Using output from other sources

This document performs no computations (i.e., it has no active code blocks) but instead uses selected parts of the output created by other documents. Thus this document can be compiled using `pdflatex summary`. The basic structure of this document is as follows.

```
\documentclass[12pt]{article}
\usepackage{pylatex}    % so that we can use \py{foo}
\usepackage{mpllatex}   % so that we can use \mpl{bah}
\usepackage{amsmath}
...                     % other packages such as geometry, hyperref, breqn etc.
\begin{document}
   ...
   \input{example-01.pytex}  % all Python output from example-01.tex
   ...
   \begin{align*}
      &\py*{ans.301}\\   % the Python output
      &\py*{ans.302}
   \end{align*}
   ...
   \input{mixed.pytex}   % all Python output from mixed.tex
   \input{mixed.mpltex}  % all Maple output from mixed.tex
   ...
   \begin{gather*}
     \mpl{ans.102}       % the Maple output
     \py{ans.102}        % the Python output
   \end{gather*}
   ...
\end{document}
```

Note that care must be taken to avoid name clashes across tags from different sources. If two or more sources define tags with the same name (e.g., `foo.pytex` and `bah.pytex` both define `\pytag{ans.101}`) then the last definition will be used. This problem does not arise when the shared tag name, e.g., `rhs.101`, occurs in two different languages, such as one in Python and the other in Maple. This can be seen below where the first and last examples both refer to the name `ans.102`.

Note also that the lines

```
\usepackage{pylatex}    % so that we can use \py{foo}
\usepackage{mpllatex}   % so that we can use \mpl{bah}
```

are not essential – they can be left out but only if the `-I` option was supplied when compiling the source. For example, if the `pylatex.sty` and `mpllatex.sty` files were located in `/users/foo/tex/` then the file `bah.tex` (containing both Python and Maple code) could be compiled using

```
pylatex.sh  -xi bah -I/users/foo/tex/pylatex.sty
mpllatex.sh -xi bah -I/users/foo/tex/mpllatex.sty
```

This will produce `bah.pytex` and `bah.mpltex` each containing not only the selected output from `bah.tex` but also the definitions of the `pyLaTeX` and `mplLaTeX` macros. The `-x` option excludes processing of the output by LaTeX.

Example 1

$\texttt{ans.102} := -x\,(-a+x)\,(x+1)$

$\texttt{ans.302} := \infty$

$\texttt{ans.303} := 2x$

$\texttt{ans.305} := e^{a}$

$$\texttt{ans.401} := \frac{1}{2} + \frac{3}{16}\,(x-1)^{2} - \frac{1}{8}\,(x-1)^{3} + \frac{5}{64}\,(x-1)^{4} - \frac{3}{64}\,(x-1)^{5} - \frac{x}{4} + O\left((x-1)^{6}\,; x \to 1\right)$$

$$\texttt{ans.402} := 1 + x + \frac{x^{2}}{2} + \frac{x^{3}}{6} + \frac{x^{4}}{24} + \frac{x^{5}}{120} + O\left(x^{6}\right)$$

$$\texttt{ans.403} := \frac{312157992955169267846963566083562620966170 9}{192081536785946309960051152615192956019200 0}$$

$$\texttt{ans.404} := \frac{\pi^{4}}{90}$$

Example 2

$$\frac{d}{dx}\sin(x) = \cos(x) \qquad \int \sin(x)\,dx = -\cos(x)$$

$$\frac{d}{dx}\cos(x) = -\sin(x) \qquad \int \cos(x)\,dx = \sin(x)$$

$$\frac{d}{dx}\tan(x) = \tan^{2}(x) + 1 \qquad \int \tan(x)\,dx = -\log(\cos(x))$$

$$\frac{d}{dx}\operatorname{asin}(x) = \frac{1}{\sqrt{1-x^{2}}} \qquad \int \operatorname{asin}(x)\,dx = x\operatorname{asin}(x) + \sqrt{1-x^{2}}$$

$$\frac{d}{dx}\operatorname{acos}(x) = -\frac{1}{\sqrt{1-x^{2}}} \qquad \int \operatorname{acos}(x)\,dx = x\operatorname{acos}(x) - \sqrt{1-x^{2}}$$

$$\frac{d}{dx}\operatorname{atan}(x) = \frac{1}{x^{2}+1} \qquad \int \operatorname{atan}(x)\,dx = x\operatorname{atan}(x) - \frac{\log(x^{2}+1)}{2}$$

$$\frac{d}{dx}\sinh(x) = \cosh(x) \qquad \int \sinh(x)\,dx = \cosh(x)$$

$$\frac{d}{dx}\cosh(x) = \sinh(x) \qquad \int \cosh(x)\,dx = \sinh(x)$$

$$\frac{d}{dx}\tanh(x) = 1 - \tanh^{2}(x) \qquad \int \tanh(x)\,dx = x - \log(\tanh(x)+1)$$

