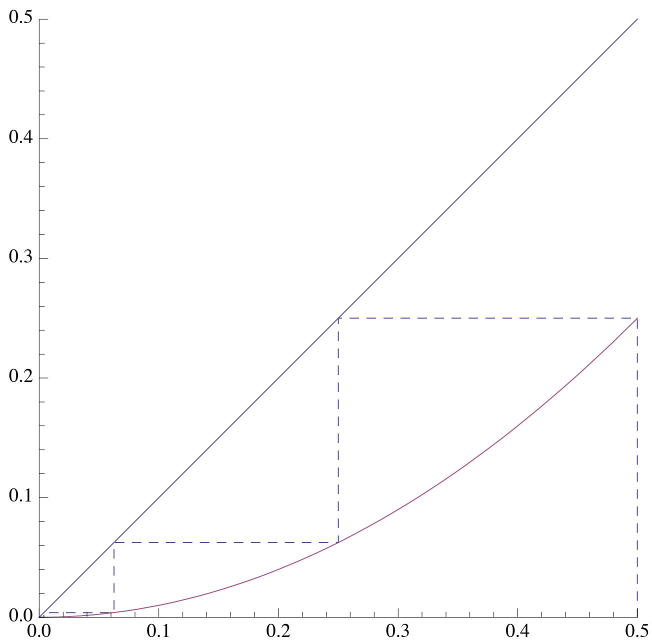
Cobweb plots for Homework #1

- **Exercise E1 cobweb plots :**

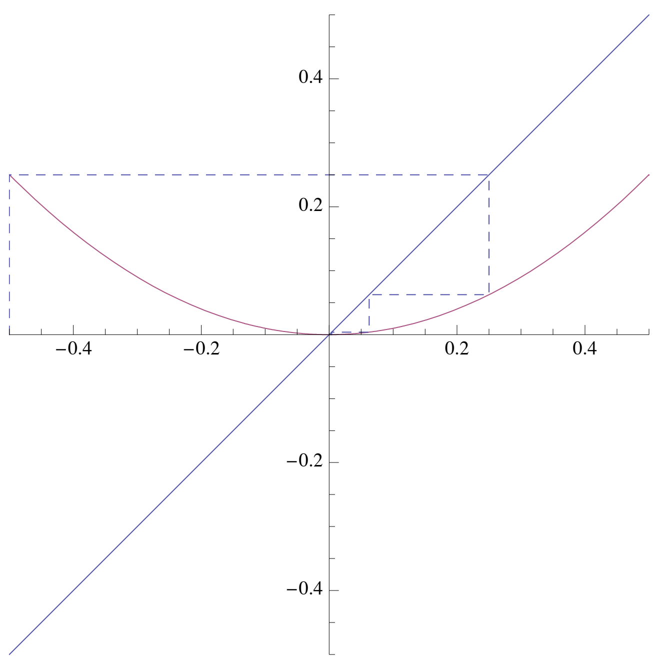
In[10]:= **cobweb**$\left[\#^2\ \&,\ \frac{1}{2},\ \left\{0,\ \frac{1}{2}\right\},\ 5\right]$

Out[10]=



In[11]:= **cobweb**$\left[\#^2\ \&,\ -\frac{1}{2},\ \left\{-\frac{1}{2},\ \frac{1}{2}\right\},\ 5\right]$

