

1.20 Consider the function $f(x) = \frac{e^x - 1}{x}$.

- (a) Use the decimal format with five significant digits (apply rounding) to calculate (using a calculator) $f(x)$ for $x = 0.005$.
- (b) Use MATLAB (`format long`) to calculate the value of $f(x)$. Consider this to be the true value, and calculate the true relative error due to rounding in the value of $f(x)$ that was obtained in part (a).

Solution

- (a) Retaining 5 significant digits,

$$f(0.00275) = \frac{e^{0.00275} - 1}{0.00275} = \frac{1.0028 - 1}{0.00275} = 1.0014$$

- (b) Using MATLAB and `format long`,

```
>> format long
>> format compact
>> x=0.00275;
>> f=(exp(x)-1)/x
f =
    1.00137626128369
```

Therefore, the true relative error in the answer of part (a) is:

$$TrueRelativeError = \left| \frac{1.00137626128369 - 1.0014}{1.00137626128369} \right| = 2.37 \times 10^{-5}$$

or less than 0.0024 %.

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