Example 3

$$\begin{aligned}
\int_0^4 \int_0^3 \int_0^2 f(x,y,z)\,dx\,dy\,dz &= \int_0^4 \int_0^3 \int_0^2 \left(xy + y\sin(z) + \cos(x+y)\right)\,dx\,dy\,dz \\
&= \int_0^4 \int_0^3 \left(2y\sin(z) + 2y - \sin(y) + \sin(y+2)\right)\,dy\,dz \\
&= \int_0^4 \left(9\sin(z) + \cos(3) + \cos(2) - \cos(5) + 8\right)\,dz \\
&= 4\cos(3) + 4\cos(2) - 4\cos(5) - 9\cos(4) + 41 \\
&\approx 40.1235865133293
\end{aligned}$$

Example 4

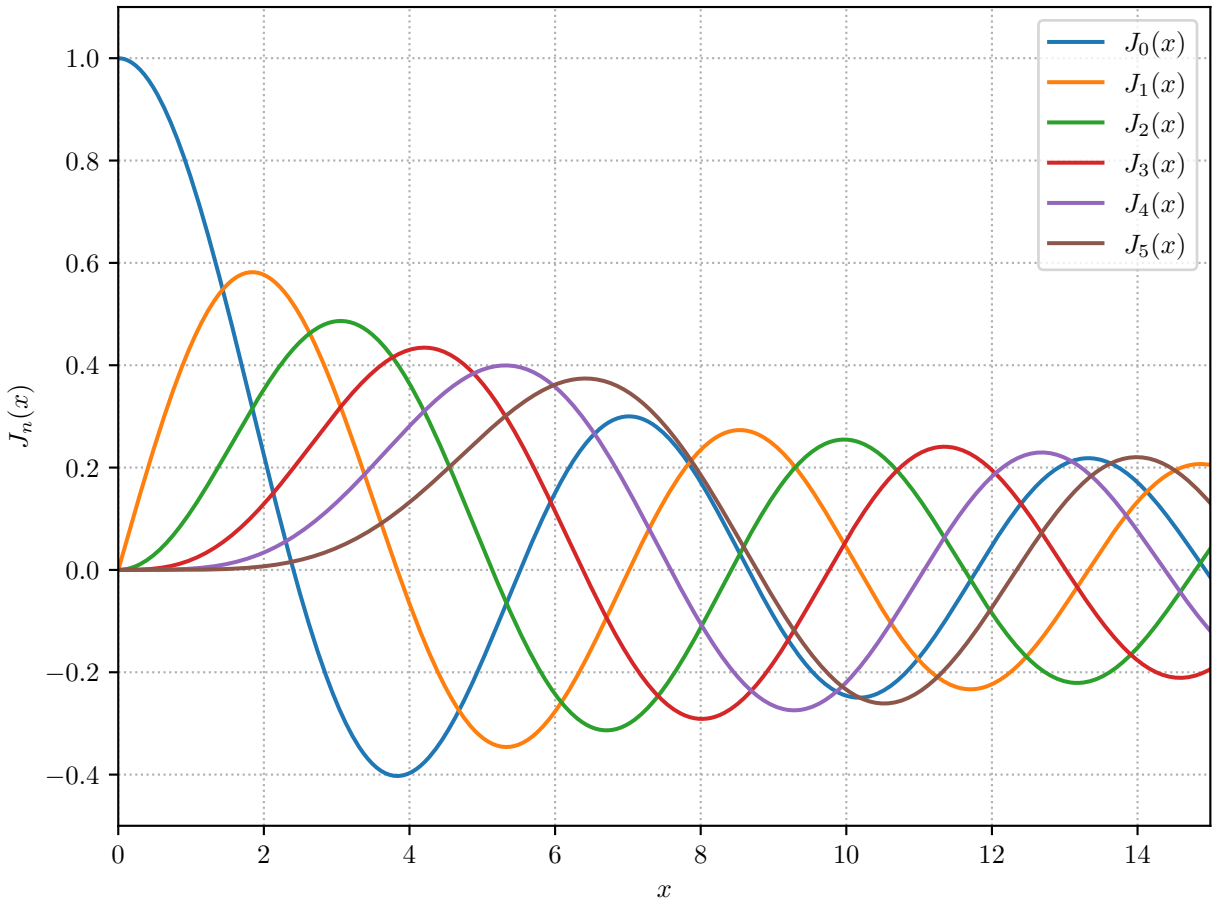

Figure 1: The first six Bessel functions.

