## Fourier Cosine Series

## Kurt Bryan and SIMIODE

A Maple notebook to compute the first few terms of the Fourier cosine expansion of a function $f(x)$ defined on an interval $0<=\mathrm{x}<=\mathrm{L}$.
restart;
[Define interval and function
> $L$ := 2 ;
$f(x):=x-\frac{x^{2}}{3}$
[Choose number $n$ of Fourier cosine coefficients to compute and set up array "a[k]" to hold coefficients
> $n:=5$;
$a:=\operatorname{array}(0 . . n)$ :
[Compute coefficients, either symbolically or numerically
$>$ for $k$ from 0 to $n$ do

$$
\begin{aligned}
& \quad a[k]:=\frac{2}{L} \cdot \operatorname{int}\left(f(x) \cdot \cos \left(\frac{k \cdot \operatorname{Pi} \cdot x}{L}\right), x=0 . . L\right): \# \text { for symbolic computation } \\
& \quad \# a[k]:=\text { evalf }\left(\frac{2}{L} \cdot \operatorname{Int}\left(f(x) \cdot \cos \left(\frac{k \cdot \operatorname{Pi} \cdot x}{L}\right), x=0 . . L\right)\right): \# \text { for numeric computation } \\
& \text { od: } \\
& \text { Form the Fourier cosine approximation } \\
& >\text { fourier_cosapp }:=\frac{a[0]}{2}+a d d\left(a[k] \cdot \cos \left(\frac{k \cdot \operatorname{Pi} \cdot x}{L}\right), k=1 . . n\right)
\end{aligned}
$$

Plot and compare to $\mathrm{f}(\mathrm{x})$
$\gg \operatorname{plot}([f(x)$, fourier_cosapp $], x=0$..L, thickness $=1$, color $=[$ red, blue $]$, labels $=[x, "$ " $]$, labeldirections $=$ [horizontal, vertical $]$, axes $=$ boxed, font $=[$ TimesRoman, fsize $]$, labelfont $=[$ TimesRoman, $f$ size $])$

