This is the new `mandi` package, which creates an environment specifically for introductory physics students. It provides for consistent notation conventions that align with ISO 80000-2 recommendations.

1 Fonts

1.1 Text Mode Fonts

1.1.1 Default Text Font Parameters

To begin with, let's look at the fonts we have at our disposal. Let's look at the default text mode font parameters first.

`\encodingdefault`	TU
`\familydefault`	lmr
`\seriesdefault`	m
`\shapedefault`	n
`\rmdefault`	lmr
`\sfdefault`	lmss
`\ttdefault`	lmtt
`\bfdefault`	b
`\updefault`	up
`\itdefault`	it
`\mddefault`	m
`\sldefault`	sl
`\scdefault`	sc

1.1.2 Text Mode Font Commands

Now let's look at the text mode commands for changing fonts and their accompanying results. Note that these commands require braced arguments and work only within the scope of the braces.

Text Mode Commands
The default normal text is `\textnormal{...}`.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
To get roman letters, use `\textrm{...}`.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
To get san serif letters, use `\textsf{...}`.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
To get typewriter letters, use `\texttt{...}`.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
To get medium letters, use `\textmd{...}`.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
To get boldface letters, use `\textbf{...}`.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
Text up `\textup{...}`
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
To get italic letters, use `\textit{...}`.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
To get slanted letters, use `\textsl{...}`.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
To get small capital letters, use `\textsc{...}`.
ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789

Some of those text mode commands may seem redundant to you, and there are some you will never need to use, so don't worry if they look confusing. Remember that `\textnormal{...}` is the default and all you have to do to get it is start typing; no command is necessary unless you have changed something (and that's usually difficult to do).

These text font commands can be used together if you remember to nest the braces correctly. Look at the following table.

Combined Text Mode Commands
To get boldface san serif letters, use `\textbf{\textsf{...}}`.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
To get boldface italic letters, use `\textbf{\textit{...}}`.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
To get boldface slanted letters, use `\textbf{\textsl{...}}`.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789

1.1.3 Emphasizing Words in Text Mode

For semantic reasons, it's important to use `\emph{...}` when you want to emphasize a word. Use `\emph{vector}` to emphasize the word *vector* or `\emph{momentum}` to emphasize the word *momentum*. In most documents, `\emph{...}` defaults to italics, but it may default to something else when using a different document class. Let the document class do its work and you will have fewer things to remember.

1.1.4 Text Mode Font Switches

Next, let's look as the various text mode switches you can use. They are called *switches* rather than *commands* because they take effect immediately and stay in effect until you explicitly turn them off or activate another one, much like a light switch. As so, they do not take braced arguments, or indeed, any arguments at all. Look at the following table.

Text Mode Switches
Use `\normalfont` to switch to the default normal font.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
Use `\rmfamily` to switch to roman letters.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
Use `\sffamily` to switch to sans serif latters.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
Use `\ttfamily` to switch to typewriter letters.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
Use `\mdseries` to switch to medium letters.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
Use `\bfseries` to switch to boldface letters.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
Use `\upshape` to switch to upright letters.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
Use `\itshape` to switch to italic letters.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
Use `\slshape` to switch to slanted letters.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
Use `\scshape` to switch to small capital letters.
ABCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789

To illustrate how these switches work, the following paragraph is in the default text font (it's just filler text).
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis egestas urna et dolor posuere, accumsan faucibus justo viverra. Pellentesque libero neque, maximus vitae placerat eu, luctus sit amet sapien. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Aenean vel nisl massa. Sed id velit tellus. Vivamus eu elit a erat aliquam auctor nec sed mi. Orci varius natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Cras ut consequat purus. Fusce imperdiet scelerisque sagittis. Etiam maximus sagittis sapien. Proin mi metus, cursus a ex eget, maximus laoreet sapien. In hac habitasse platea dictumst. Morbi eget est dui. Cras posuere nisl quis leo facilisis, vel viverra augue sagittis. Nullam posuere, ex id efficitur mollis, velit nisi tincidunt augue, vel tempor orci nisi a justo.

