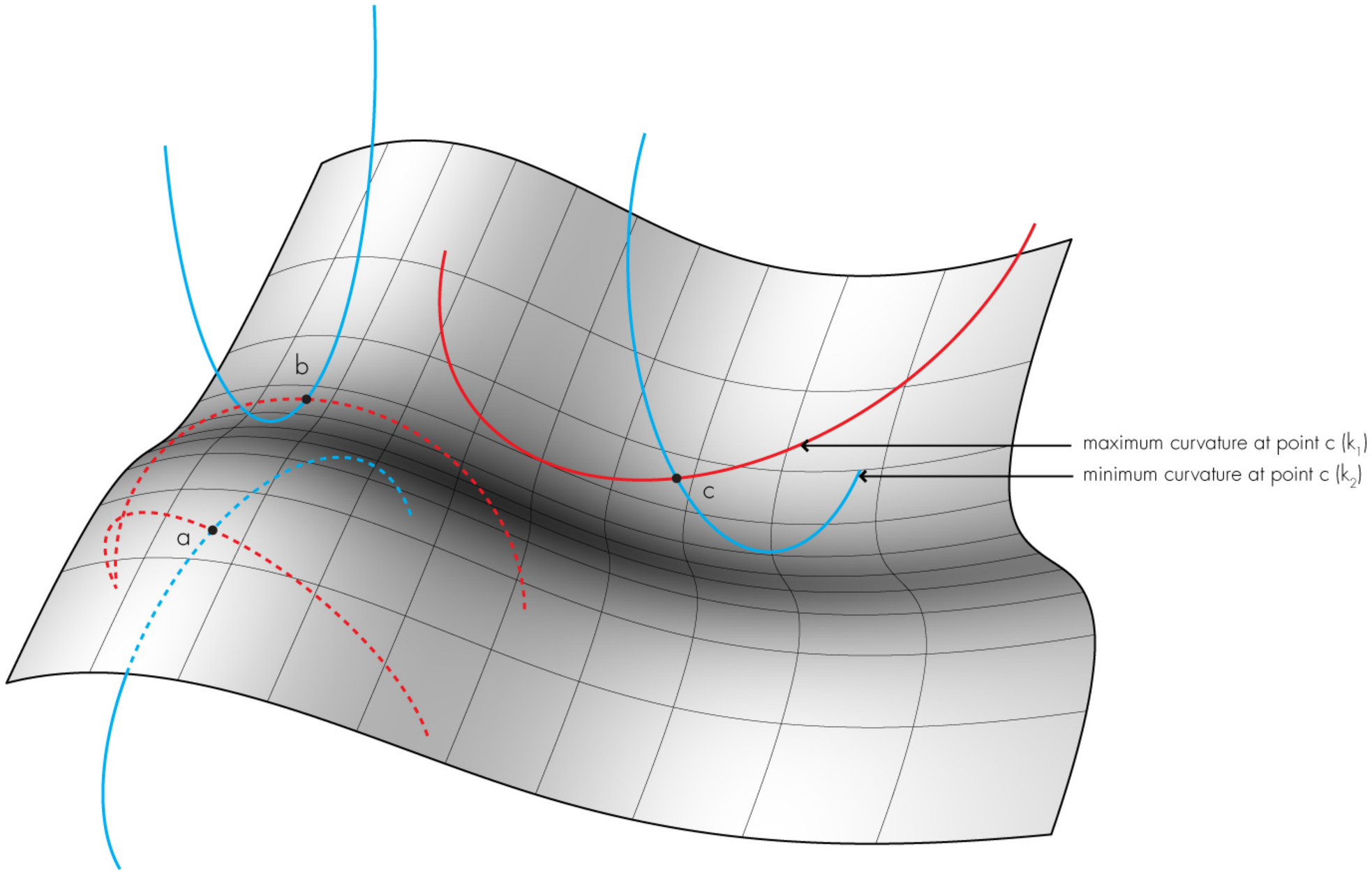
VARIABLE

CURVATURE
curvature in space curves



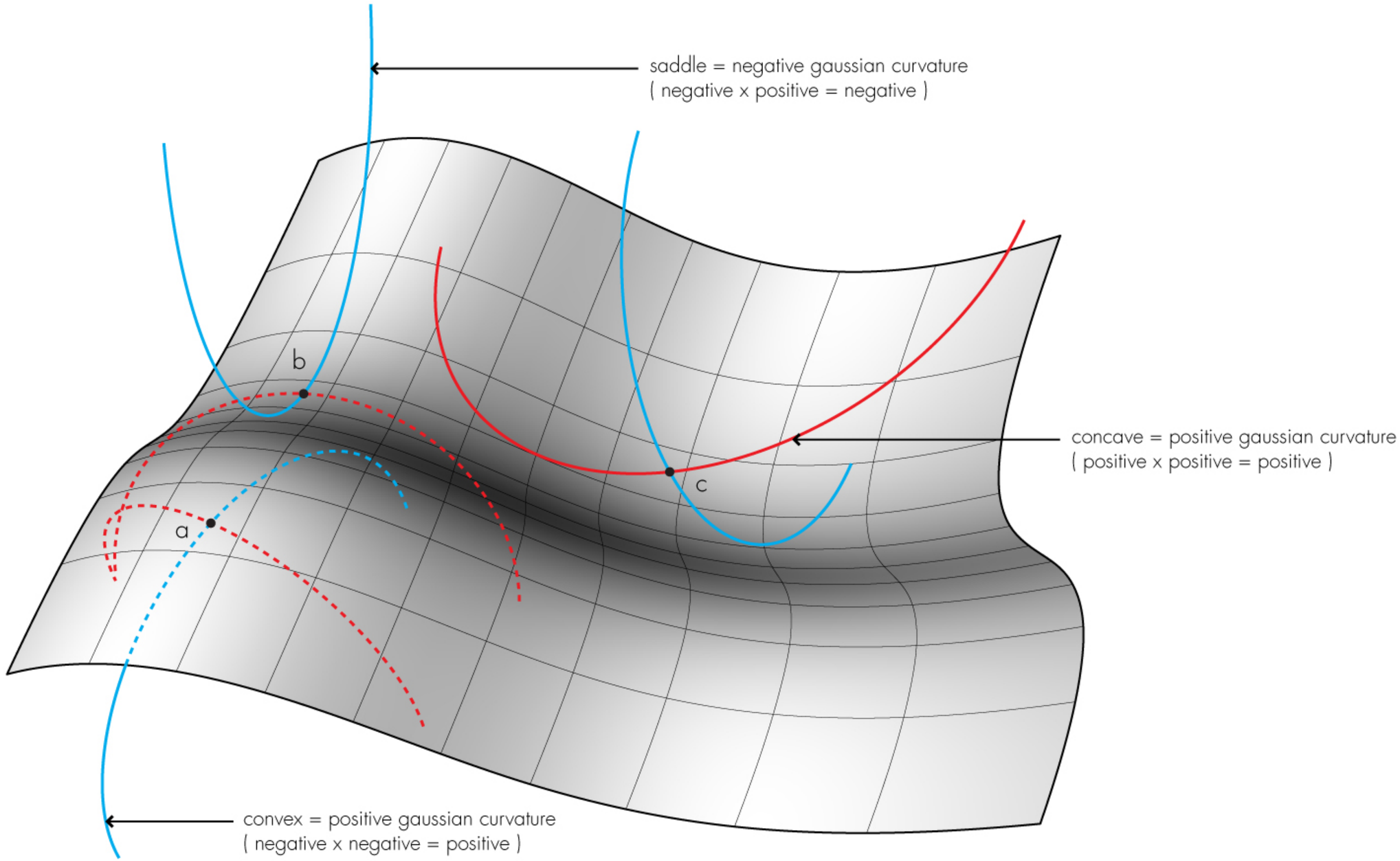


CURVATURE
principal curvature in surfaces (k_1, k_2)

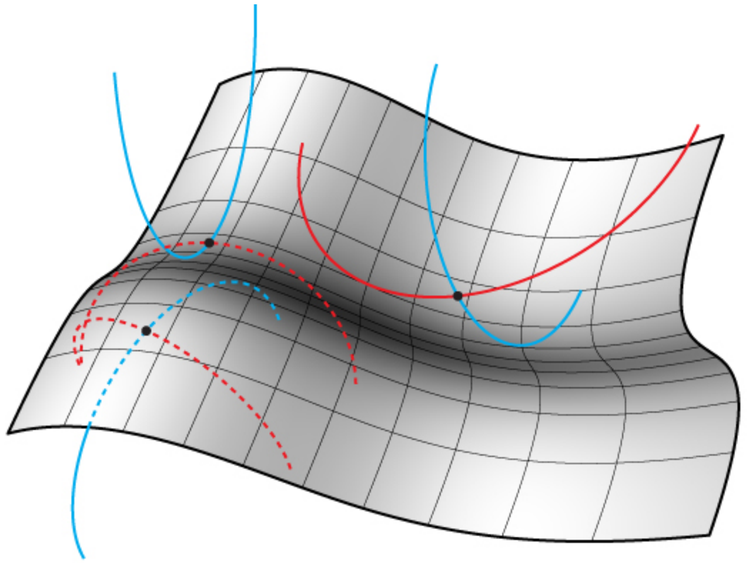


CURVATURE

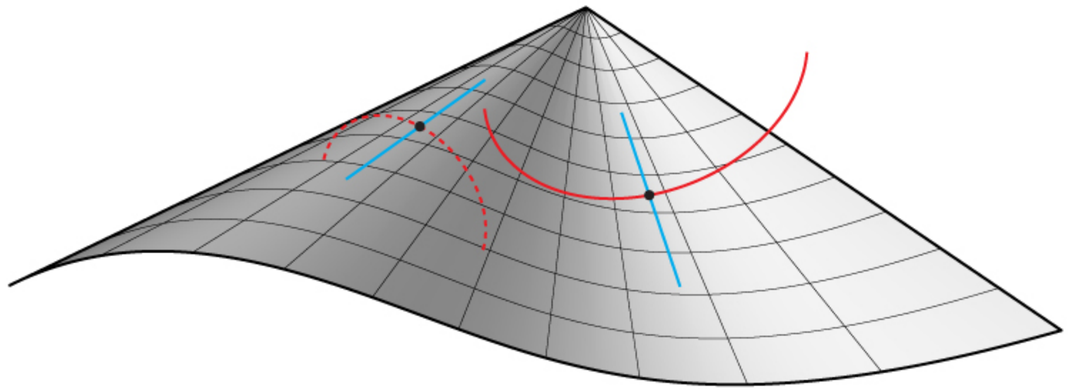
gaussian curvature in surfaces ($K = k_1 \times k_2$)