Example 5

$$
\begin{aligned}
f(x) &= \frac{1}{x+1} && \texttt{(ans.511)}\\
&= 1 - x + x^2 - x^3 + x^4 - x^5 + x^6 - x^7 + x^8 - x^9 + O\left(x^{10}\right) && \texttt{(ans.512)}\\
&= 1 - x + x^2 - x^3 + x^4 - x^5 + x^6 - x^7 + x^8 - x^9 + x^{10} - x^{11} + x^{12} - x^{13} + x^{14} - x^{15} + x^{16}\\
&\quad - x^{17} + x^{18} - x^{19} + O\left(x^{20}\right) && \texttt{(ans.513)}\\
&= 1 - x + x^2 - x^3 + x^4 - x^5 + x^6 - x^7 + x^8 - x^9 + x^{10} - x^{11} + x^{12} - x^{13} + x^{14} - x^{15} + x^{16}\\
&\quad - x^{17} + x^{18} - x^{19} + x^{20} - x^{21} + x^{22} + O\left(x^{23}\right) && \texttt{(ans.514)}\\
&= 1 - x + x^2 - x^3 + x^4 - x^5 + x^6 - x^7 + x^8 - x^9 + x^{10} - x^{11} + x^{12} - x^{13} + x^{14} - x^{15} + x^{16}\\
&\quad - x^{17} + x^{18} - x^{19} + x^{20} - x^{21} + x^{22} + O\left(x^{23}\right) && \texttt{(ans.514)}
\end{aligned}
$$

Example 6

Newton-Raphson iterations $x_{n+1} = x_n - f_n/f'_n\ , \quad f(x) = x - e^{-x}$			
n	x_n	$\epsilon_n = x_n - e^{-x_n}$	$\epsilon_n/\epsilon_{n-1}^2$
0	0.50000000000000000000000000	-1.0653065971e-1	
1	0.56631100319721815304164922	-1.3045098060e-3	-0.11495
2	0.56714316503486221278651210	-1.9648047172e-7	-0.11546
3	0.56714329040978102869957660	-4.4574262753e-15	-0.11546
4	0.56714329040978387299996870	-2.2941072910e-30	-0.11546
5	0.56714329040978387299996870	-6.0767705445e-61	-0.11546
6	0.56714329040978387299996870	-4.2637434326e-122	-0.11546

Example 7

```
      date :    Wed 17 Nov 2021 13:58:45
    python :    3.6.13
    system :    Darwin
   release :    20.6.0
   machine :    x86_64
 processor :    i386
  platform :    Darwin-20.6.0-x86_64-i386-64bit
```

Python and Maple

The Maple output

The general solution of the differential equation is

$$y\left(x\right) = C_1\,\mathrm{e}^{-x}\sin\left(3\,x\right) + C_2\,\mathrm{e}^{-x}\cos\left(3\,x\right) \qquad \texttt{(ans.102)}$$

while the particular solution satifying the boundary conditions is given by

$$y(x) = \mathrm{e}^{-x}\sin\left(3\,x\right) + 3\,\mathrm{e}^{-x}\cos\left(3\,x\right)$$

The Python output

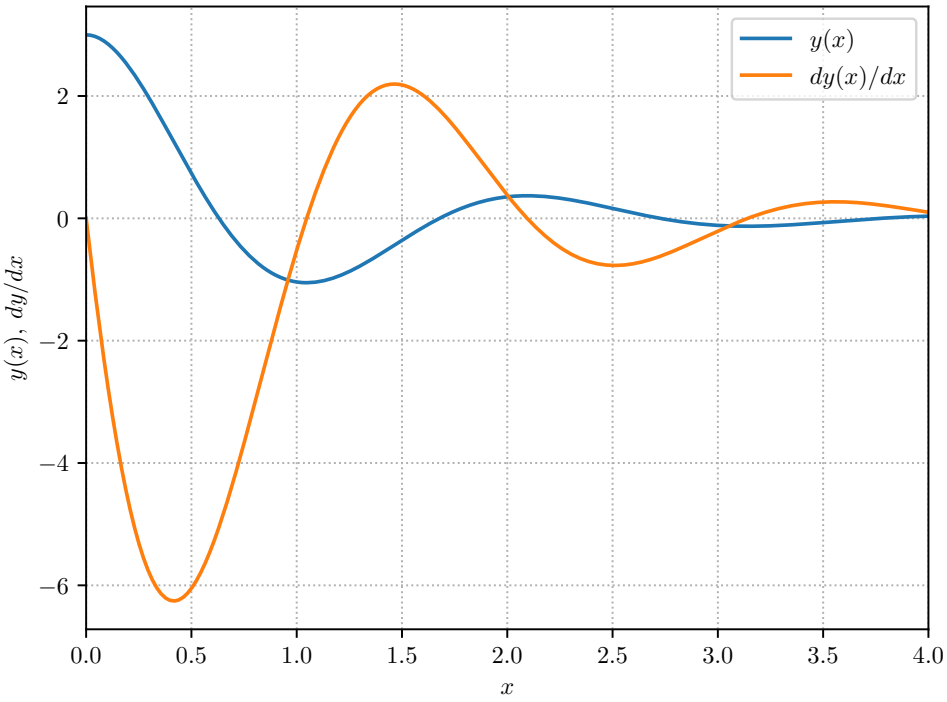

Figure 2: The function and its derivative.