The following paragraph is the same filler text, but now preceded by the `\sffamily` switch.
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis egestas urna et dolor posuere, accumsan faucibus justo viverra. Pellentesque libero neque, maximus vitae placerat eu, luctus sit amet sapien. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Aenean vel nisl massa. Sed id velit tellus. Vivamus eu elit a erat aliquam auctor nec sed mi. Orci varius natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Cras ut consequat purus. Fusce imperdiet scelerisque sagittis. Etiam maximus sagittis sapien. Proin mi metus, cursus a ex eget, maximus laoreet sapien. In hac habitasse platea dictumst. Morbi eget est dui. Cras posuere nisl quis leo facilisis, vel viverra augue sagittis. Nullam posuere, ex id efficitur mollis, velit nisi tincidunt augue, vel tempor orci nisi a justo.

Note that this paragraph is still typeset in sans serif letters because the `\sffamily` switch is still activated. We can deactivate it by activating another switch, like `\normalfont` to get back to normal default text, or like `\bfseries` **to get bold letters, or even like** `\itshape` ***to get italic letters. Note that we got both bold and italic letters in that last phrase, and in this sentence, because the*** `\bfseries` ***switch was still activated when we activated the*** `\itshape` ***switch. Activated switches can accumulate to give us new combinations of letter styles and shapes. We can return to the normal default font by activating the*** `\normalfont` ***switch*** just like this. Now everything is back to normal.

1.2 Math Mode Fonts

Now we need to discuss math mode fonts, which are considerably more complicated than text mode fonts. There are math mode font *commands*, but there are no math mode font *switches*. Math mode fonts sometimes include lowercase and/or uppercase Greek letters, which are frequently used in mathematical notation. Math mode fonts go into effect whenever you

enter inline math mode with `\(...\)` or display math mode with `\[...\]`. Many LaTeX tutorials use `$...$` for inline math mode and `$$...$$` for display math mode. For various technical reasons, these are not recommended so please do not use them. Please consistently use `\(...\)` for inline math mode and `\[...\]` for display math mode.

1.2.1 Math Mode Font Commands

We have a problem in math mode, because we use the `isomath`, `amsmath`, `amsfonts`, `amsfonts`, `bbm`, `bm`, and `upgreek` packages to create new font combinations that vary from those without loading that packages. The math mode font commands available to you in this environment are given in the following table.

Use `\(...\)` or `\[...\]` to get the default math mode font.
Also use this for vector index notation.
$abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789$
$\alpha\beta\gamma\delta\epsilon\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi o\pi\varpi\rho\varrho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega$
Use `\mathrm{...}` to get roman letters. This style doesn't have lowercase Greek letters.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
$\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega$
Use `\mathbf{...}` to get boldface letters. This style doesn't have lowercase Greek letters.
Note that this style gives upright letters and numbers.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
$\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega$
Use `\mathsf{...}` to get sans serif letters. This style doesn't have lowercase Greek letters.
Also use this to typeset physical dimensions.
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789
$\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega$
Use `\mathbfit{...}` and `\matrixsym{...}` for vectors and matrices.
Also aliased as `\mathbfit{...}` and `\boldsymbol{...}`.
$\boldsymbol{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ}0123456789$
$\boldsymbol{\alpha\beta\gamma\delta\epsilon\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi o\pi\varpi\rho\varrho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega}$
Use `\mathsfit{...}` for tensor index notation.
$abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789$
$\alpha\beta\gamma\delta\epsilon\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi o\pi\varpi\rho\varrho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega$
Use `\mathbfsfit{...}` for tensors.
Also aliased as `\mathbfsfit{...}`.
$\boldsymbol{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ}0123456789$
$\boldsymbol{\alpha\beta\gamma\delta\epsilon\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi o\pi\varpi\rho\varrho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega}$
Use `\up<...>` to name subatomic particles.
Also, `\upOmega` represents the ohm.
$\alpha\beta\gamma\delta\epsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi\pi\varpi\rho\sigma\tau\upsilon\phi\varphi\chi\psi\omega\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega$
Use `\symbb{...}` to get sets of numbers and the contraction tensor symbol.
$\mathbf{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ}$
Use `\mathcal{...}`, which only applies to uppercase letters, to get these distinctive letters.
Thorne and Blandford use this font to name points on a manifold.
It may also be useful for labeling coordinate systems.
$\mathcal{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$
$\boldsymbol{\mathcal{ABCDEFGHIJKLMNOPQRSTUVWXYZ}}$
Here's a math script font if you need it.
$\mathscr{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ}$
$\boldsymbol{\mathscr{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ}}$