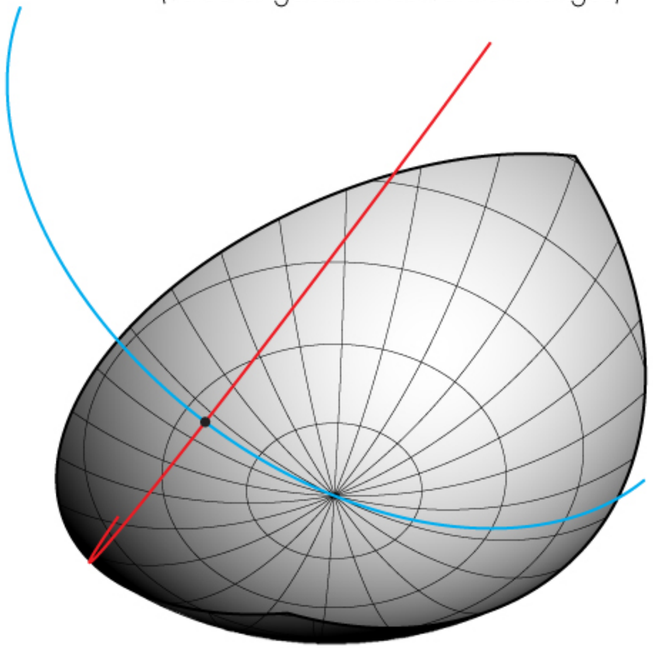
CURVATURE
special cases and gaussian curvature



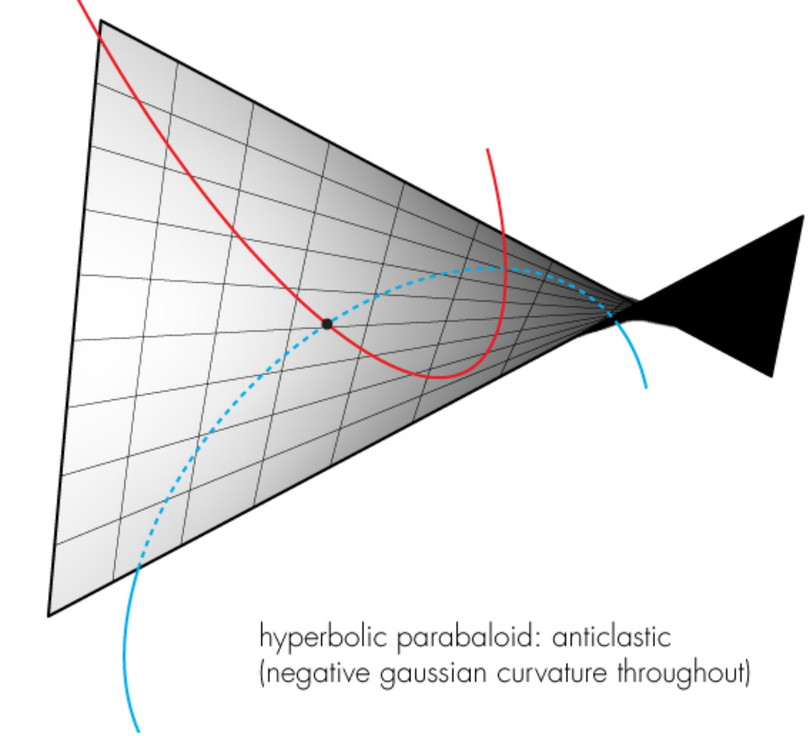
complex surface
(value of gaussian curvature changes)



conic surface: developable
(zero gaussian curvature throughout)

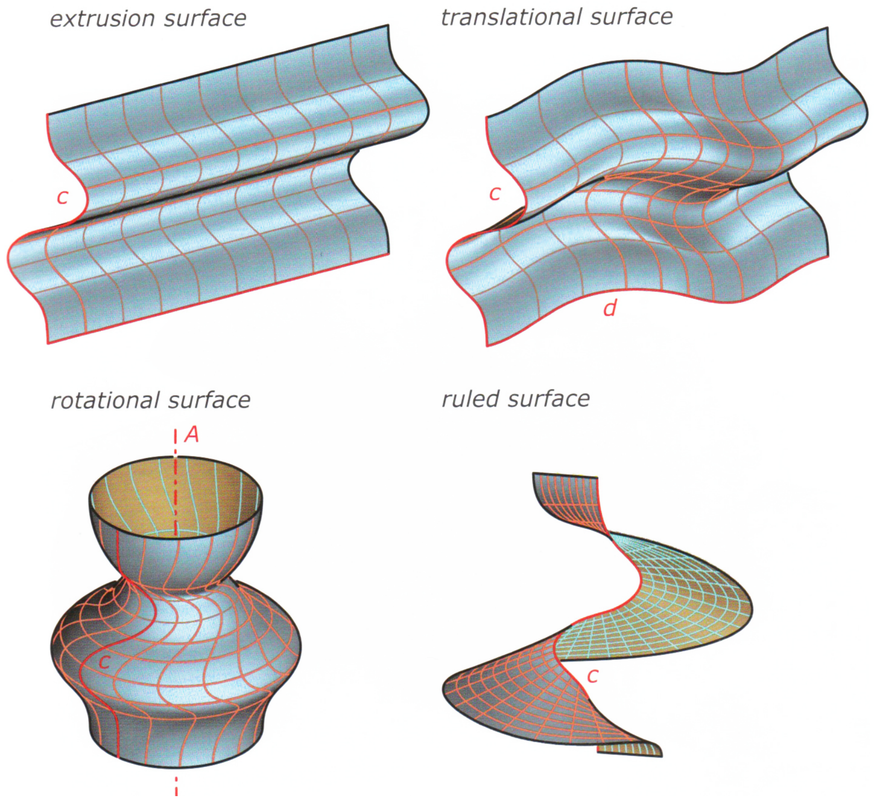


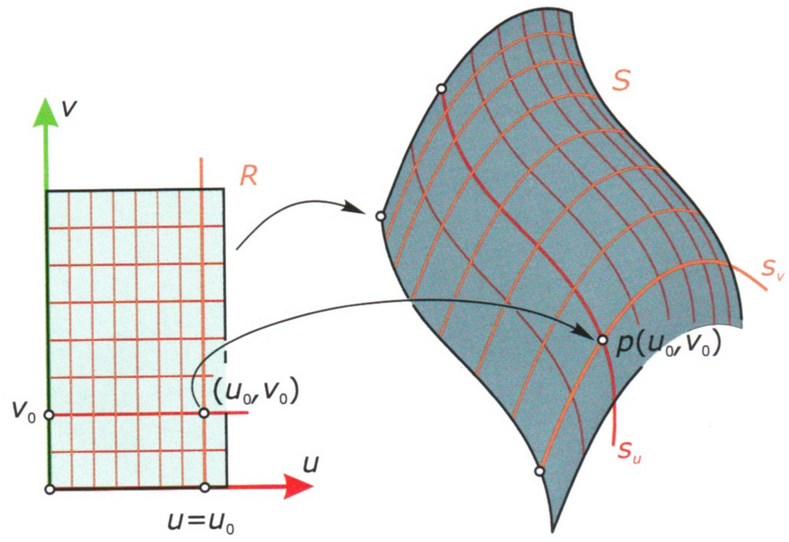
sphere: synclastic
(positive gaussian curvature throughout)



hyperbolic parabaloid: anticlastic
(negative gaussian curvature throughout)

