

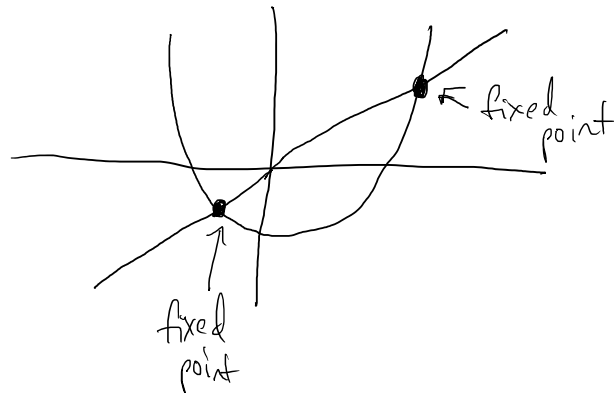
To find fixed points, let  $f(x)=x$  and find roots, or find points of intersection of  $f(x)$  and  $y=x$ .

ex:  $f(x) = x^2 - 1$  roots are  $x=1$  and  $x=-1$

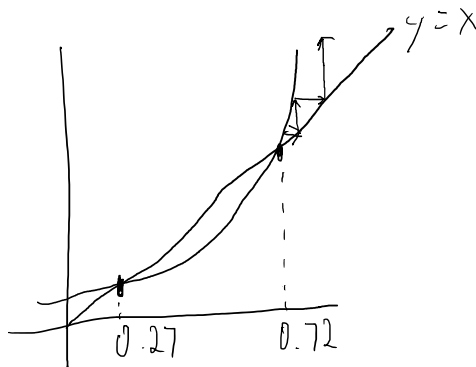
fixed points:  $x = x^2 - 1$

$$\Rightarrow 0 = x^2 - x - 1$$

$$\Rightarrow x = \frac{1 \pm \sqrt{5}}{2}$$



ex:



$$g(x) = x^2 + 0.2$$

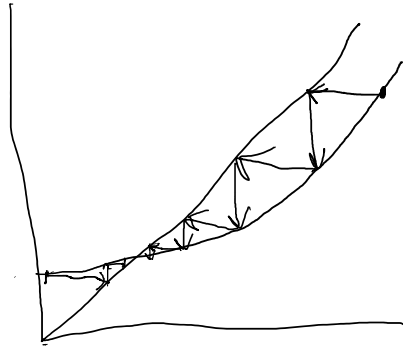
$$x = x^2 + 0.2$$

$$0 = x^2 - x + 0.2$$

← unstable fixed point  
 (can never converge to 0.72)

# How To DRAW COBWEB DIAGRAMS

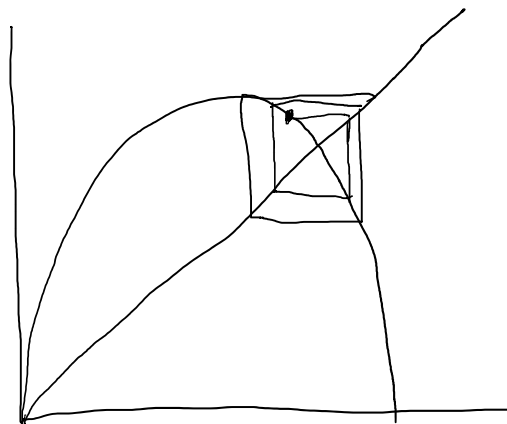
- ① start on x-axis with initial guess  $x_0$   
Repeat next 2 steps for  $i=1,2,\dots$   
until reach a fixed point or non-convergence  
discovered.



note: can  
converge to 0.27  
from both sides;  
stable fixed point

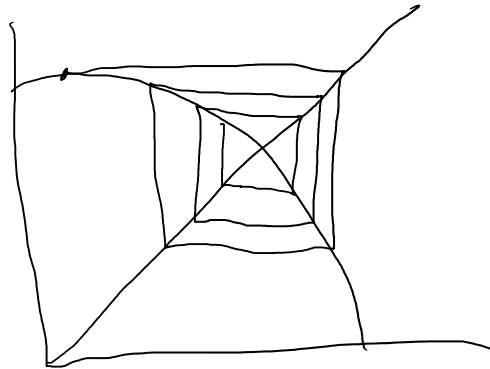
- i) find  $x_{i+1}$  by moving horizontally until  
you hit  $y=x$  line
- ii) find  $g(x_{i+1})$  by moving vertically

ex:  $g(x) = 3.1x(1-x)$ , initial guess  $x_0 = 0.62$



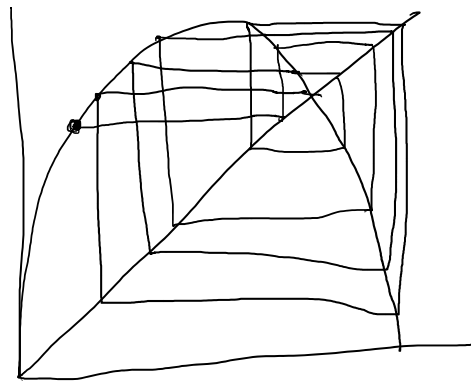
diverges

ex:  $g(x) = 1.5 - 0.4x^2$ ,  $x_0 = 0.2$



Converges

ex:



converges, but  
with chaos