

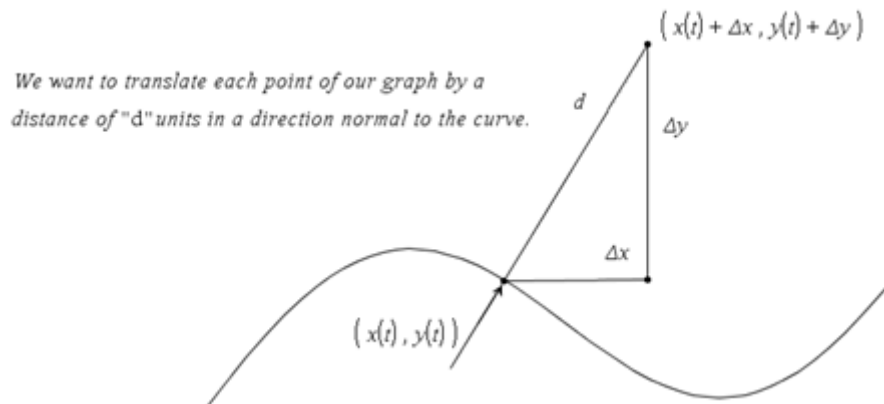
Calculus Challenge Problem #6

Due January 20, 2010

Exploring “Parallel” Curves

We know that the graph of $y = f(x) + d$ is d units above the graph of $y = f(x)$, but you wouldn't say that the two curves were “parallel”. The two curves are not d units apart because the distance d between them is measured vertically instead of perpendicular to the curve $y = f(x)$. Can you find the equation of the curve that is always 1 unit away (perpendicular) from $y = x^2$. This challenge is to find a way to construct a curve any given distance from a specified curve. This problem is most easily done in parametric form.

Given a curve defined parametrically by $x = f(t)$ and $y = g(t)$, find the equations of the curve that is always d units away.



Try your solution on a variety of curves and values of d and comment on any peculiarities or problem points you see. Include in your solution the most interesting graphs you find and I'll include the best in my solution page.

If you need software to make the graphs, Winplot (which you can download it free from <http://math.exeter.edu/rparris/winplot.html>) will allow you to graph your original curve and your “parallel” curve parametrically.