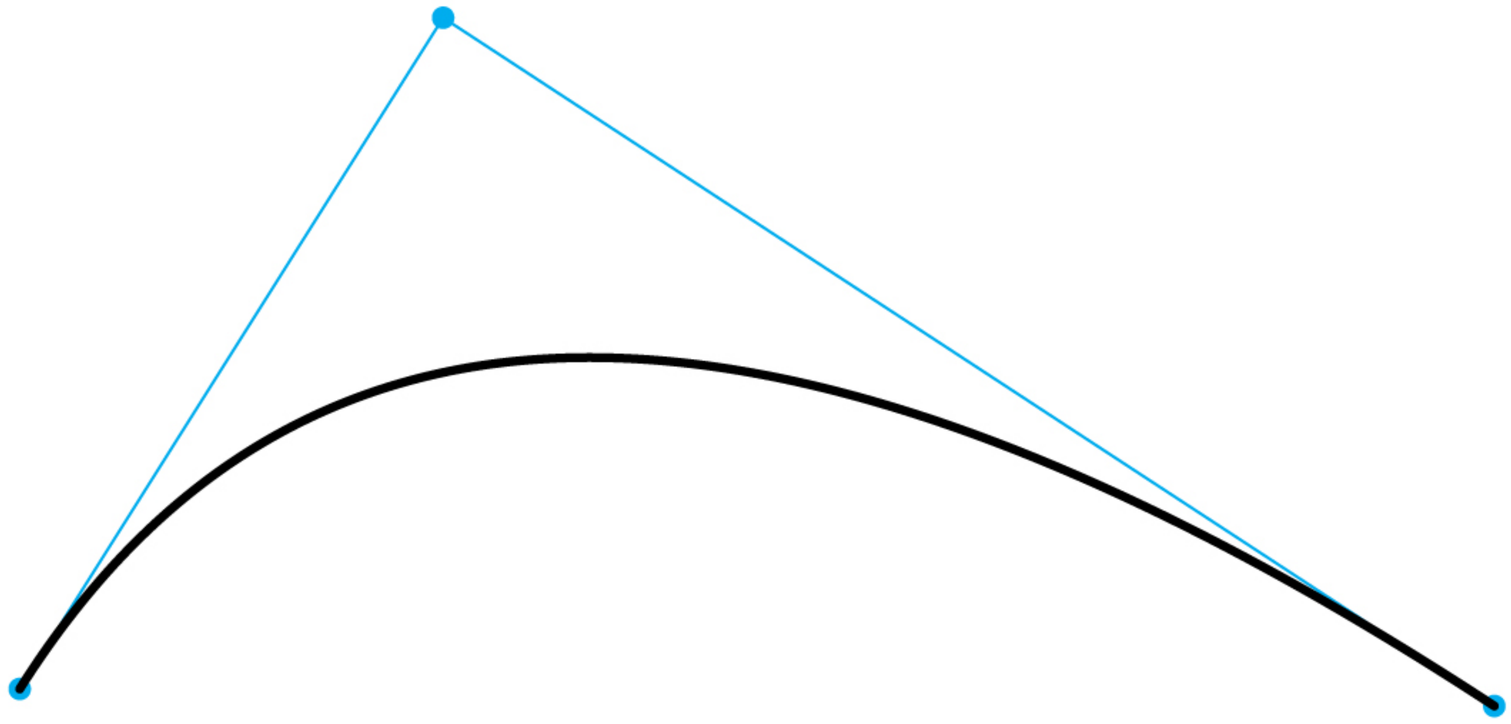
CURVATURE
curves + surfaces





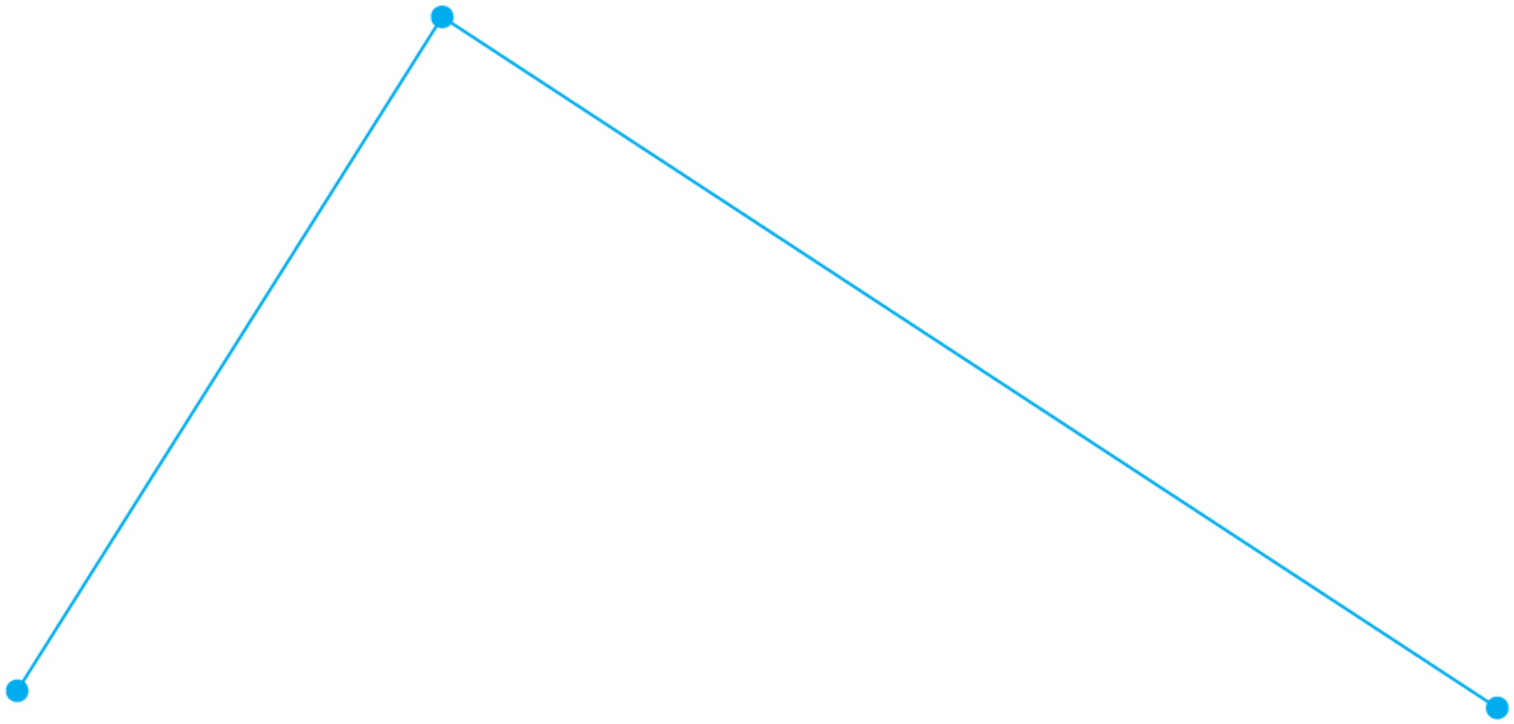
Images: *Architectural Geometry*, Bentley Institute Press 2007. (Axel Kilian, Helmut Pottman et al.)

CURVATURE
bezier curves and de castljau's algorithm



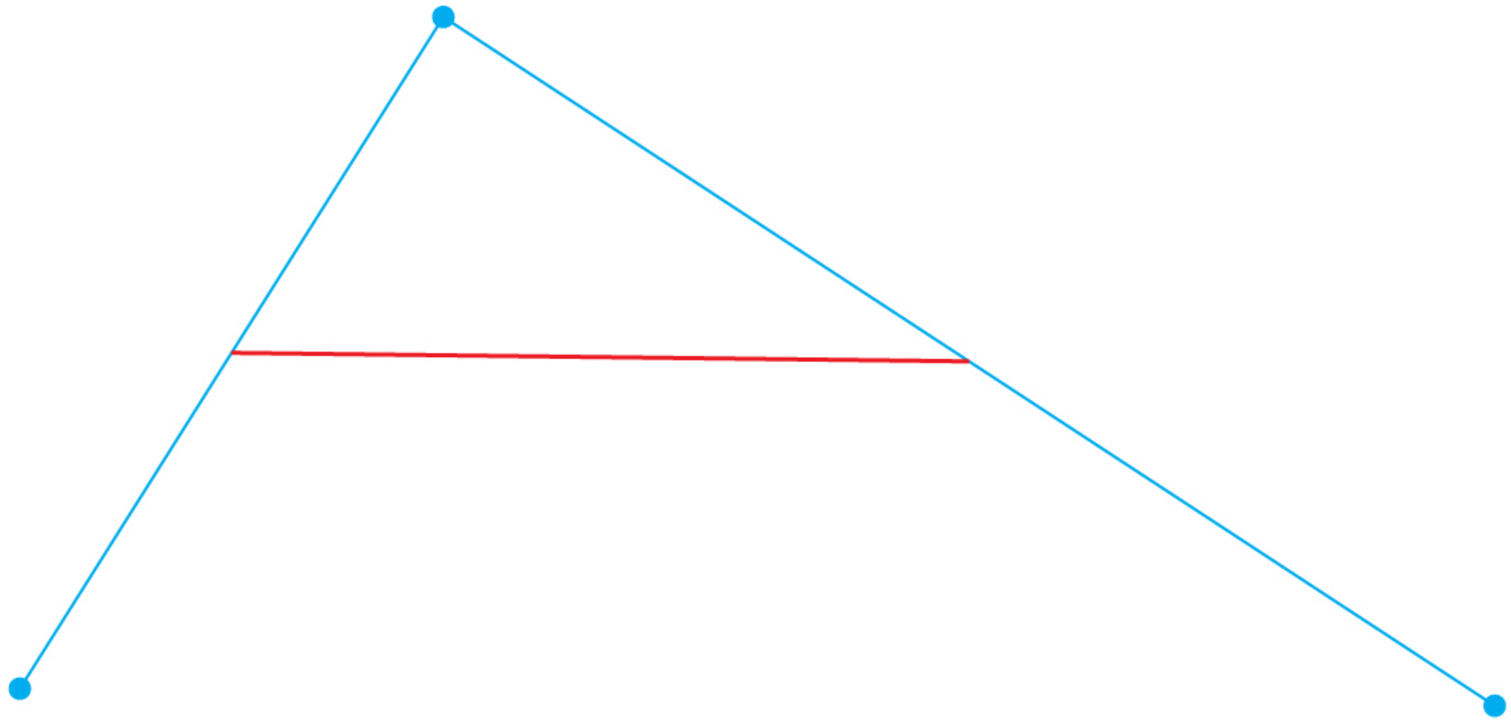
Bezier Curve with 3-Point control polygon