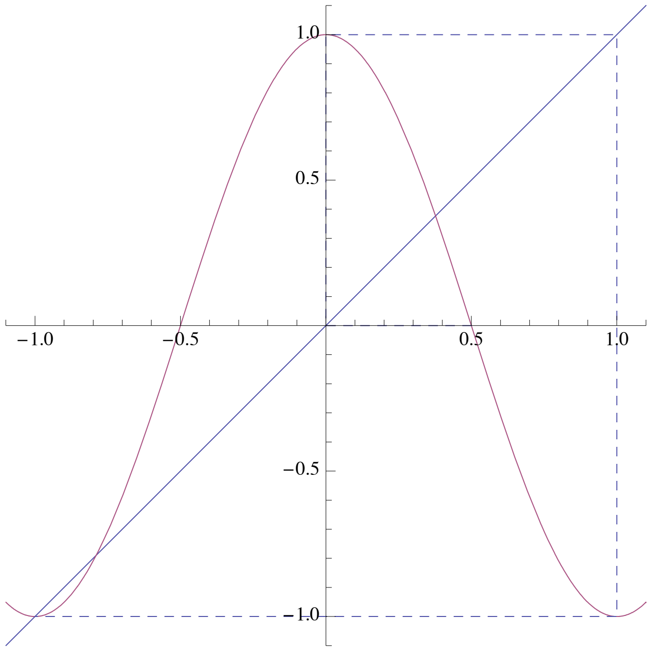
Out[11]=



- **Exercise E2 cobweb plots :**

In[17]:=
```
cobweb[Cos[π #] &, 1/2, {-1.1, 1.1}, 7]
```

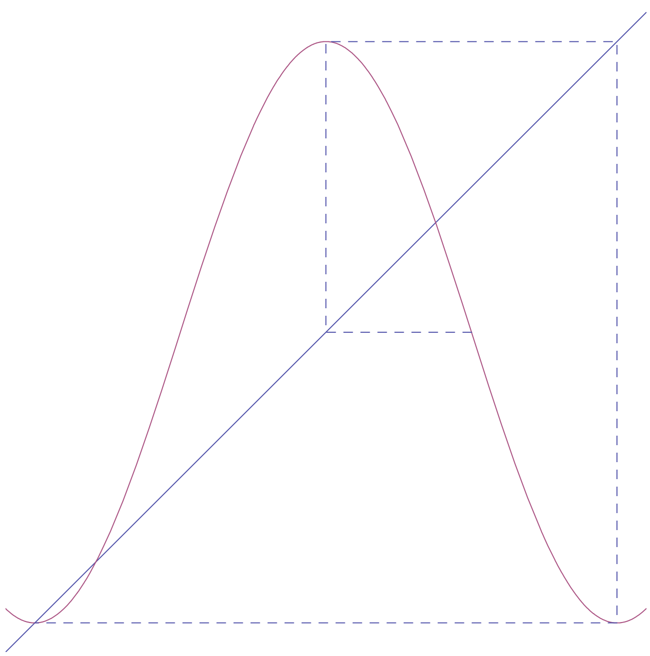
Out[17]=



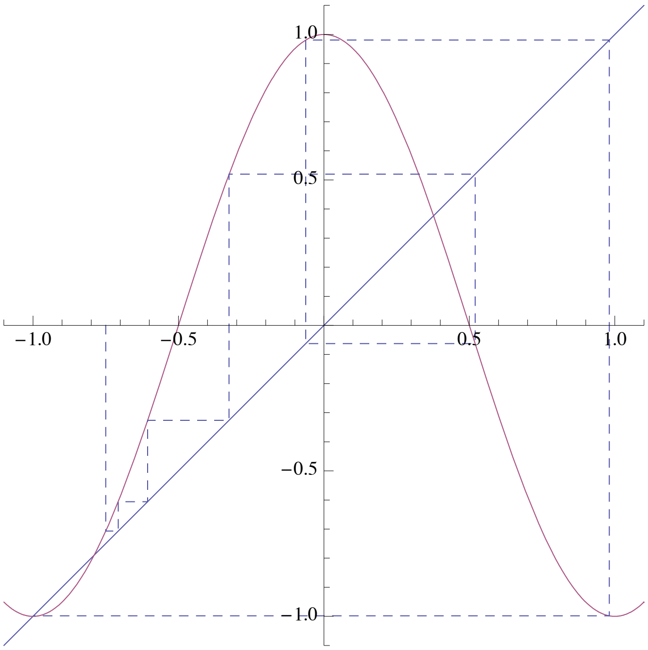
The first few line segments are obscured by the coordinate axes, so we can redisplay the plot with the axes suppressed :

