Using the Durham Solutions LaTeX Package

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Introduction

The Durham Solutions package contains all commands needed to format solutions in a consistent style. A full template of a model solution using this package is at the end of this document. To use the package, save the DurhamSolutions.sty file to your working directory and add \usepackage{DurhamSolutions} to the preamble of the LaTeX file (as shown in the example template). It has been designed with ease of use in mind, but doesn't preclude more advanced formatting techniques. The package requires several other packages to be installed; this should happen automatically when you compile using the DurhamSolutions package, depending on your package manager. More advanced formatting can be used alongside this package, it was merely designed to make certain aspects of solution formatting easier! If there are any issues, suggestions or comments please contact Dr Wrathmall (s.a.wrathmall@durham.ac.uk).

1 Headings

Command	Description
\title{<text>}	Formats the main title, usually the exercise number. Argument should be the full text for the heading eg. \title{Exercise 1.23} will show the text 'Exercise 1.23'.
\Part{<A,B etc.>}	Formats the heading of each part (a,b,c etc.) of the question. Can be used within other environments eg. the questionbox environment. Argument should be the letter/number denoting the part, eg. \Part{A} will show the text 'Part A'. This will be in bold unless inside a 'questionbox' environment.
\model	Inserts the centred heading 'Example Solution'. No argument is needed here.

The headings for the box environments are controlled from the DurhamSolutions package, so there is no need to add titles/headings to these.

2 Boxes

There are 3 new box environments, examples of each are shown in the template. They have predefined titles, so the only text in the environment should be text to be shown within the shaded box.

Command	Description
\begin{questionbox}	Opens the 'Question' box environment in which the problem can be written. Can incorporate equations and figures in the usual manner. If there are multiple parts to the question, these can be separated using the \Part{} command.
\begin{howtobox}	Opens the 'How to approach the problem?' box environment which appears before the start of the model solution to each part of the question.
\begin{commentbox}	Used to add extra information or to contain asides, this command opens a right-aligned 'Comment' box shaded in the same manner as the howtobox environment. There is no option for a heading here.

Each box environment is closed with the corresponding \end{<box type>} command.

3 Diagrams and Figures

Command	Description
\diagram{<scale>}{<filename>}	Will insert the specified graphic as a centred floating object. The <scale> argument should be a number, and defines the size of the image. The filename will need to include the extension for files that are not .jpg images. The initial float placement is [h!] but LaTeX may decide otherwise!

This provides a shortcut command for inserting graphics, however this will automatically centre the figure and provide no option for inserting a caption. Figure placement can sometimes be corrected by forcing LaTeX to begin a new page, using the \clearpage command. If a caption is required or the figure placement needs to be manually manipulated, the figure will need to be inserted manually using \includegraphics[scale=<scale>]{<filename>}.
Note: the \diagram{}{} command does not work inside box environments!

4 Units and Constants

To make writing up solutions quicker and easier, the DurhamSolutions package includes commands which will print values of common physical constants or units. These are of course optional! They print the values as given in Young & Freedman Appendix F to 3 significant figures.

Command	Description	Example
\c	Speed of light	3.00×10^{8} m s^{-1}
\g	Acceleration due to gravity	9.81 m s^{-2}
\h	Planck's Constant	6.63×10^{-34} J s
\hbarval	Reduced Planck's Constant	1.05×10^{-34} J s
\e	Charge of electron	1.60×10^{-19} C
\kb	Boltzmann constant	1.38×10^{-23} J K^{-1}
\gasconst	Gas constant	8.31 J mol^{-1} K^{-1}
\melectron	Mass of the electron	9.11×10^{-31} kg
\mproton	Mass of the proton	1.67×10^{-27} kg
\muzero	Permeability of free space	$4\pi \times 10^{-7}$ Wb A^{-1} m^{-1}
\ezero	Permittivity of free space	8.85×10^{-12} C^2 N^{-1} m^{-2}
\grav	Gravitational constant	6.67×10^{-11} N m^2 kg^{-2}
\amu	Atomic mass unit	1.66×10^{-27} kg

These commands should be enclosed in an equation environment but can be used in text e.g. by using `$\h$`.
Note: The normal cedilla (ç) command `\c{}` has been overwritten to print the speed of light. To produce a cedilla now requires the command `\cedilla{}`.