CURVATURE
bezier curves and de castljau's algorithm



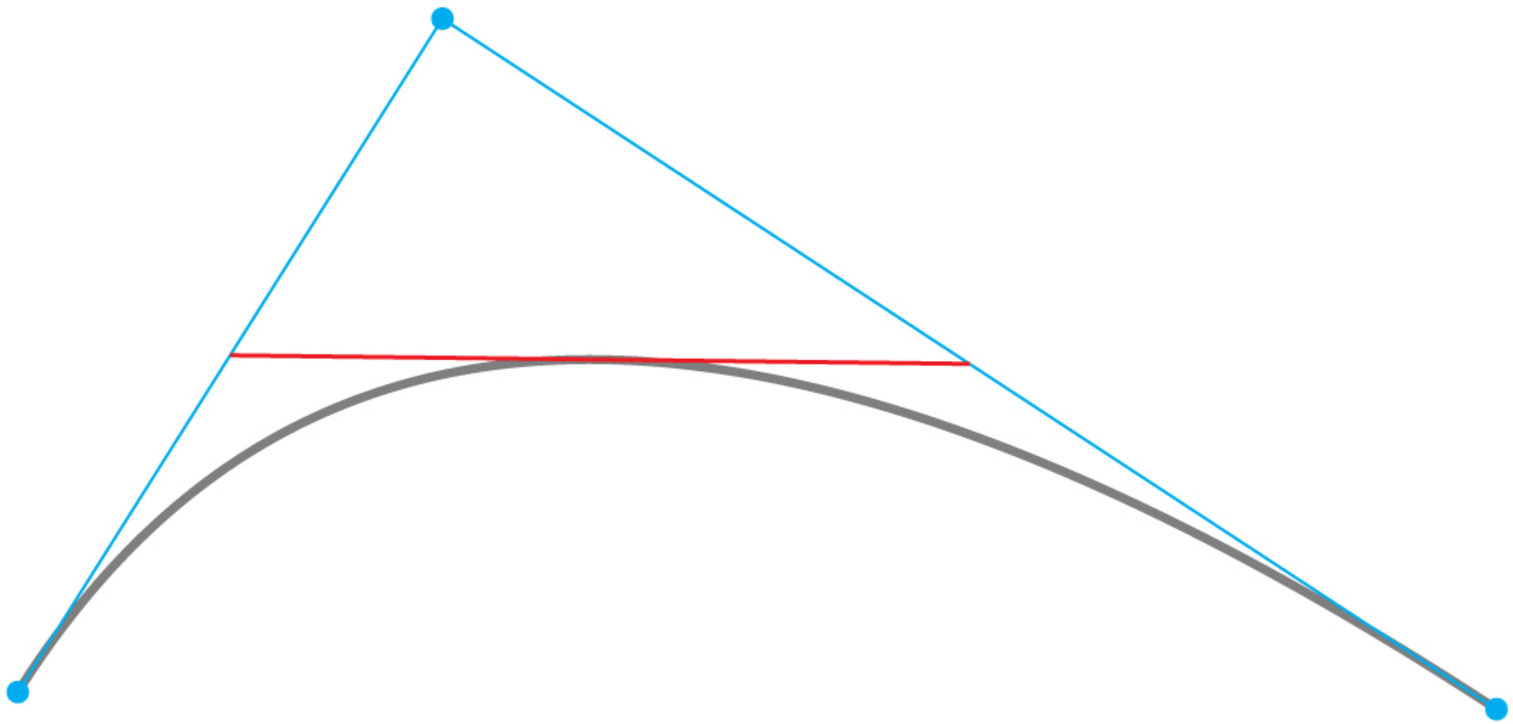
3-Point control polygon

CURVATURE
bezier curves and de castljau's algorithm



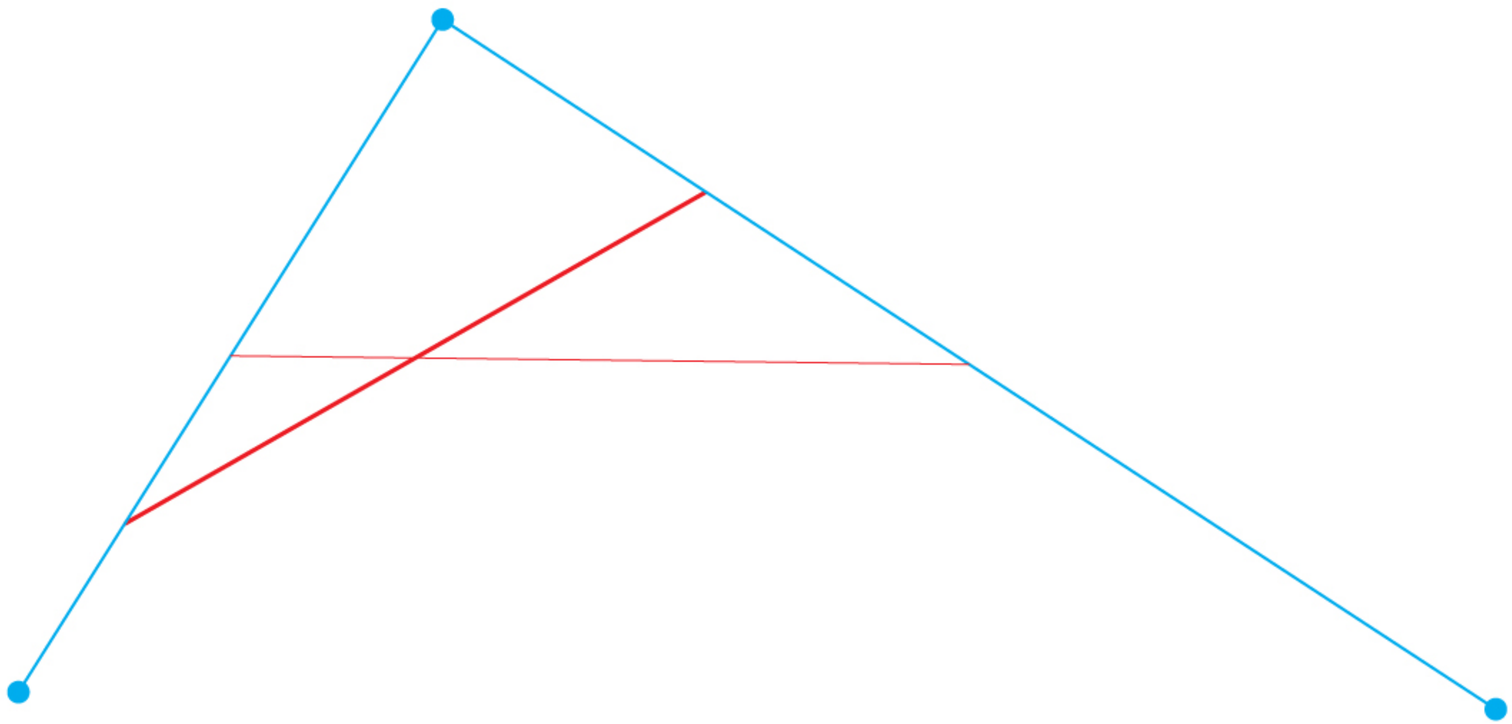
Line connecting mid-points of control polygon legs

CURVATURE
bezier curves and de castljau's algorithm



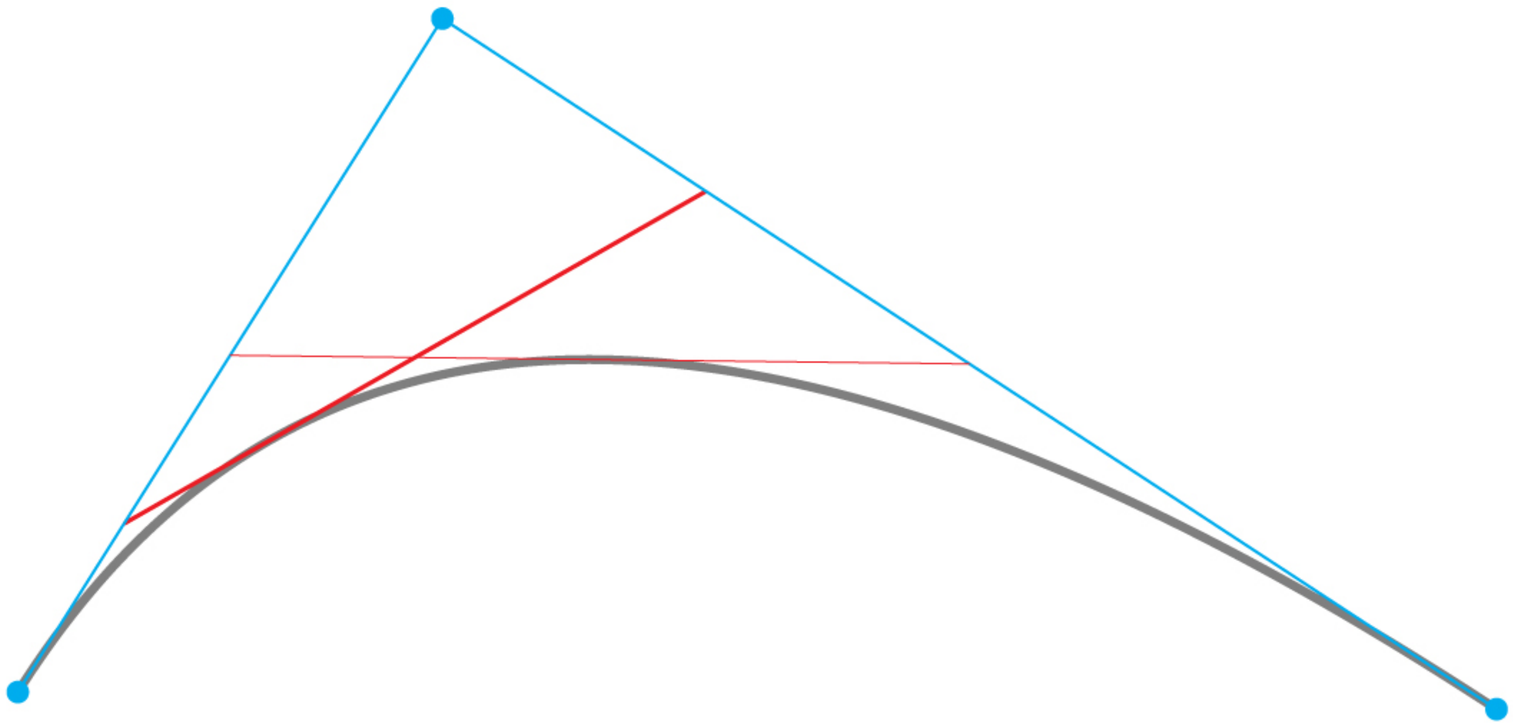
Bezier lies tangent to the mid-point of this line

CURVATURE
bezier curves and de castljau's algorithm



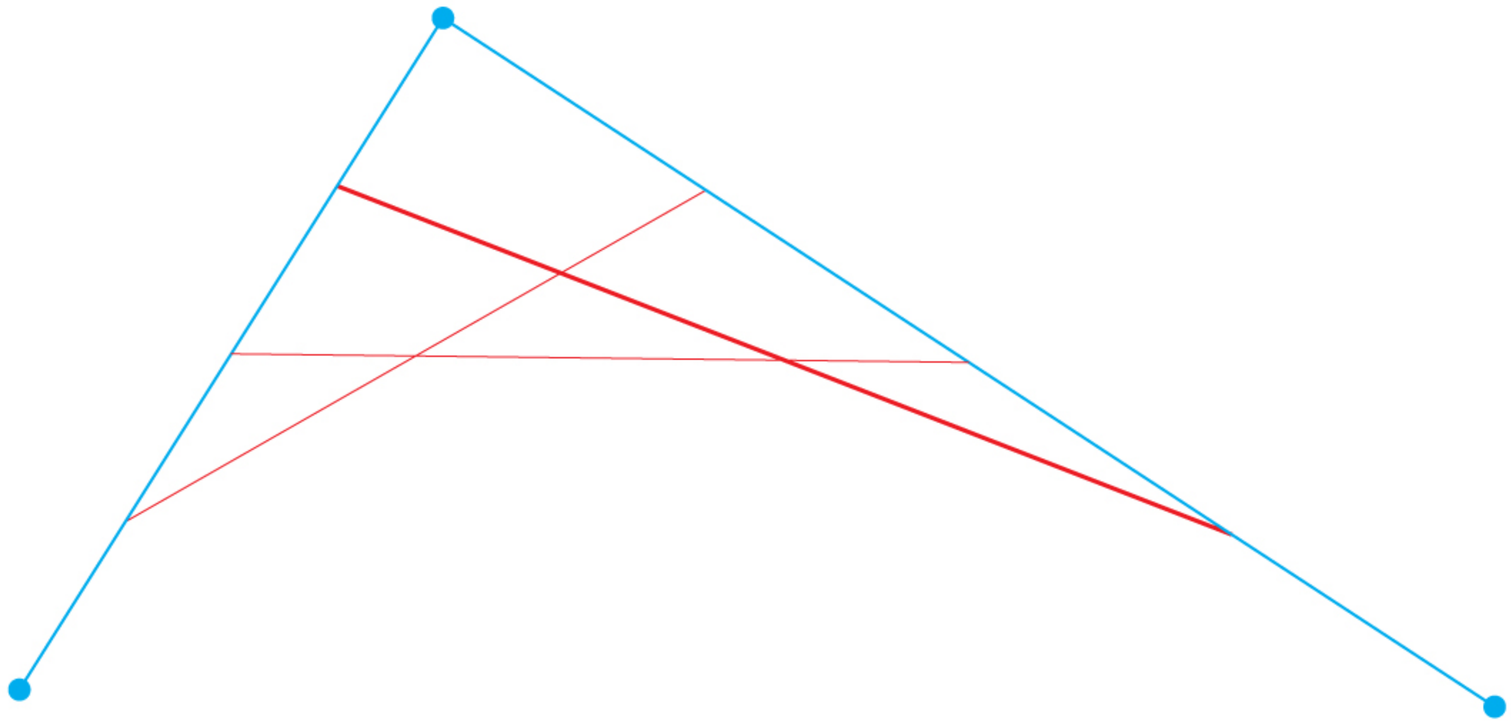
Line connecting quarter-points of control polygon legs

CURVATURE
bezier curves and de castljau's algorithm



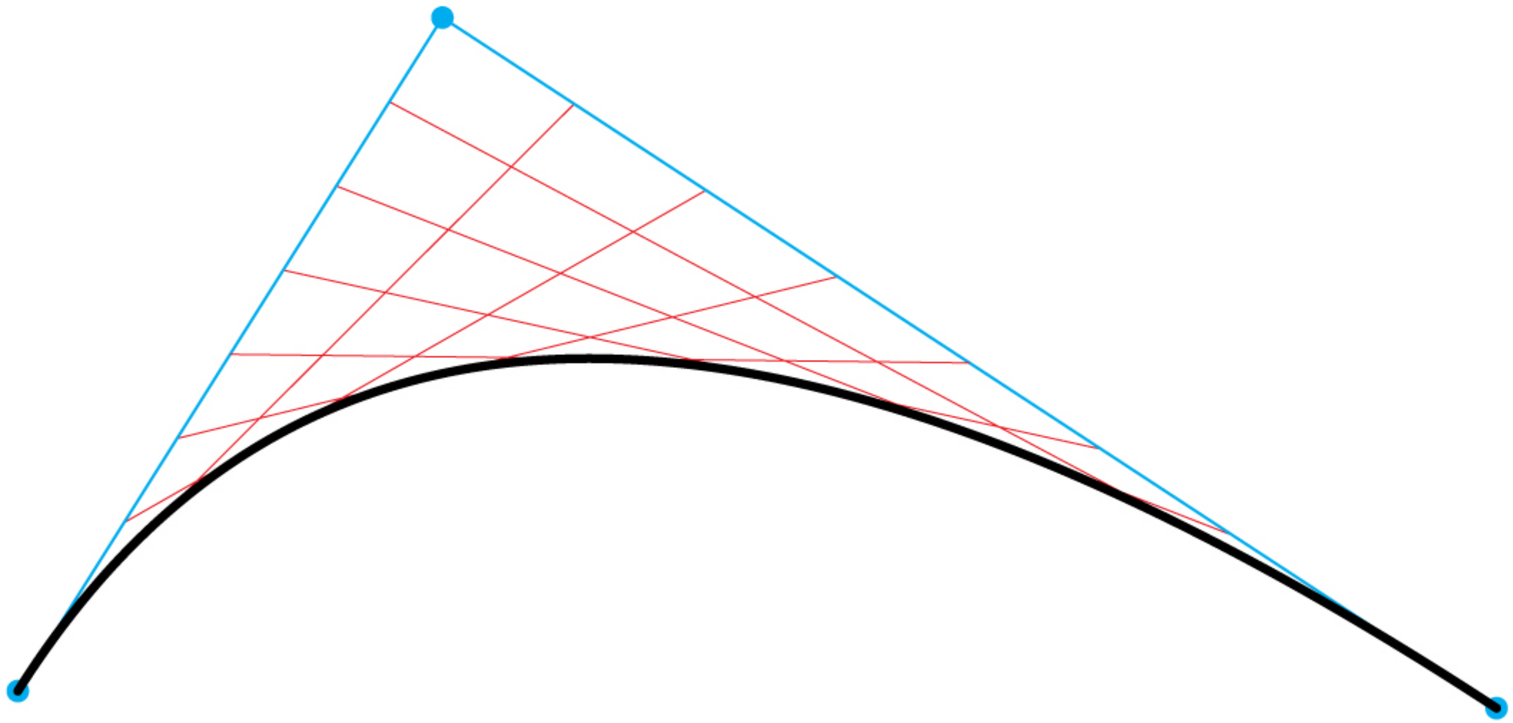
Bezier lies tangent to the quarter-point of this line