The `\mathbfit{...}` example above is a bit misleading for numbers. The only number that is ever used as the name of a vector quantity is zero, and when a *single digit* is used as such, it is typeset upright. That means `\mathbf{0}` gives **0** as expected.

1.2.2 Unicode Font Commands

Let's test the `unicode-math` font commands.

Use `\(...\)` or `\[...\]` or `\symnormal{...}` to get the default italic math mode font.
Use this for vector index notation. Does not apply to numerals; they are always upright.
$abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789$
$\alpha\beta\gamma\delta\epsilon\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi o\pi\varpi\rho\varrho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega$
Use `\symbf{...}` for boldface italic. Does not apply to numerals. Use this for vectors and matrices.
$\boldsymbol{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ}$
$\boldsymbol{\alpha\beta\gamma\delta\epsilon\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi o\pi\varpi\rho\varrho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega}$
Use `\symup{...}` for upright serif.
$\mathrm{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789}$
$\mathrm{\alpha\beta\gamma\delta\epsilon\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi o\pi\varpi\rho\varrho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega}$
Use `\symbfup{...}` for boldface upright serif.
$\mathbf{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789}$
$\mathbf{\alpha\beta\gamma\delta\epsilon\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi o\pi\varpi\rho\varrho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega}$
Use `\symsfup{...}` for sans serif upright. Does not apply to Greek letters.
Use this to typeset physical dimensions.
$\mathsf{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789}$
Use `\symbfsfup{...}` for boldface sans serif upright. Applies to Greek letters.
$\mathbf{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789}$
$\mathbf{\alpha\beta\gamma\delta\epsilon\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi o\pi\varpi\rho\varrho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega\Delta\Gamma\Theta\Lambda\Xi\Pi\Sigma\Upsilon\Phi\Psi\Omega}$
Use `\symsfit{...}` for sans serif italic.
Use this for tensor index notation. Does not apply to Greek letters.
Does not apply to numerals; they are always upright.
$\mathsf{\mathit{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ}}$
Use `\symbfsfit{...}` for boldface sans serif italic. Use this for tensors.
$\mathbf{\mathit{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ}}$
Use `\symcal{...}` for, say, naming points on a manifold.
$\mathcal{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$
Use `\symbfcal{...}` this for naming points on a manifold too.
$\boldsymbol{\mathcal{ABCDEFGHIJKLMNOPQRSTUVWXYZ}}$
Use `\symscr{...}` to get script letters. Does not apply to Greek letters.
$\mathscr{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ}$
Use `\symbfscr{...}` to get boldface script letters. Does not apply to Greek letters. Does not apply to numerals.
$\boldsymbol{\mathscr{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ}}$
Use `\symtt{...}` to get typewriter letters. Does not apply to Greek letters.
$\mathtt{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789}$
Use `\symfrak{...}` to get Fraktur letters. Does not apply to Greek letters. Does not apply to numerals.
$\mathfrak{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ}$
Use `\symbffrak{...}` to get boldface Fraktur letters. Does not apply to Greek letters. Does not apply to numerals.
$\boldsymbol{\mathfrak{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ}}$
Use `\symbb{...}` to get blackboard letters. Does not apply to Greek letters.
$\mathbb{abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789}$
Use `\symbbit{...}` to get blackboard italic letters. Only applies to five letters.
$\mathbb{deijD}$

There's a handful of other mathematical symbols you will need, and here they are. Don't worry if you've never seen any or all of these before. The third row of symbols is unique to `mandi`.