The package also provides a couple of shortcuts for commonly used units.

Command	Units	Example
\vel	velocity	m s^{-1}
\acc	acceleration	m s^{-2}
\mom	momentum	kg m s^{-1}

Again these should be used within equation environments, but can simply be used between two $ signs. Even in math-type environments the units text will remain non-italicised.

5 Miscellaneous

The package also provides a few other functions which may be of use during preparation of solutions. To keep notation consistent with Young & Freedman, the `\vect{}` command can be used to typeset vectors that are both bold and overarrowed (e.g. $\vec{\boldsymbol{E}}$). There are also commands (`\ivec`, `\jvec` and `\kvec`) which produce the unit vectors in this format (e.g. $\hat{\boldsymbol{\imath}}$, $\hat{\boldsymbol{\jmath}}$, $\hat{\boldsymbol{k}}$). It also automatically loads the *tasks* package (Copyright C. Niederberger) which can be used to create horizontal lists. This is useful when providing several short multiple choice answers that would take up unnecessary space in a column list. It is implemented by opening an environment using the command `\begin{tasks}(<number of columns>)` and preceding each item with `\task`. An example of its use can be found in the template, and for more detailed information on all of its features see the package documentation (`http://anorien.csc.warwick.ac.uk/mirrors/CTAN/macros/latex/contrib/tasks/tasks_en.pdf`)

6 Example

The following code was used to create the basic example shown at the end of the document.

```
\documentclass[12pt]{article}
\usepackage{DurhamSolutions}

\begin{document}
\title{Exercise 1.23}
\begin{questionbox}
\Part{A}
First part of question.
\Part{B}
Second part of question. Is the answer\textellipsis ?
\begin{tasks}(3)
\task First option
\task Second option
\task Third option
\end{tasks}
\end{questionbox}

\Part{A}
\begin{howtobox}
Help for students on problem solving.
\end{howtobox}
\model
\diagram{0.3}{Graph.jpeg}
This is how you solve the problem.
\pagebreak
\Part{B}
\begin{howtobox}
Help for students on problem solving.
\end{howtobox}
\model
\diagram{0.4}{GraphandCode.png}
Inserting an equation
\begin{align*}
E = mc^2.
\end{align*}
where the speed of light $c$ is $\c$.
\begin{commentbox}
Helpful aside.
\end{commentbox}
\end{document}
```

Exercise 1.23

Question:

Part A

First part of question.

Part B

Second part of question. Is the answer…?

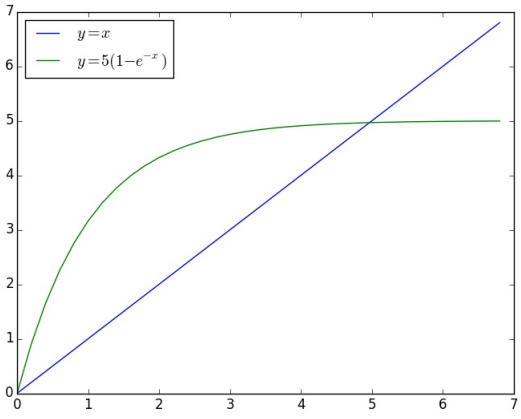
a) First option b) Second option c) Third option

Part A

How to approach the problem?

Help for students on problem solving.

Example of Solution



This is how you solve the problem.

Part B

How to approach the problem?

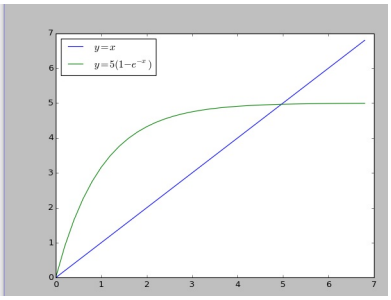
Help for students on problem solving.

Example of Solution

```
from __future__ import division
import numpy
import matplotlib.pyplot as pyplot

x = numpy.arange(0,7,0.2)
y1 = x
y2 = 5*(1-numpy.exp(-x))

pyplot.figure()
pyplot.plot(x,y1, label=r'$y=x$')
pyplot.plot(x,y2, label=r'$y=5(1-e^{-x})$')
pyplot.legend(loc=0)
pyplot.show()
```



Inserting an equation

$$E = mc^2.$$

where the speed of light c is 3.00×10^8 m s^{-1}.

Helpful aside.