CURVATURE
bezier curves and de castljau's algorithm



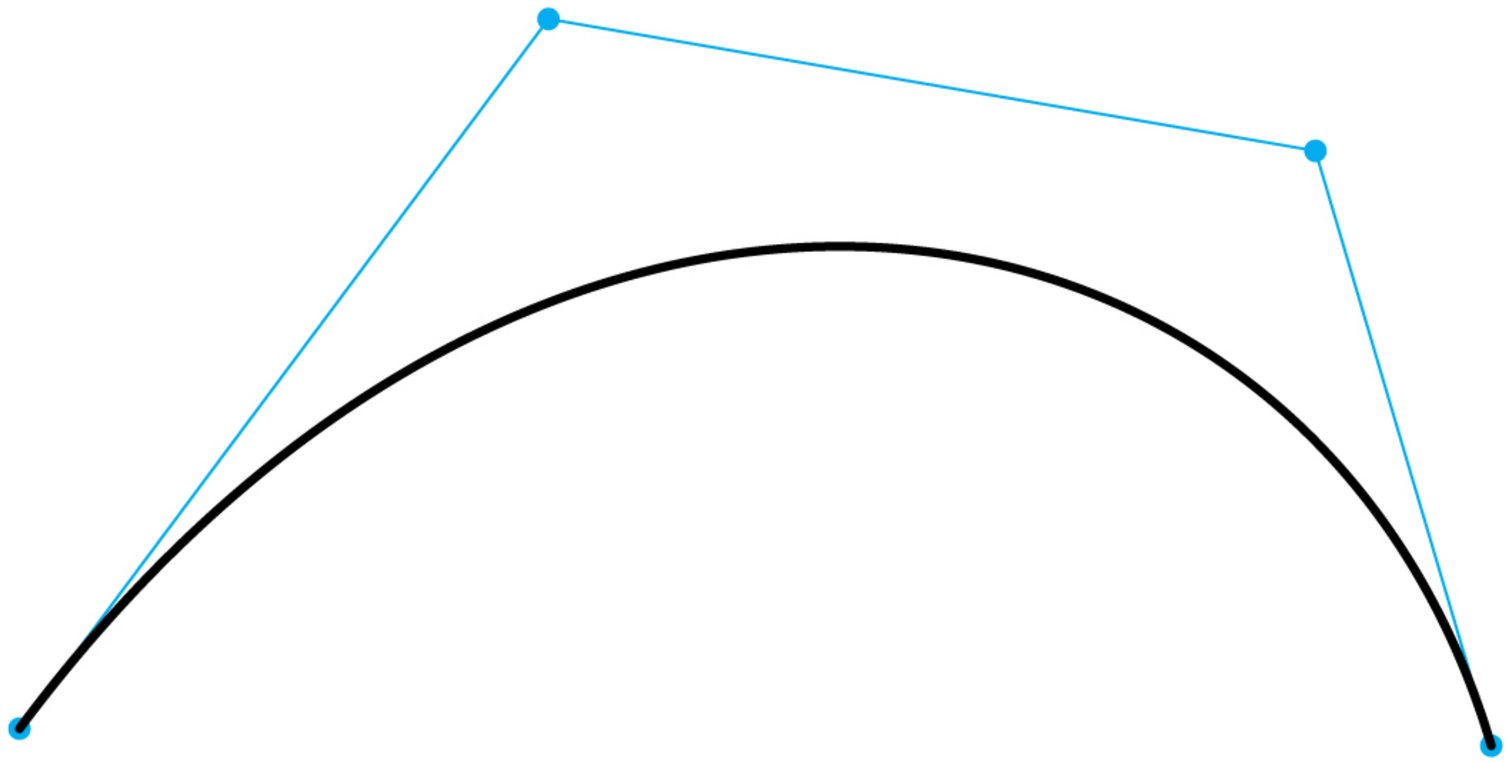
Line connecting three-quarter-points of control polygon legs

CURVATURE
bezier curves and de castljau's algorithm



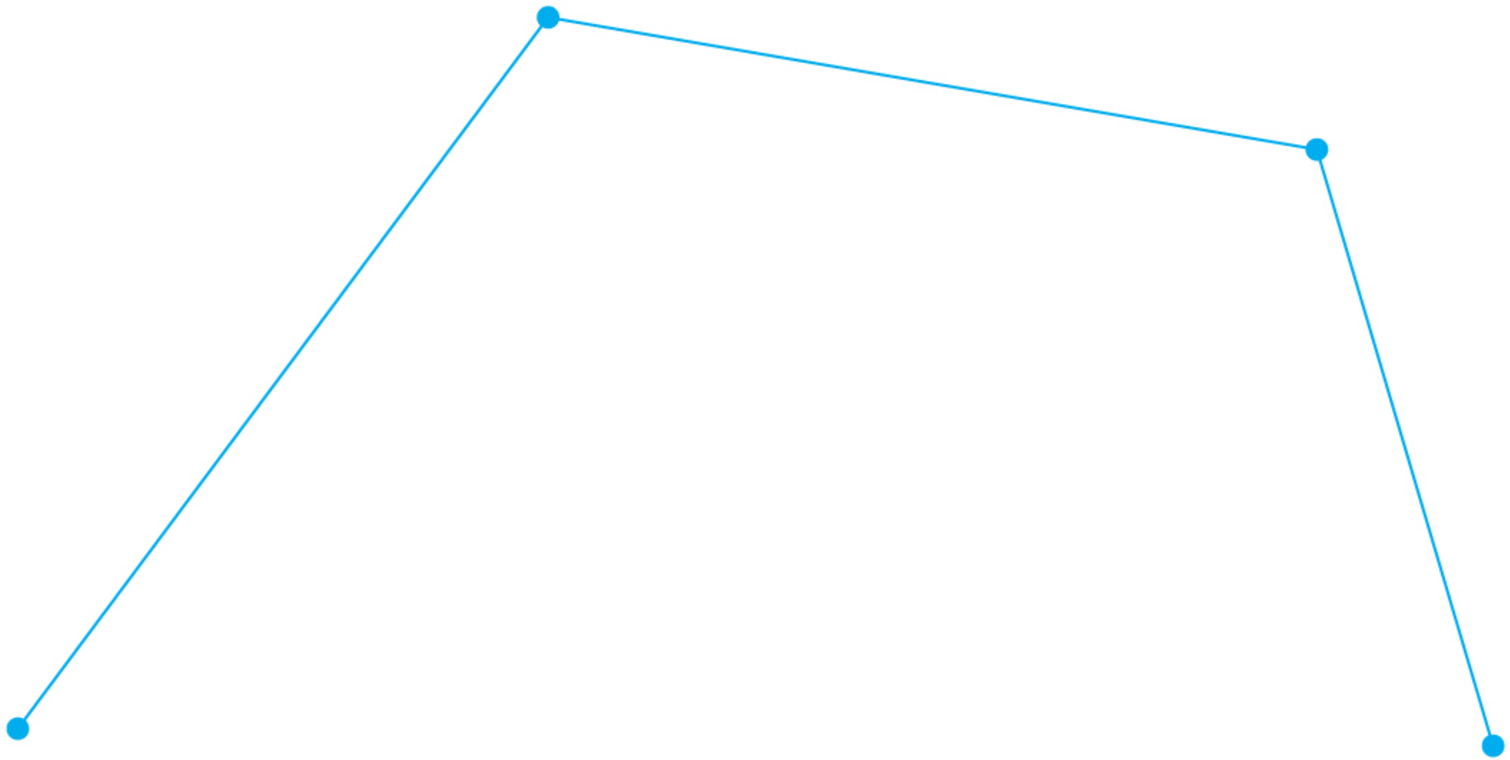
Bezier = Limit as N approaches infinity

CURVATURE
bezier curves and de castljau's algorithm



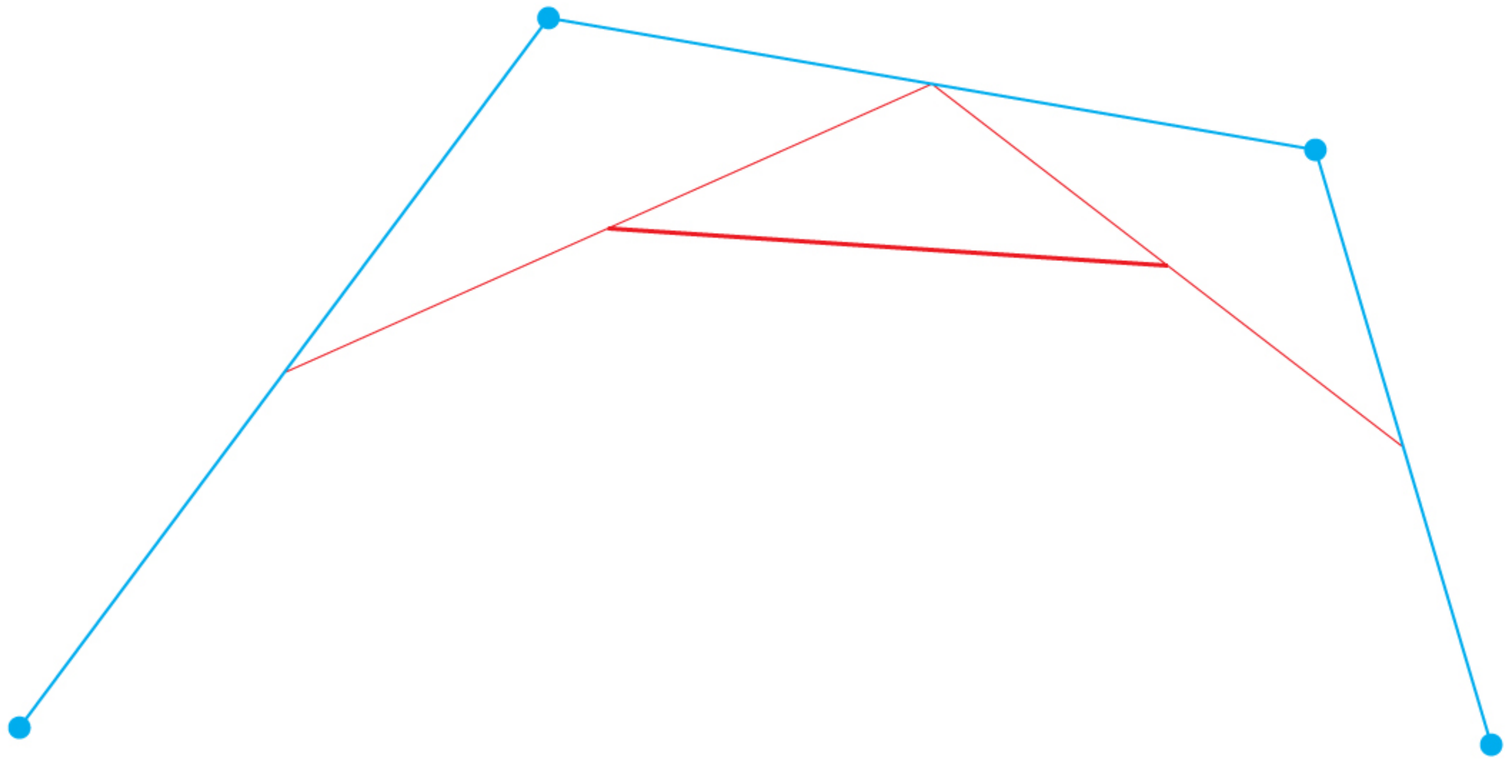
Bezier Curve with 4-point control polygon