$\nabla \Box \partial \otimes \times \cdot \bullet$
$\boldsymbol{\nabla \Box \partial \otimes \times \bullet \bullet}$
$\nabla_{\boldsymbol{u}} \nabla^{\boldsymbol{u}}$
$\_\_\_ \underline{\boldsymbol{a}} \; \mathbb{C}_{(1,2)} \; \mathbb{C}_{(1,3)(2,4)} \; \mathsf{C}_{(1,2)} \; \mathsf{C}_{(1,3)(2,4)}$

There are four ways to write a vector quantity (in this case, a first rank contravariant, or $(1,0)$, tensor).

$\boldsymbol{a} = a^i \boldsymbol{e}_i$	with a basis, using vector symbols
$\boldsymbol{a} = a^i \boldsymbol{e}_i$	with a basis, using tensor symbols
$\boldsymbol{a} = \boldsymbol{a}(\_\_\_)$	coordinate-free, using vector symbols
$\boldsymbol{a} = \boldsymbol{a}(\_\_\_)$	coordinate-free, using tensor symbols

There are five ways to write a tensor quantity (in this case, a second rank contravariant, or $(2,0)$, tensor).

$\boldsymbol{T} = \boldsymbol{T}(\_\_, \_\_)$	coordinate-free, with slots
$\boldsymbol{T} = T^{ij}\boldsymbol{e}_i \otimes \boldsymbol{e}_j$	with a basis
$\boldsymbol{T} = T^{ij}$	omitting the basis
$\boldsymbol{T} = \boldsymbol{Tensor}(\_\_, \_\_)$	coordinate free, named, with slots

It probably seems strange to use a word as the name of a tensor (e.g. $\boldsymbol{Riemann}$, $\boldsymbol{Faraday}$, $\boldsymbol{Maxwell}$, $\boldsymbol{Einstein}$), but MTW introduced that convention and it most definitely has merit.

Showing tensor contraction is challenging because there is no standardized coordinate-free notation for it. Therefore, we introduce such a notation here. It may surprise you see that this is all equivalent to the dot product of the two vectors, but you will see how and why that is very soon. Ultimately, these are all just different ways of writing the same real number.

$$\mathbb{C}_{(1,2)}\boldsymbol{a}(\_\_) \otimes \boldsymbol{b}(\_\_)$$
$$\mathbb{C}_{(1,2)}\boldsymbol{b}(\_\_) \otimes \boldsymbol{a}(\_\_)$$
$$\boldsymbol{a}(\,\boldsymbol{b}\,)$$
$$\boldsymbol{b}(\,\boldsymbol{a}\,)$$
$$\boldsymbol{a}(\underline{\boldsymbol{b}}\,)$$
$$\boldsymbol{b}(\underline{\boldsymbol{a}}\,)$$
$$\boldsymbol{dot}(\,\boldsymbol{a}\,,\,\boldsymbol{b}\,)$$
$$\boldsymbol{dot}(\,\boldsymbol{b}\,,\,\boldsymbol{a}\,)$$
$$\boldsymbol{dot}(\underline{\boldsymbol{a}}\,,\underline{\boldsymbol{b}}\,)$$
$$\boldsymbol{dot}(\underline{\boldsymbol{b}}\,,\underline{\boldsymbol{a}}\,)$$
$$\boldsymbol{metric}(\,\boldsymbol{a}\,,\,\boldsymbol{b}\,)$$
$$\boldsymbol{metric}(\,\boldsymbol{b}\,,\,\boldsymbol{a}\,)$$
$$\boldsymbol{metric}(\underline{\boldsymbol{a}}\,,\underline{\boldsymbol{b}}\,)$$
$$\boldsymbol{metric}(\underline{\boldsymbol{b}}\,,\underline{\boldsymbol{a}}\,)$$
$$\boldsymbol{g}(\,\boldsymbol{a}\,,\,\boldsymbol{b}\,)$$
$$\boldsymbol{g}(\,\boldsymbol{b}\,,\,\boldsymbol{a}\,)$$
$$\boldsymbol{g}(\underline{\boldsymbol{a}}\,,\underline{\boldsymbol{b}}\,)$$
$$\boldsymbol{g}(\underline{\boldsymbol{b}}\,,\underline{\boldsymbol{a}}\,)$$
$$\boldsymbol{a} \cdot \boldsymbol{b}$$
$$\boldsymbol{b} \cdot \boldsymbol{a}$$
$$\mathbb{R}$$

