Assignment 1: Drawing functions

Foundations of Neural and Cognitive Modelling

1-11-2013

Exercise 1 *Draw (qualitatively) the solutions to the following two equations:*

$$-\frac{1}{c}(x - a + by) = 0 \qquad\qquad c\left(x - \frac{1}{3}x^3 + y + i\right) = 0$$

where you may assume that all parameters a, b, c and i are larger than 0 (or, if you prefer concrete numbers, assume $a = 0.7, b = 0.8, c = 3, i = 1.6$).

Hints:

- Because $-\frac{1}{c}z$ can only be 0 if $z = 0$, you can drop the $-\frac{1}{c}$ term.
- Because $(x - a + by)$ is only 0 when $x - a = -by$, you know that the first function to draw is the linear function $y = -\frac{1}{b}x + \frac{a}{b}$.
- For more complicated functions, remember that a 2nd degree polynomial yields a parabola (decreasing first, increasing later, or vice versa), and a third degree polynomial a 'cubic parabola' (with parabola as derivative: if it starts increasing, the increase will gradually become less (possibly become a decrease for a while), before growing again).
- Reason about what the functions will to when x goes to $-\infty$ and $+\infty$.

Exercise 2 *Check your solutions by plotting the functions in* `R`*, with parameters* $a = 0.7, b = 0.8, c = 3, i = 1.6$*.*

Hints:

- `R` is installed on most university computers. You can install it on your own machine by downloading it from `www.r-project.org/`.
- The easiest way to plot a function is by first generating a vector with x-coordinates. In this case, generate 101 x-values from -5 to $+5$ with the function `seq()` ("generate a sequence"):
  `x <- seq(-5,5,by=0.1)`
- You can set the parameters by simply typing:
  ```
  a=0.7
  b=0.8
  c=3
  i=1.6
  ```
- You can then generate a vector with the y-coordinates with help of the function `c()` ("generate a column vector"):
  `y = c(-(1/b)*x+(a/b))`
  (in newer versions of `R` simply typing $y = -(1/b) * x + (a/b)$ will also work).
- And plot the x, y pairs with `plot()` (with option 'line'):
  `plot(x,y,type='l')`
- The values of a second variable, say z can be plotted on top of the first with the function `lines()`:
  `lines(x,z)`