

# The *intexgral* package<sup>\*</sup>

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## Abstract

While integral composition is prevalent in  $\text{\LaTeX}$ , it often proves to be impractical. When the expression becomes complex, it is then difficult to modify its various elements in an illegible source code. To address this problem, the *intexgral* package offers a central macro whose only argument is the integrand. Everything else (symbol, limits, variables...) can be modified using a `\key=value` interface. Unlike the traditional method, where the user chooses the limit order with the active characters `_` and `^`, the package had to establish a convention. Thus, for the two keys that will deal with limits, the assumed input will be `_{lower limit}^{upper limit}`. Since this package is written in *expl3*, it depends on the  $\text{\LaTeX}$ 3 group of packages *l3kernel* and *l3package*. In addition, *intexgral* uses the *derivative*<sup>1</sup> package to facilitate the manipulation of differentials, as well as *pkginfo grab*<sup>2</sup>.

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<sup>\*</sup>This file describes v3.0.0, last updated 2025-12-24

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<sup>1</sup>Available on CTAN under: <https://ctan.org/pkg/derivative>

<sup>2</sup>Available on CTAN under: <https://ctan.org/pkg/pkginfo grab>

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*Monospace Argon Medium*

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## Repository

 See GitHub repository.

## Acknowledgements

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# 1 Package options

---

`\intexgralsetup` `\intexgralsetup` {<package options>}

---

new: v2.0.0

These options can be declared in a classic way with `\usepackage` or with the present macro in the preamble:

---

`invert-limits` `invert-limits=<true|false>`

This key inverts the limit order convention. The entirety of the document can only follow one convention.

---

`invert-diff` `invert-diff=<true|false>`

---

updated: v3.0.0

It is common to see the differentials placed before the integrand in physics papers. This key hence swaps their position.

---

`limits-mode` `limits-mode=<limits|nolimits>`

---

new: v3.0.0

Applies `\limits` or `\nolimits` to every single integral.

---

`italic` `italic=<true|false>`

---

`upright` `upright=<true|false>`

These are the two keys of the *derivative* package.

# 2 Presentation of the main macro

---

`\integral` `\integral` [<list of keys>] {<integrand>}

---

updated: v3.0.0

This macro is used to typeset integrals. It must, of course, be used in math mode only. Here is a first example in its simplest form:

```
\begin{equation}
  \integral{x}
\end{equation}
```

$$\int x \, dx \tag{1}$$

Since this macro focuses on the use of keys, the first part of this documentation will present them, grouping them by domain. The second part will introduce a few additional macros that complement the use of certain keys. The rest of this document will outline the other features of the package.

## 3 List of keys

### 3.1 Integration limits

#### 3.1.1 Defining the limits

---

```

limits  limits= {⟨mixed-list⟩}, ⟨keyword⟩
limits* limits*= {⟨mixed-list⟩}, ⟨keyword⟩

```

---

This key determines the integration limits to be used, following the convention explained in the abstract. In its simplest form, the value of the key takes as its argument a list of elements separated by commas (*comma-separated values* or  $\langle\text{csv-list}\rangle$ <sup>1</sup>).

```

\begin{equation}
  \int\limits_{1}^{10} f(x) \, dx
\end{equation}

```

$$\int_1^{10} f(x) \, dx \quad (2)$$

The notable advantage of the `limits` key is that you can specify the integration limits for several integrals, and the package automatically typesets the corresponding symbols. To separate pairs of limits, we use a semicolon (*semicolon-separated values* or  $\langle\text{ssv-list}\rangle$ <sup>1</sup>).

```

\begin{equation}
  \iint\limits_{1, 2; 3, 4} f(x, y) \, dx \, dy
\end{equation}

```

$$\int_1^2 \int_3^4 f(x, y) \, dx \, dy \quad (3)$$

It is also possible to specify predefined limits using keywords (see section 4.2). Finally, the starred variant allows the limits of the integral to be expressed as an interval. The direction of the brackets automatically adjusts itself to the presence of  $\pm\infty$ .

```

\begin{equation}
  \int\limits_{[1,10]} f(x) \, dx
\end{equation}

```

$$\int_{[1,10]} f(x) \, dx \quad (4)$$

---

<sup>1</sup>We therefore mean by  $\langle\text{mixed-list}\rangle$  that `limits` can accept a set of  $\langle\text{csv-list}\rangle$  in a more general  $\langle\text{ssv-list}\rangle$ .

## 3.2 Display modes

mode `mode=\langle\text{default}|\text{nested}|\text{product}\rangle`

new: v3.0.0 *Solely* when the `limits` key is used, it is possible to choose between three distinct display styles. Each of these is fully compatible with the `invert-diff` option.

