# Interesting Asymptotic

The constant $e$ is often defined by the *interest* formula $e := \lim_{n\to\infty} \left(1+\frac{1}{n}\right)^n$.

**Problem**. What values of $a$ and $b$ make $1+\frac{a}{n}+\frac{b}{n^2}$ the best possible approximation to $\frac{1}{e}(1+\frac{1}{n})^n$ as $n\to\infty$? We may define $a$ for instance by

$$a = \lim_{n\to\infty} n\left[\frac{1}{e}\left(1+\frac{1}{n}\right)^n - 1\right].$$

*Hint.* Consider the Newton-Mercator series for $\ln(1+\frac{1}{n})$. (Look it up!)

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Submit your solution online by scanning QR code and filling out the form, or submit at

`sites.google.com/unomaha.edu/unopow`

A photo of handwritten work is fine. You can also turn in solutions physically at the UNO math department's mail room (located on the second floor of the Durham Science Center).