EMAT10001 Exercise Sheet 13.

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Exercise sheet

The difference between the work sheet and the exercise sheet is that the solutions to the exercise sheet won't be given and the problems are designed to be more suited to working on on your own, though you are free to discuss them in the work shop if you finish the work sheet problems. Selected problems from the exercise sheet will be requested as part of the continual assessment portfolio.

1. Solve
$$\frac{df}{dt} = 5f \tag{1}$$
with $f(0) = 12$.

2. Differentiate
$$f(x) = x^3 e^{x^3} \tag{2}$$

3. Solve
$$\frac{df}{dt} = 5(1 - f) \tag{3}$$
with $f(0) = 0$.

4. The growth equation is not a realistic model of growth if there is a finite resource the population requires, this might be food, or space, or available uninfected individuals. The Verhulst-Pearl equation is an alternative that includes a *carrying capacity* for the environment, growth depends not only on the population but the residual carrying capacity. A simple Velhulst-Pearl equation is
$$\frac{dP}{dt} = P(1 - P) \tag{4}$$
More complicated versions include constants which have been set to one here. Solving this equation is tricky, it involves direct integration and a partial fractions expansion. However, it is easier to check the solution is indeed a solution, the solution with $P(0) = 1/2$ is
$$P = \frac{1}{1 + \exp(-t)} \tag{5}$$
Check this.

Challenge

First three to get onto level five, that is complete four levels, of `http://www.pythonchallenge.com/` gets chocolate. Send a screenshot.