Mathematical appendix

A review of the math needed for this part of the course

Algebra:
      How to solve a linear equation
      How to read slope and intercept from a graph
         slope $= (y_2-y_1)/(x_2-x_1)$
         intercept $= (y_1x_2-y_2x_1)/(x_2-x_1)$
            reading from the graph is easier

Exponentials and logarithms

$$\frac{1}{e^a} = e^{-a}$$

$$e^a e^b = e^{a+b}$$

$$\frac{e^a}{e^b} = e^{a-b}$$

$$a \ln b = \ln b^a$$

$$\ln ab = \ln a + \ln b$$

$$\ln\left(\frac{a}{b}\right) = \ln a - \ln b$$

Calculus:
      How to differentiate some simple functions

$$\frac{d}{dx}(ax) = a$$

$$\frac{d}{dx}(ax^2) = 2ax$$

$$\frac{d}{dx}\left(\frac{a}{x}\right) = -\frac{a}{x^2}$$

$$\frac{d}{dx}(e^{ax}) = ae^{ax}$$

chain rule

$$\frac{dy}{dt} = \frac{dy}{dx}\frac{dx}{dt}$$

$$\frac{d}{dx}(gh) = g\frac{dh}{dx} + h\frac{dg}{dx}$$

$$\frac{d}{dx}\left(\frac{g}{h}\right) = \frac{h\frac{dg}{dx} - g\frac{dh}{dx}}{h^2}$$

How to integrate some simple functions
(in use one would either add a constant or integrate between limits)

$$\int a\,dx = ax$$

$$\int ax\,dx = \frac{ax^2}{2}$$

$$\int e^{ax}\,dx = \frac{e^{ax}}{a}$$

$$\int \frac{dx}{x} = \ln(x)$$

$$\int \frac{a}{x^2}\,dx = -\frac{a}{x}$$

Taylor series (approximation for small h)

$$f(x+h) = f(x) + h\frac{df}{dx}$$

e.g.   if $f = \ln$, $x = 1$, $h = \delta$

$$\ln(1+\delta) = \ln(1) + \delta\frac{1}{1} = \delta$$