CURVATURE
bezier curves and de castljau's algorithm



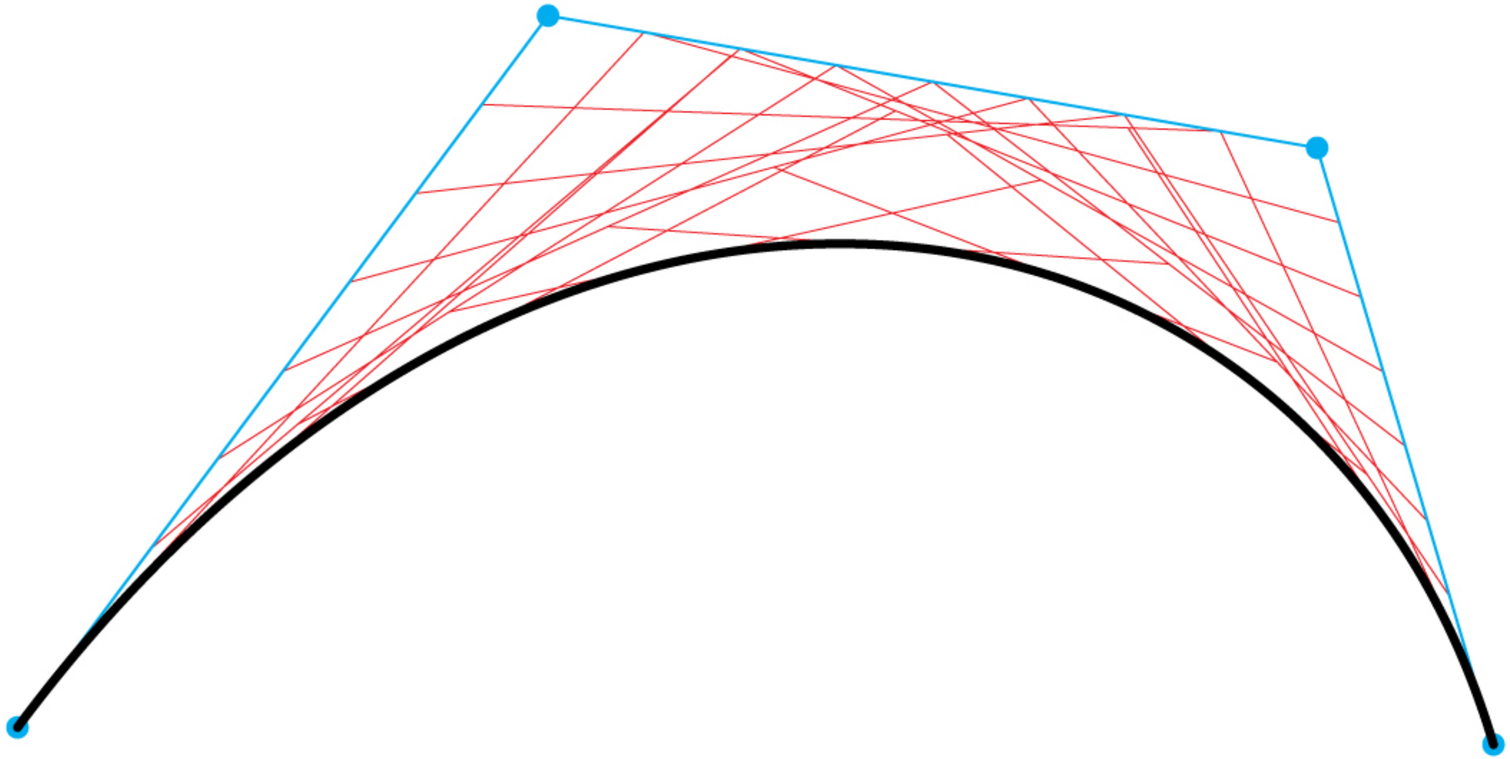
4-point control polygon

CURVATURE
bezier curves and de castljau's algorithm



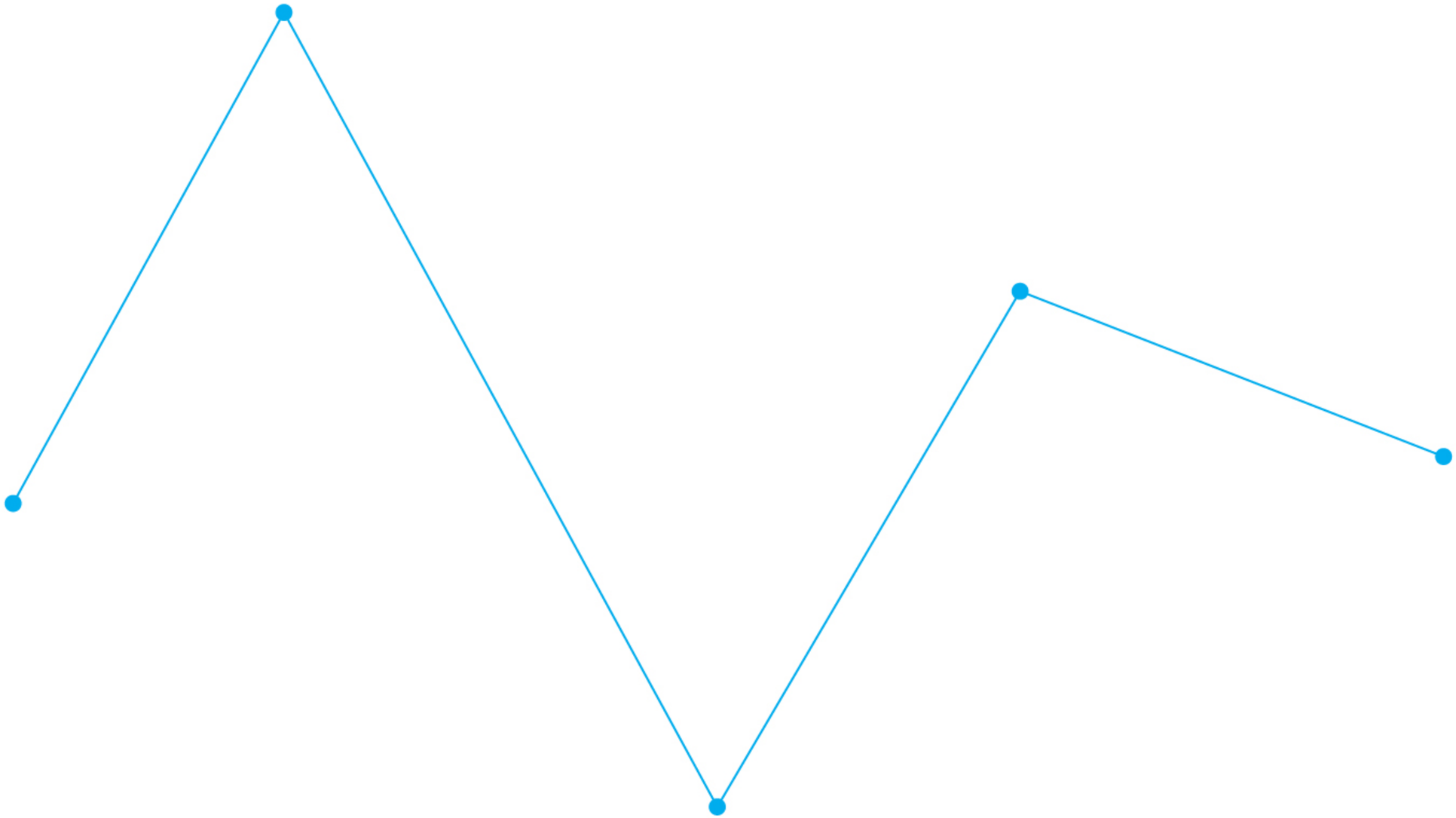
Line connecting mid-points of lines connecting mid-points of control polygon legs

