Another example

Solve for a root of $x^3+x^2-1=0$ between 0 and 1. Note that if $f(x)=x^3+x^2-1$, then $f(0)=-1<0<1=f(1)$.

Trial and error yields the equivalent expressions

$$f(x)=0 \iff x=\sqrt{\frac{1}{x+1}}=g(x)$$

Now $f(0.5)=-0.625$, so the root actually lies between $\frac{1}{2}$ and 1. Check that $|g'(x)|\leq\sqrt{\frac{2}{27}}$ on this interval. If we set $x_0=$

and $x_{n+1}=g(x_n)$, then we get (to 7 places)

$x_2 = 0.7653669$
$x_4 = 0.7553612$
$x_6 = 0.7549000$
$x_8 = 0.7548787$
$x_{10} = 0.7548777$

(and further approximations to 7 places are the same as x_{10}).