

**Question #1838** Use the definition of  $e$ , and numerical approximations as  $y$  approaches 0 from the left, and  $y$  approaches 0 from the right.

(b) Use a calculator to estimate the values of the limits given below, correct to two decimal places.  $\lim_{y \rightarrow 0} (2.7^y - 1)/y$  and  $\lim_{y \rightarrow 0} (2.8^y - 1)/y$  What can you conclude about the value of  $e$ ?

**Solution.** The first question is unclear. For the next use if  $a > 0$  then  $\lim_{x \rightarrow 0} \frac{a^x - 1}{x} = \ln a$ . Hence  $\lim_{y \rightarrow 0} (2.7^y - 1)/y = \ln 2.7 \approx 0.99$  and  $\lim_{y \rightarrow 0} (2.8^y - 1)/y = \log 2.8 \approx 1.03$ . Hence  $2.7 < e < 2.8$ .