CURVATURE
bezier curves and de castljau's algorithm



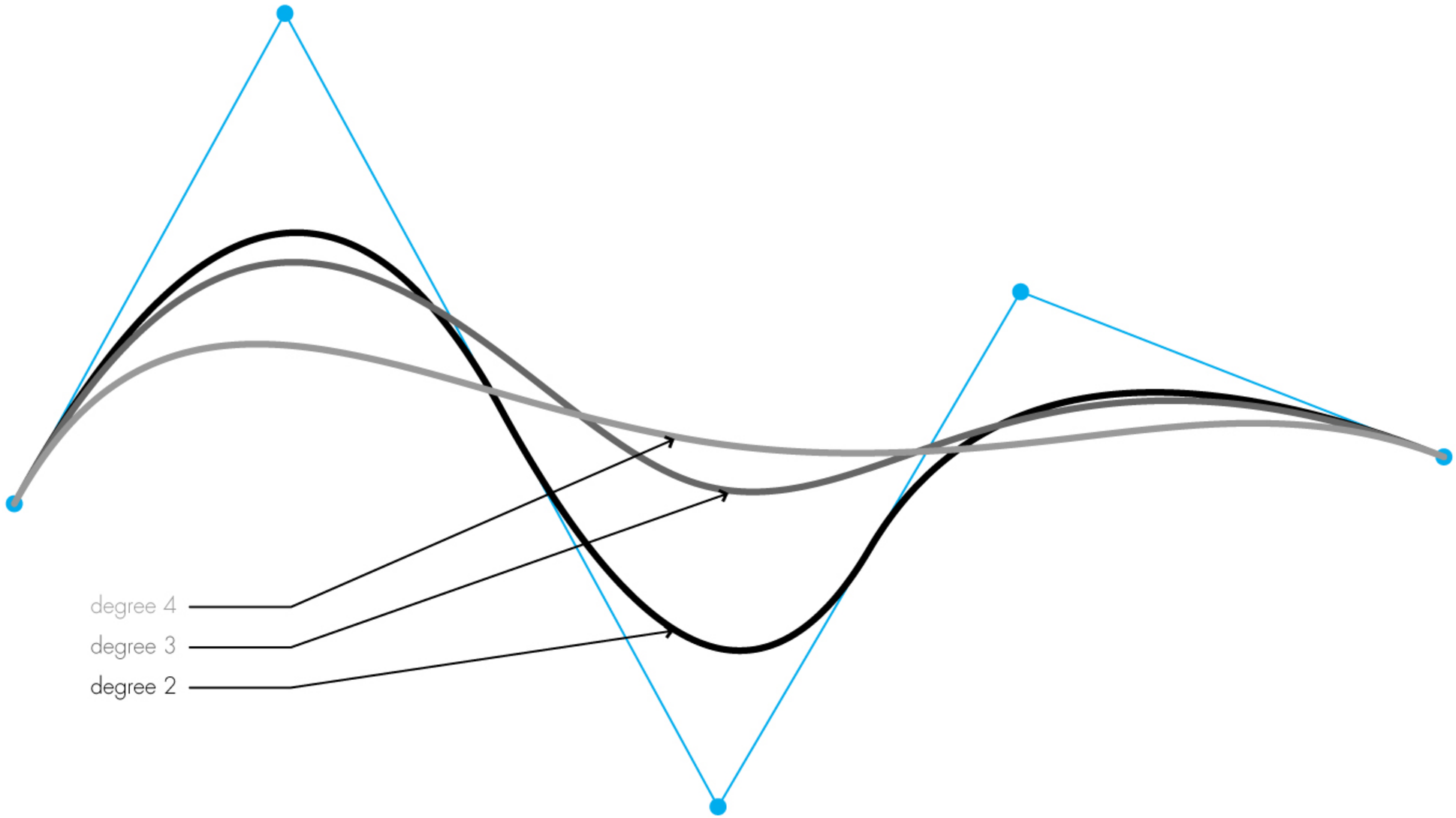
Bezier = Limit as N approaches infinity

CURVATURE
nurbs: non-uniform rational b-spline



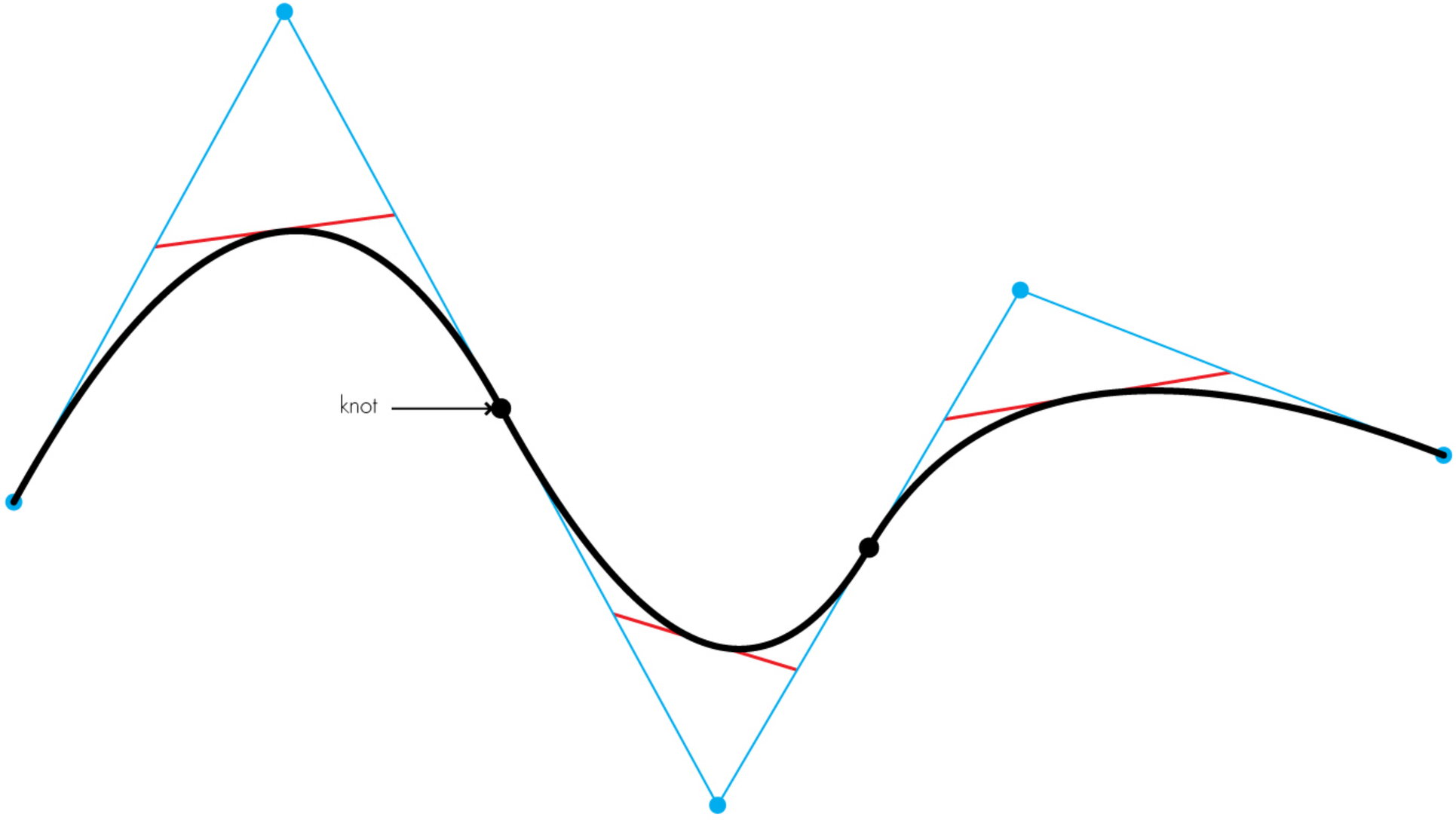
Control Polyon

CURVATURE
nurbs: non-uniform rational b-spline



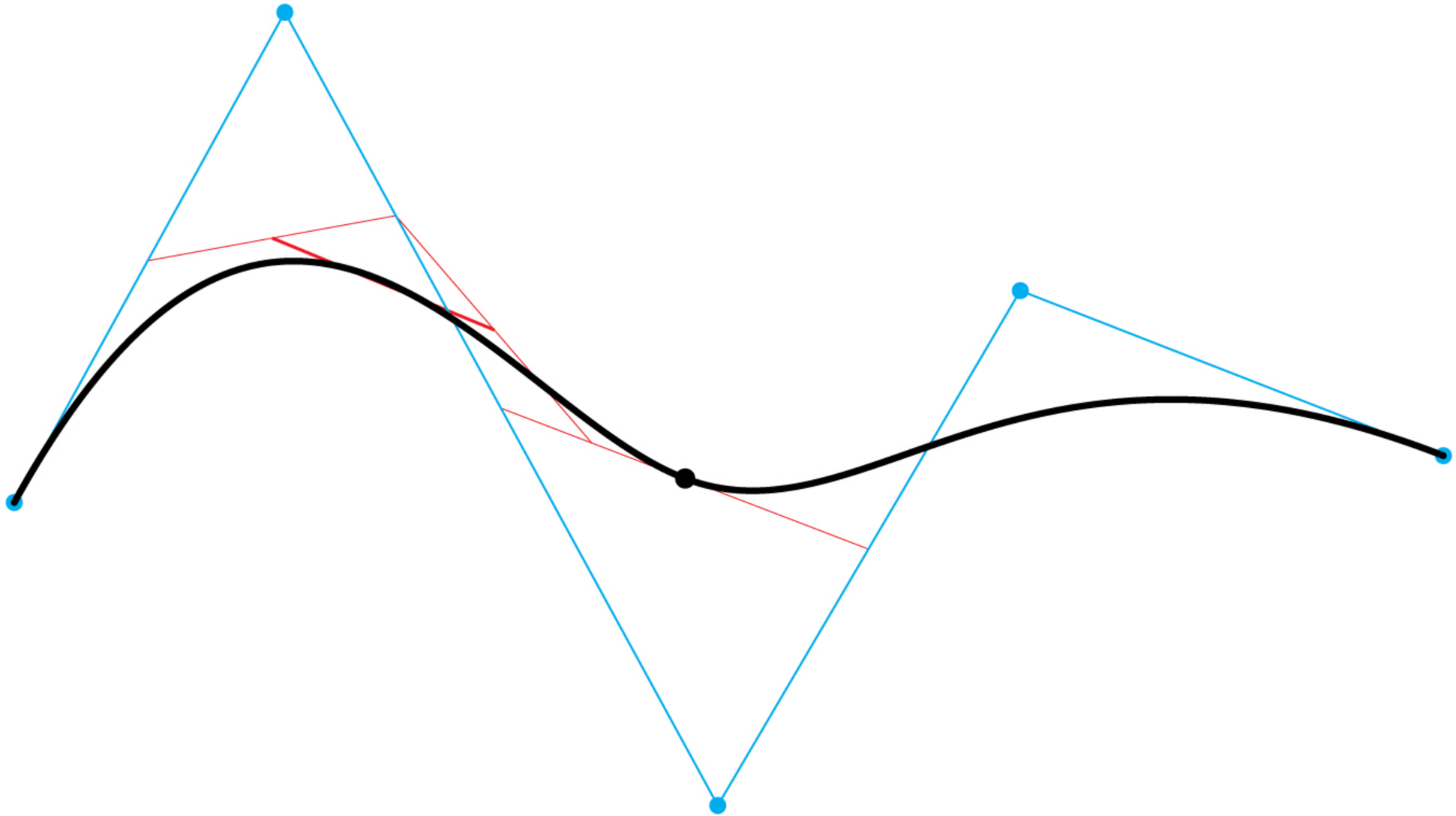
Nurbs Curves

CURVATURE
nurbs: non-uniform rational b-spline



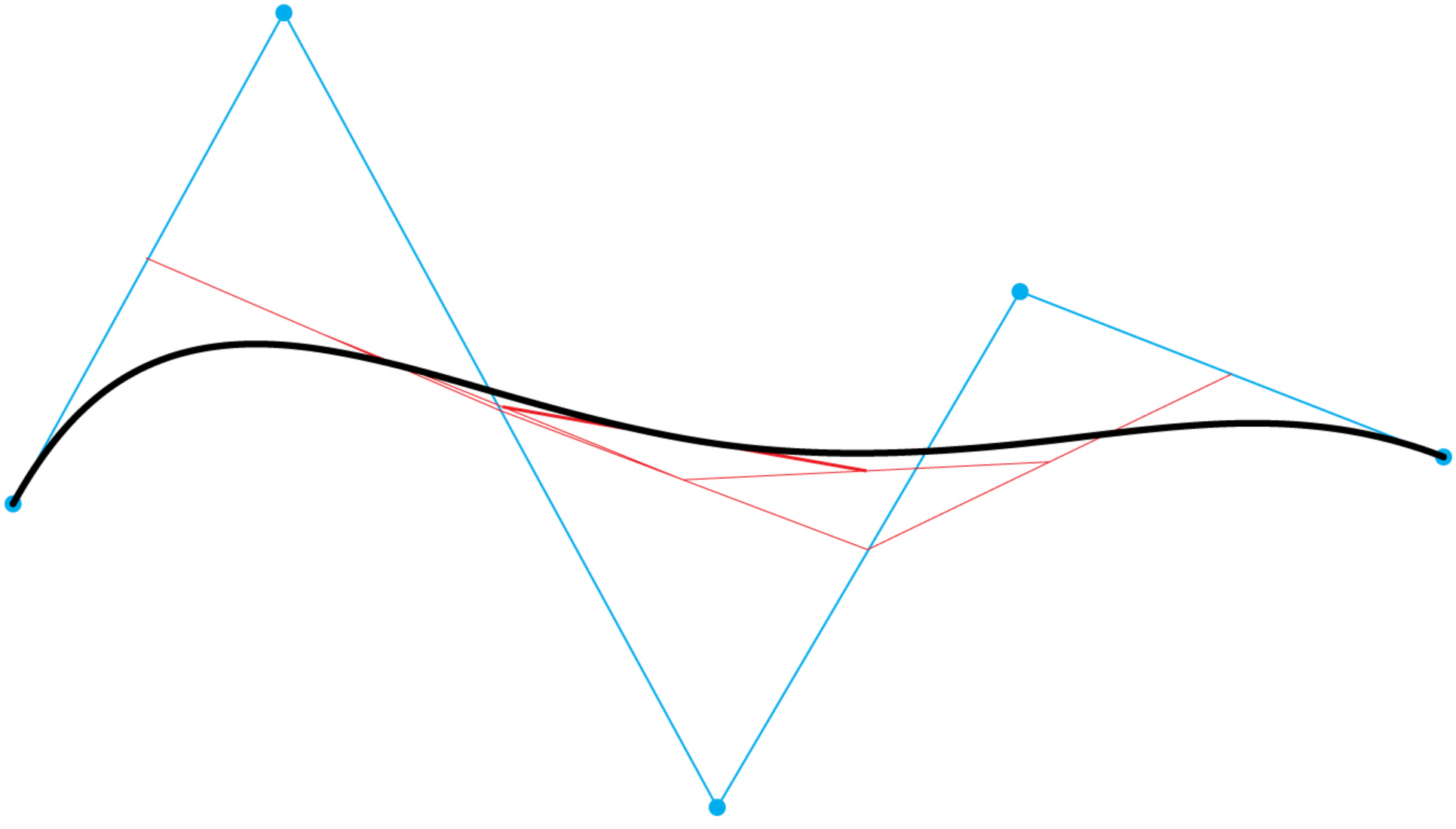
Degree 2 Nurbs Curve

CURVATURE
nurbs: non-uniform rational b-spline



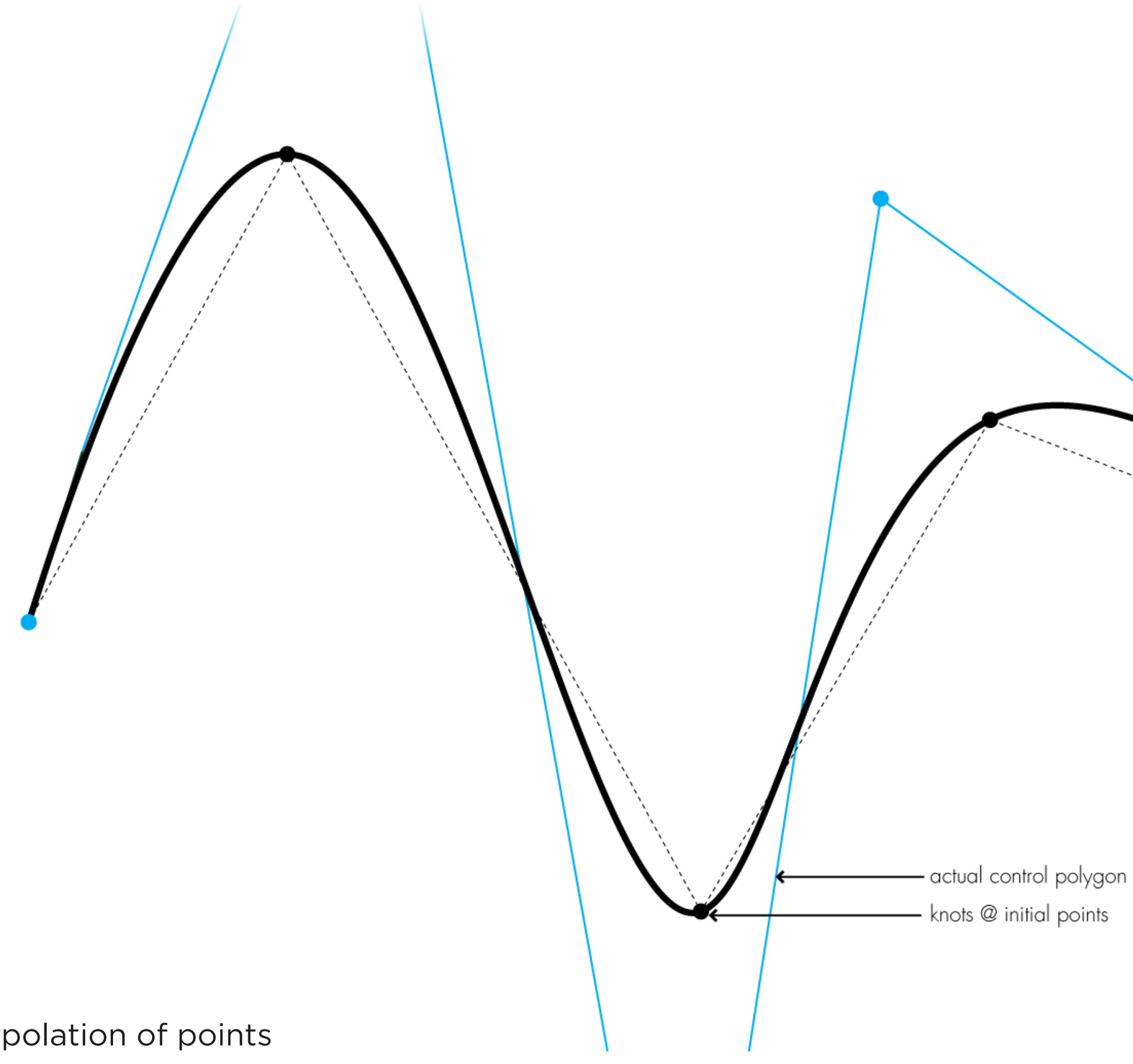
Degree 3 Nurbs Curve (default)

CURVATURE
nurbs: non-uniform rational b-spline



Degree 4 Nurbs Curve