**default** Typesets all the symbols, then the integrand, then the variables. As the macro operates by default in this mode, it is not necessary to use the key with this value.

**nested** Typesets a nested integral where the symbol and integrand alternate before all the variables are written.

**product** Typesets a product of integrals where the symbol, integrand, and variables alternate.

Of course, nothing prevents you from using the `\integral` macro several times in a row to produce the same result as in the example below. However, for those who would prefer to obtain the result with a single macro, this method is permitted.

**important:** For the last two modes, the integral will be *cut off* in a certain way. In order to perform this action correctly, the same method must be used as with `limits`, i.e. by using a semicolon.

MODE **default**

```
\begin{equation}
\integral[limits={1, 2; 3, 4; 5, 6}, variables={x, y, z}, mode=default]{xyz}
\end{equation}
```

$$\int_1^2 \int_3^4 \int_5^6 xyz \, dx \, dy \, dz \quad (5)$$

MODE **nested**

```
\begin{equation}
\integral[limits={1, 2; 3, 4; 5, 6}, variables={z, y, x}, mode=nested]{x;y;z}
\end{equation}
```

$$\int_1^2 x \int_3^4 y \int_5^6 z \, dz \, dy \, dx \quad (6)$$

MODE **product**

```
\begin{equation}
\integral[limits={1, 2; 3, 4; 5, 6}, variables={x, y, z}, mode=product]{x;y;z}
\end{equation}
```

$$\int_1^2 x \, dx \int_3^4 y \, dy \int_5^6 z \, dz \quad (7)$$

To function correctly, it is obvious that the keys `limits` and `variables` (see 3.4.1), as well as the integrand, must have the same number of elements. If this is not the case,

compilation will not fail, but the expression of the integral may no longer make sense. Numerous warning messages will be displayed to inform you of this.

### 3.3 Symbol (and more about limits)

The `limits(*)` keys are very useful when typesetting a definite integral. However, this only covers final expressions where the limits of each variable have been specified. For more general cases — indefinite integrals — they are relatively inconvenient. To typeset a double integral over a surface  $S$ , one would have to write `limits={,;S,}`. Needless to say, this is rather inconvenient for the user and not optimal for the package. Furthermore, the glyph would not be correct. The set of keys below therefore offers an easy way to modify both the symbol and the bounds.

#### 3.3.1 Selecting a symbol

`symbol`

`symbol=<control sequence>`

updated: v3.0.0

This key accepts a macro designating an integral symbol. Any symbol previously defined by a control sequence is acceptable. If you attempt to use one that is not defined, it will be substituted with `\iint` and a warning message will be issued.

*remark:* Apart from verifying the existence of the macro, no specific checks are performed, and the value of the key is used as is to compose the symbol. This implies two things in particular. First, the symbol will depend on how it is defined. For instance, *amsmath* and *unicode-math* do not define `\iint` in the same way. The result will naturally be different. Furthermore, if you assign a *defined* macro as the key argument but it does not correspond to an integral symbol, the package will ignore it and still use the given symbol. In addition to the mathematical inconsistency that this may represent, it is likely to lead, under certain circumstances, to low-level errors.

```
\begin{equation}
  \integral[symbol=\iint, llimit=S, variables={x, y}]{f(x, y)}
\end{equation}
```

$$\iint_S f(x, y) \, dx \, dy \quad (8)$$

#### 3.3.2 Generating many integrals

`nint` `nint=<integer>`

This key accepts an integer  $n$  which allows  $n$  integrals to be composed. It is advisable to use this key only if the number of symbols exceeds 4 to favour the glyphs defined by the mathematical font used.

```
\begin{equation}
  \integral[nint=5, llimit=\Omega, variables={x_1, x_2, x_3, x_4, x_5}]{f(x_1, x_2,
    x_3, x_4, x_5)}
\end{equation}
```

$$\iiint\limits_{\Omega} f(x_1, x_2, x_3, x_4, x_5) \, dx_1 \, dx_2 \, dx_3 \, dx_4 \, dx_5 \quad (9)$$

### 3.3.3 Defining boundaries on an ad hoc basis

---

|                     |   |
|---------------------|---|
| <code>llimit</code> | <code>llimit=&lt;lower limit&gt;</code> |
| <code>ulimit</code> | <code>ulimit=&lt;upper limit&gt;</code> |

---

updated: v3.0.0

These two keys allow you to specify the lower and upper limits, respectively. They are only suitable if a single symbol is displayed. If you need to specify both limits, the `limits` key should be used instead.

```
\begin{equation}
  \integral[llimit={x^2 + y^2 \leq 1}, variables={x, y}]{f(x, y)}
\end{equation}
```

$$\int_{x^2+y^2 \leq 1} f(x, y) \, dx \, dy \quad (10)$$

### 3.3.4 Recurring limits motif

Lower limits sometimes follow common patterns that can be generalised with keys, thus avoiding overloading the argument of `llimit`.

