# GradSchoolEssentials

LaTeX *Style Guide — ver. 0.9*

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## Contents

## 1 Motivation

Hey there, LaTeX ninja, and thanks for your interest in this project! It all started in 2021, when I finally got tired of typing out some opaque, monstrous amalgamation of operators[1] when all I wanted to see was a simple $\frac{\partial \hat{\boldsymbol{x}}}{\partial t}$! With gradschoolessentials, printing this expression is as easy as `\pd{\bhats{x}}{t}`, which I believe is a more literate approach.

Stated plainly, this style file provides macros to quickly and conveniently produce the high-quality typesetting that TeX is famous for. The style guide itself is intended as a working document, so check the github (https://github.com/rigzridge/gradschoolessentials) for more information.

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[1] `\frac{\partial\hat\boldsymbol{x}}{\partial t}`

## 2   Initialization

Using `gradschoolessentials` is as simple as including as single `\usepackage{}` command! The following is a minimum working example:

```
\documentclass{article}
\usepackage[utf8]{inputenc}

\usepackage[blue]{gradschoolessentials}

\begin{document}
$$\N\in\Z\in\Q\in\R\in\C$$
\end{document}
```
$$\mathbb{N} \in \mathbb{Z} \in \mathbb{Q} \in \mathbb{R} \in \mathbb{C}$$

## 3   Environments

The `gradschoolessentials` style provides three new environments to simplify homework. Indexing is done automatically, and the operation of `\label{}` and `\ref{}` is analogous to its use in `\section{}`, `\subsection{}`, `\subsubsection{}`.

### 3.1   `problem`

Likely a homework problem, and numerically indexed. Importantly, the counter associated with `problem` (*i.e.*, `\theproblem`) will reset when a new section is created.

**Example of `problem` environment**

```
\begin{problem}\label{prob::e^-tx}
    Here is an example problem. Show that
    $$\int_0^\infty e^{-tx} dx = \frac{1}{t}.$$
\end{problem}
```

**Problem 1** ...................................................................................

Here is an example problem. Show that

$$\int_0^\infty e^{-tx} dx = \frac{1}{t}. \tag{1}$$

### 3.2   `subprob`

An alphabetically indexed subproblem. Will appear as current `\sectioncolor` (must adjust `gradschooolessentials.sty` to change).

**A problem with subprob**

```
\begin{problem}\label{prob::factorial}
    \begin{subprob}\label{subprob::gamma}
        Using the results of Problem \ref{prob::e^-tx}, verify the well-
            known relation
        $$\int_0^\infty x^ne^{-x} dx = n!.$$
        {\it Hint: Take derivatives of Eq. \eqref{eq::one_over_t} with
            respect to $t$.}
    \end{subprob}
    \begin{subprob}
        Confirm your result for part \ref{subprob::gamma} using repeated
            integration by parts.
    \end{subprob}
    \begin{subprob}
        Plot the integrand $x^ne^{-x}$ for $n\in\{0,1,2,3\}$.
    \end{subprob}
\end{problem}
```

**Problem 2** . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

**(a)** Using the results of Problem 1, verify the well-known relation

$$\int_0^\infty x^n e^{-x} dx = n!.$$

*Hint: Take derivatives of Eq. (1) with respect to t.*
**(b)** Confirm your result for part **(a)** using repeated integration by parts.
**(c)** Plot the integrand $x^n e^{-x}$ for $n \in \{0, 1, 2, 3\}$.

## 3.3  subsubprob

A sub-subproblem, indexed by an italic, lower-case roman numeral. Will appear as current `\sectioncolor`. Note that neither the `subprob` nor the `subsubprob` environment require the prior use of a `problem` environment.

---

**A problem with subsubprob**

```
\begin{problem}\label{prob::drop_object}
    Consider an object released from a height $h$ from the Earth's
        surface. Sketch the object's
    \begin{subsubprob}\label{subsubprob::x}
        The position $x(t)$
    \end{subsubprob}
    \begin{subsubprob}
        The velocity $v(t)$ (What is the relationship with part \ref{
            subsubprob::x}?)
    \end{subsubprob}
    \begin{subsubprob}
        The acceleration $a(t)$
    \end{subsubprob}
\end{problem}
```

## Problem 3 ...........................................................................

Consider an object released from rest at a height $h = 10$ m from the Earth's surface. Neglecting the effect of air resistance, and for each of the following, sketch the object's:

*i.* Position $h(t)$
*ii.* Velocity $v(t)$
*iii.* Acceleration $a(t)$ (What is the relationship with parts *i* & *ii*?)
*You may assume that the acceleration due to gravity is $g \approx 10$ $m/s^2$.*

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# 4  Tools

## 4.1  hwtitle

For titling assignments. Usage is \hwtitle{<Class>}{<Title>}{<First name>}{<Last name>}

---

**Title example #1**

```
\hwtitle{Math 101}{What addition means to me}{Alice}{Lastname}
```

# Math 101

## What addition means to me
*Alice Lastname*                                            **June 12, 2024**

---

<div style="border:1px solid #888; border-radius:8px;">
<div style="background:#666; color:white; padding:4px 8px;">**Title example #2**</div>

```
\hwtitle{{\huge $\mathcal{P}$}}{\bf \sc{hys}
793a}}{$\mathcal{H}\mathrm{omework}$ \#5}{Greg}{Riggs}
```

$\mathcal{P}$HYS 793A

$\mathcal{H}$omework #5
$\mathcal{G}$reg $\mathcal{R}$iggs                                    **June 12, 2024**
</div>

**4.2  ans**

**4.3  anst**

# 5  Sets

## 5.1  N

Natural numbers

`$n\in\N\implies n+1\in\N$`                    $n \in \mathbb{N} \implies n+1 \in \mathbb{N}$

## 5.2  Z

Integers

`$n\in\Z\implies n^2\in\N$`                    $n \in \mathbb{Z} \implies n^2 \in \mathbb{N}$

## 5.3  Q

Rationals

`$\frac{a}{b}\in\Q\iff a,b\in\Z$`             $\frac{a}{b} \in \mathbb{Q} \iff a,b \in \mathbb{Z}/0$

## 5.4  R

Reals

`$\alpha\in\Q\implies e^{\alpha}\in\R$`       $\alpha \in \mathbb{Q} \implies e^\alpha \in \mathbb{R}$

## 5.5  C

## 5.6  set

### 5.6.1  bigset

### 5.6.2  biggset

### 5.6.3  Bigset

### 5.6.4  Biggset