CURVATURE
nurbs: non-uniform rational b-spline



Nurbs by Interpolation of points

See also *Architectural Geometry* for b-spline and subdivision curve calculations

Possible Resources

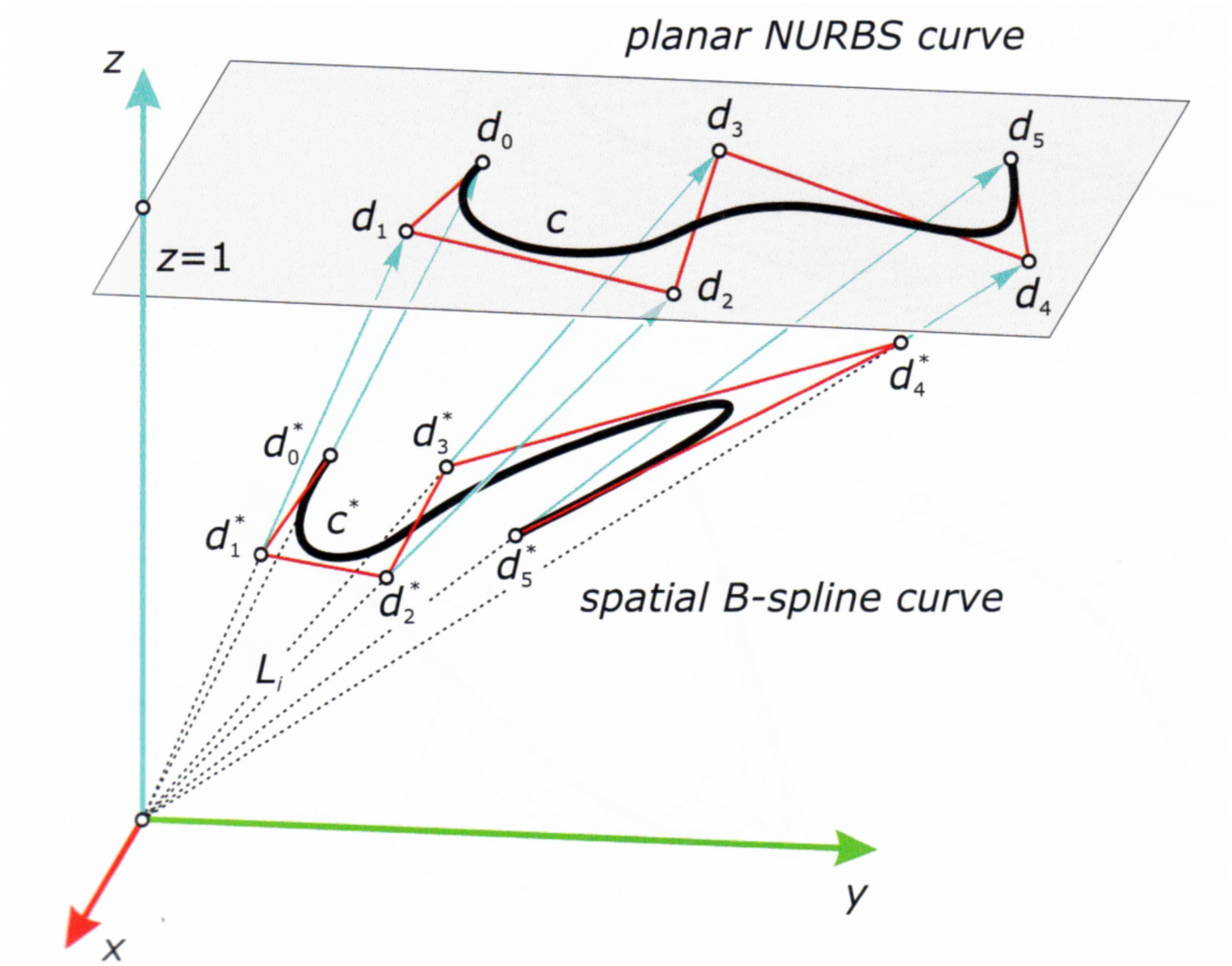
In Technique:

- Pottaman, Asperil, Hofer, Kilian: *Architectural Geometry* (Ch. 8)

In Discourse:

- Greg Lynn: *Animate Form* (introduction)
- Brandon Clifford: *In Defense of the Curve*

CURVATURE
nurbs: non-uniform rational b-spline



Images: *Architectural Geometry*, Bentley Institute Press 2007. (Axel Kilian, Helmut Pottman et al.)

4.105 Geometric Disciplines and Architecture Skills: Reciprocal Methodologies
Fall 2012