In[18]:=
```
Show[%, Axes → False]
```

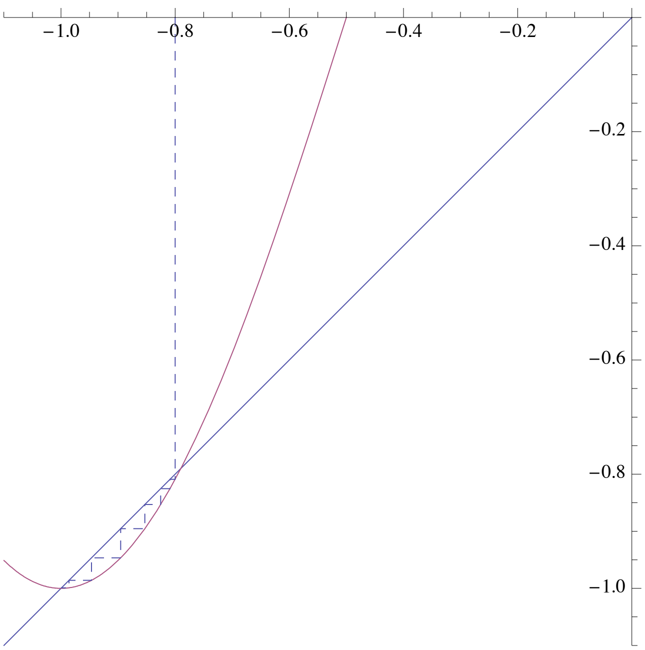
Out[18]=



In[19]:= `cobweb[Cos[π #] &, -3/4, {-1.1, 1.1}, 7]`

Out[19]=


In[23]:= `cobweb[Cos[π #] &, -4/5, {-1.1, 0}, 7]`

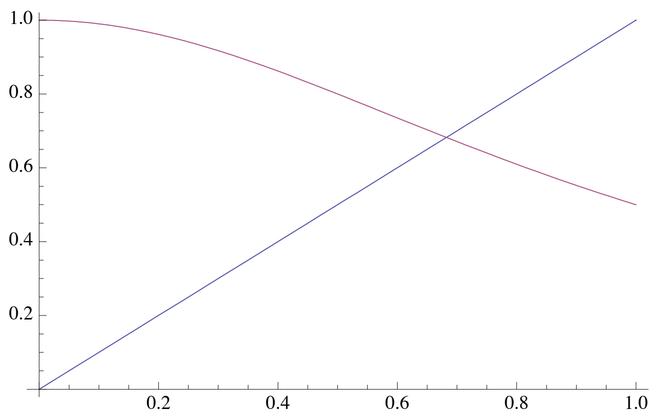
Out[23]=


Approximating fixed points

You can use *Mathematica*'s FindRoot function to numerically approximate solutions of nonlinear equations. For example, to approximate the fixed points of $f(x) = \frac{1}{1+x^2}$, we could plot f(x) and x and look for intersections of the graphs:

In[41]:= $\text{Plot}\left[\left\{x, \frac{1}{1+x^2}\right\}, \{x, 0, 1\}\right]$

Out[41]=



(Since $0 < f(x) < 1$ unless $x = 0$, we only need to look for intersections between 0 and 1.)
There is an intersection near $\frac{2}{3}$, so we take that as our initial guess for FindRoot :

In[43]:= $\text{FindRoot}\left[\frac{1}{1+x^2} == x, \left\{x, \frac{2}{3}\right\}\right]$

Out[43]= $\{x \to 0.682328\}$

We can substitute this value into the derivative of f to see if we have a sink or source :

In[44]:= $D\left[\frac{1}{1+x^2}, x\right]$ /. %

Out[44]= -0.635344

Sink! Here's a sample cobweb plot:

In[46]:= `cobweb[` $\frac{1}{1+\#^2}$ `&, 1, {0, 1}, 10]`

Out[46]=