---

|                      |  |
|----------------------|--|
| <code>domain</code>  | <code>domain= {&lt;*-list&gt;}</code>  |
| <code>domain*</code> | <code>domain*= {&lt;*-list&gt;}</code> |

---

updated: v3.0.0

These keys accept a list delimited by an asterisk. Each element of the list is then parsed as follows:

- The first token of the item is passed `\mathbb` (preceded by `\uppercase` in case the SHIFT key is too far away for your fingers).
- The remaining tokens — which may be empty — are placed as superscript (or subscript for the starred variant of the key).

```
\begin{equation}
  \integral[symbol=\iint, domain={\mathbb R*\mathbb R}, variables={x, y}]{xy}
\end{equation}
```

$$\iint_{\mathbb R \times \mathbb R} xy \, dx \, dy \quad (11)$$

---

|                       |  |
|-----------------------|--|
| <code>boundary</code> | <code>boundary= {&lt;lower limit&gt;}</code> |
|-----------------------|--|

---

This key simply places the symbol  $\partial$  before the lower bound.

```
\begin{equation}
  \integral[symbol=\oint, boundary=S, diff-vec]{G(\vec r)}
\end{equation}
```

$$\oint_{\partial S} G(\vec r) \cdot d\vec r \quad (12)$$



## 3.4 Differentials

### 3.4.1 Specifying the integration variables

**variables** `variables={⟨csv-list⟩}, ⟨keyword⟩, none`

updated: v3.0.0 This key allows you to define the variables of the integral in the form of a `⟨csv-list⟩`. Like `limits`, the key can accept a keyword as an argument. This behaviour is also explained later (see section 4.3).

**note:** If no variable is specified, i.e. `variables` is not called, the package automatically sets “`dx`” (or “`d̄r`” if `diff-vec` is active). Furthermore, if `none` is passed as a value, no variable will be displayed.

```
\begin{equation}
\integral[variables=t]{t^2}
\end{equation}
```

$$\int t^2 dt \quad (13)$$

### 3.4.2 Including the Jacobian

**jacobian** `jacobian`

This key enables the display of the Jacobian when defined by `\NewVariableKeyword`.

```
\begin{equation}
\integral[limits={0, R; 0, 2\pi; 0, \pi}, variables=spherical, mode=product,
jacobian]{;}
\end{equation}
```

$$\int_0^R r^2 dr \int_0^{2\pi} \sin \theta d\theta \int_0^\pi d\phi \quad (14)$$

As mentioned earlier, `derivative` is used by the package to compose differentials. The set of keys to follow, whose names will be prefixed with “`diff-`”<sup>1</sup>, thus allows you to apply the features of the macro `\odif`.

### 3.4.3 Modifying the differential symbol

**diff-symb** `diff-symb=⟨differential macro⟩`

This key allows you to change the style of differentials among those defined by `\NewDifferential`.

```
\NewDifferential{\feynmandiff}{\mathcal{D}}
\begin{equation}
\integral[variables={q(t)}, diff-symb=\feynmandiff]{e^{+\dfrac{\imath}{S[q(t)]}}
\hbar}
\end{equation}
```

<sup>1</sup>Although the key `diff-vec` is not linked to `derivative`.

$$\int e^{+\frac{iS[q(t)]}{\hbar}} \mathcal{D}q(t) \quad (15)$$

### 3.4.4 Creating a path integral

diff-vec diff-vec

This key applies a vector to each variable in addition to a centred dot. It is only compatible with the `default` mode.

```
\begin{equation}
\int\limits_S \vec{F} \cdot d\vec{S}
\end{equation}
```

$$\iint_S \vec{F} \cdot d\vec{S} \quad (16)$$

### 3.4.5 Opting for the starred variant

diff-star diff-star

Activating this key is equivalent to using `\odif*` or its variants.

```
\begin{equation}
\int\limits_S x^2 \exp(y) dx dy
\end{equation}
```

$$\iint x^2 \exp(y) dx dy \quad (17)$$

### 3.4.6 Designating options

diff-options diff-options={keyval list}

This key accepts a list of keys as it would have been written as an optional argument of `\odif` or its variants. For example, `diff-options={order={2, 3}, var=all}` will be interpreted as `\odif[order={2, 3}, var=all]{...}`.

```
\begin{equation}
\int \bar{\psi}(x) (\gamma^\mu \partial_\mu - m) \psi(x) d^4x
\end{equation}
```

$$\int \bar{\psi}(x) (\gamma^\mu \partial_\mu - m) \psi(x) d^4x \quad (18)$$

## 4 Additional macros

In addition to the wide range of keys defined by the package, a few macros also enhance their uses.

