EMAT10001 Exercise Sheet 14.

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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. Revise differentiating; find df/dx of
   (a) $f(x) = 1 - \cos^2 x$.
   (b) $f(x) = 1/(1-x)$.
2. Calculate a Taylor series for $\cos x$.
3. Plot the behavior of different truncated Taylor series for $\cos x$ and compare them to $\cos x$ itself, truncate after one, two, four, eight and ten terms and plot over -2π to 2π.
4. We saw the natural log in last week's problem sheet, $\ln x = y$ means $x = e^y$. now prove using the chain rule that
$$\frac{d}{dx}\ln x = \frac{1}{x} \tag{1}$$
5. Calculate the Taylor series for $\ln(1+t)$ around $t = 0$.
6. Calculate a Taylor series for $1/(1-x)$. Test the accuracy of the series after three terms for $x = 0$, $x = 0.5$, $x = 0.75$ and $x = 0.9$.
7. Write a program to implement the Euler method and the second and fourth order Runge-Kutta methods for solving differential equations for $\dot{y} = f(y)$; use these to solve the equation $\dot{P} = P(1-P)$ mentioned last week and check the error of the various methods.

Challenge

First four to get onto level ten, that is have completed nine levels, of
`http://www.pythonchallenge.com/`
gets chocolate. Send a screenshot.