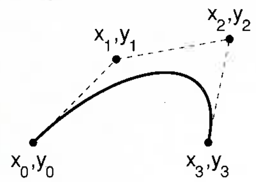
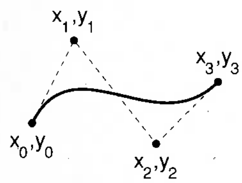
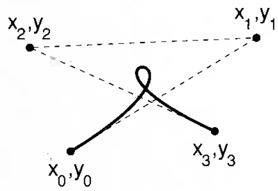
curveto $x_1\ y_1\ x_2\ y_2\ x_3\ y_3$ **curveto** –







adds a Bézier cubic section to the current path between the current point, referred to here as (x_0, y_0), and the point (x_3, y_3), using (x_1, y_1) and (x_2, y_2) as the Bézier cubic control points. After constructing the curve, **curveto** makes (x_3, y_3) become the new current point. If the current point is undefined (because the current path is empty), **curveto** executes the error **nocurrentpoint**.

The four points define the shape of the curve geometrically. The curve starts at (x_0, y_0), it is tangent to the line from (x_0, y_0) to (x_1, y_1) at that point, and it leaves the point in that direction. The curve ends at (x_3, y_3), it is tangent to the line from (x_2, y_2) to (x_3, y_3) at that point, and it approaches the point from that direction. The lengths of the lines (x_0, y_0) to (x_1, y_1) and (x_2, y_2) to (x_3, y_3) represent in some sense the 'velocity' of the path at the endpoints. The curve is always entirely enclosed by the convex quadrilateral defined by the four points.

The mathematical formulation of a Bézier cubic curve is derived from a pair of parametric cubic equations:

$$x(t) = a_x t^3 + b_x t^2 + c_x t + x_0$$
$$y(t) = a_y t^3 + b_y t^2 + c_y t + y_0$$

The cubic section produced by **curveto** is the path traced by $x(t)$ and $y(t)$ as t ranges from 0 to 1. The Bézier control points corresponding to this curve are:[1]

$$x_1 = x_0 + c_x/3 \qquad y_1 = y_0 + c_y/3$$
$$x_2 = x_1 + (c_x + b_x)/3 \qquad y_2 = y_1 + (c_y + b_y)/3$$
$$x_3 = x_0 + c_x + b_x + a_x \qquad y_3 = y_0 + c_y + b_y + a_y$$

ERRORS:
limitcheck, nocurrentpoint, stackunderflow, typecheck

SEE ALSO:
lineto, moveto, arc, arcn, arcto

[1]For a more thorough treatment of the mathematics of Bézier cubics, see J. D. Foley and A. Van Dam, *Fundamentals of Interactive Computer Graphics*, Addison-Wesley, 1982.