SIO 103: Some useful math from way back when!

Logs:

$$ln(a) + ln(b) = ln(ab) \qquad ln(a) - ln(b) = ln(\frac{a}{b}) \qquad b\,ln(a) = ln(a^b)$$

$$e^{ln(a)} = a \qquad ln(e^a) = a$$

Differentiation:

$$\frac{d}{dx}(x^a) = ax^{a-1} \qquad \frac{d}{dx}(e^{ax}) = ae^{ax} \qquad \frac{d}{dx}u(y) = \frac{du}{dy}\frac{dy}{dx}$$

$$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx} \qquad \frac{d}{dx}(\frac{u}{v}) = -\frac{u}{v^2}\frac{dv}{dx} + \frac{1}{v}\frac{du}{dx}$$

Integration (don't forget constants of integration for indefinite integrals):

$$\int x^a\,dx = \frac{x^{a+1}}{a+1} + C \qquad \int \frac{1}{x}\,dx = ln(x) + C$$

$$\int \frac{dy}{dx}\,dx = y + C \qquad \int \frac{d^2y}{dx^2}\,dx = \frac{dy}{dx} + C \qquad \text{remember} \quad \frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{dy}{dx}\right)$$

$$\int e^{ax}\,dx = \frac{1}{a}e^{ax} + C$$

Binomial theorem:

$$(1+x)^n = 1 + nx + \frac{n(n-1)x^2}{2!} + \cdots$$

Taylor series:

$$y(x_0 + h) = y(x_0) + h\frac{dy}{dx}(x_0) + \frac{h^2}{2!}\frac{d^2y}{dx^2}(x_0) + \cdots$$