As you can see there is a lot of flexibility in how tensor slots are typeset. This design is intentional and I hope to see this notation propagated into textbooks at every level.

$$\boldsymbol{T}(\_\_, \_\_)$$
$$\boldsymbol{T}(\,\boldsymbol{a}\,, \_\_)$$
$$\boldsymbol{T}(\underline{\boldsymbol{a}}\,, \_\_)$$
$$\boldsymbol{T}(\_\_, \,\boldsymbol{b}\,)$$
$$\boldsymbol{T}(\_\_, \underline{\boldsymbol{b}}\,)$$
$$\boldsymbol{T}(\,\boldsymbol{a}\,,\,\boldsymbol{b}\,)$$
$$\boldsymbol{T}(\underline{\boldsymbol{a}}\,,\underline{\boldsymbol{b}}\,)$$

An important issue is how a filled slot is visualized. You can choose to either show it explicitly or not show it at all. I tend to prefer to explicitly show a filled slot, but your preferences may vary.

$$\mathbf{T}(\_\_, \mathbf{S}(\mathbf{B}, \_\_), \_\_)$$
$$\boldsymbol{T}(\_\_, \boldsymbol{S}(\boldsymbol{B}, \_\_), \_\_)$$

Notation for filling slots with quantities having their own slots can get complicated, and perhaps this is something to be considered.

2 Row and Column Vectors

2.1 Column Vectors

$$\begin{pmatrix}0\\1\\2\\3\end{pmatrix}\begin{pmatrix}a_1\\a_2\\a_2\end{pmatrix}$$

2.2 Row Vectors

$$\begin{pmatrix}0 & 1 & 2 & 3\end{pmatrix}\begin{pmatrix}a_1 & a_2 & a_2\end{pmatrix}$$

3 Symbolic Vectors

$$\boldsymbol{E}^{\text{one}}_{\text{ball}}$$
$$\vec{E}^{\text{one}}_{\text{ball}}$$

4 Program Listings

`GlowScript` and `VPython` program listings now float so they won't split across page breaks as often now. However, there is still the problem that if a listing is too long for the floating window it will be truncated. I'll provide two environments to address this problem.

```
1  GlowScript 3.0 VPython
2
3  # a Young's modulus problem
4
5  Lo = 3    # wire's original length in m
6  d = 3e-3 # wire's diameter in m
7  g = 9.8   # surface grav. field strength in N/kg
8  m = 10    # ball's mass in kg
9  Y = 2e11 # steel's Young's modulus in N/m^2
10 # Find DeltaL, the amount the wire stretches.
11
12 area = (pi*d**2)/4
13 Force = m*g
14 DeltaL = (Force*Lo)/(area*Y)
15
16 print ("The wire stretches by ",DeltaL," m")
```

Listing 1: Problem 37 Code

$$\nabla \bullet \boldsymbol{E} = \frac{\rho}{\varepsilon_o}$$
$$\nabla \bullet \boldsymbol{B} = 0$$
$$\nabla \times \boldsymbol{E} = -\frac{\partial \boldsymbol{B}}{\partial t}$$
$$\nabla \times \boldsymbol{B} = \mu_o\left(I + \varepsilon_o \frac{\partial \boldsymbol{E}}{\partial t}\right)$$

$$\mathbf{d}\omega$$

$\Delta \boldsymbol{r} = \boldsymbol{r}_{\text{final}} - \boldsymbol{r}_{\text{initial}}$	definition	(1)
$\Delta \vec{r} = \vec{r}_{\text{final}} - \vec{r}_{\text{initial}}$	Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus.	(2)
$\Delta \boldsymbol{r} = \boldsymbol{r}_{\text{final}} - \boldsymbol{r}_{\text{initial}}$	definition	(3)
$\Delta \boldsymbol{r} = \boldsymbol{r}_{\text{final}} - \boldsymbol{r}_{\text{initial}}$	definition	(4)