

# Generating $e$

Proof that:  $e = \lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n$

$$\rightarrow \log(1 + x) = x - \frac{x^2}{2} + \frac{x^3}{3} + \dots$$

$$\Rightarrow \log\left(1 + \frac{1}{n}\right) = \frac{1}{n} - \frac{1}{2n^2} + \frac{1}{3n^3} + \dots$$

$$\Rightarrow n \log\left(1 + \frac{1}{n}\right) = 1 - \frac{1}{2n} + \frac{1}{3n^2} + \dots$$

$$\Rightarrow \log\left(1 + \frac{1}{n}\right)^n = 1 - \frac{1}{2n} + \frac{1}{3n^2} + \dots$$

$$\Rightarrow \lim_{n \rightarrow \infty} \log\left(1 + \frac{1}{n}\right)^n = 1$$

$$\Rightarrow \lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n = e$$