## 4.1 Custom differentials placement

### `\differentials` `\differentials`

Although the `invert-diff` option exists, it is often desirable to be able to place differentials wherever one wishes. For example, they are frequently seen in the numerator of a fraction when the numerator is 1. To meet this need, the package provides the macro `\differentials`. For the `default` and `nested` modes, the macro typesets all differentials at once. With `product`, the macro must be repeated between each semicolon.

```
\begin{equation}
  \integral{\frac{\differentials}{x}}{}
\end{equation}
```

$$\int \frac{dx}{x} \tag{19}$$

## 4.2 Looking back at the *limits* key

---

```
\NewLimitsKeyword    \NewLimitsKeyword {\keyword} {\limits}
\RenewLimitsKeyword
\ProvideLimitsKeyword
\DeclareLimitsKeyword
```

---

It is common to have to specify the same limits in an integral. To make them easier to write, the `limits(*)` keys accept, in addition to explicit limits, a keyword designating a pair of them predefined by one of these four macros:

- `\NewLimitsKeyword` Creates a new keyword and issues an error if it already exists.
- `\RenewLimitsKeyword` Redefines a keyword and issues an error if it does not already exist.
- `\ProvideLimitsKeyword` Only creates a new keyword if it does not already exist. No message will be issued if this is the case.
- `\DeclareLimitsKeyword` Creates a new keyword regardless, overwriting any previous definition.

Here is the list of keywords already defined by the package and the limits they contain:

|                       |                    |
|-----------------------|--------------------|
| <code>ab</code>       | $a, b$             |
| <code>unit</code>     | $0, 1$             |
| <code>real</code>     | $-\infty, \infty$  |
| <code>positive</code> | $0, \infty$        |
| <code>negative</code> | $-\infty, 0$       |
| <code>circle</code>   | $0, 2\pi$          |
| <code>sircle</code>   | $0, \pi$           |
| <code>qcircle</code>  | $0, \frac{\pi}{2}$ |
| <code>height</code>   | $0, H$             |
| <code>radius</code>   | $0, R$             |
| <code>length</code>   | $0, L$             |
| <code>time</code>     | $0, T$             |

**remark:** Keywords contain both limits of an integral at the same time. They must therefore be preceded and/or followed by semicolons.

**important:** Due to the implementation of `\NewLimitsKeyword` and its variants, the user *must* follow the package's limit order convention, even if `invert-limits` is set to `true`

We could therefore modify the expression of an integral as follows:

```
\begin{equation}
  \integral[limits={radius;circle;scircle}, variables={\rho, z, \phi}]{\rho z \phi}
\end{equation}
```

$$\int_0^R \int_0^{2\pi} \int_0^\pi \rho z \phi \, d\rho \, dz \, d\phi \quad (20)$$

It is entirely possible to combine these keywords with the more explicit syntax of `limits`.

```
\begin{equation}
  \integral[limits={time; 34, 40; height}, variables={h, \omega, t}]{h \omega t}
\end{equation}
```

$$\int_0^T \int_{34}^{40} \int_0^H h \omega t \, dh \, d\omega \, dt \quad (21)$$

### 4.3 Looking back at the *variables* key

---

```

\NewVariableKeyword    \NewVariableKeyword {\keyword} {\variables} [\jacobian]
\RenewVariableKeyword
\ProvideVariableKeyword
\DeclareVariableKeyword

```

---

Similarly, the same groups of variables often reappear. We can therefore also define keywords containing a set of pre-registered variables. The variants of this macro behave in the same way as for `\NewLimitsKeyword`. The only difference is that here it is possible to define a Jacobian, in the form of a `\csv-list` if necessary. Its display is then controlled by the `jacobian` key as explained above. Here is the list of variable keywords already defined by the package, with the Jacobian for some of them:

```

cartesian    x, y, z
planar       x, y
polar        r, \theta(r)
cylindrical  r, \theta, z(r)
spherical    r, \theta, \phi(r^2, \sin \theta)

```

```

\begin{equation}
  \integral[triple=V, variables=spherical]{f(x, y, z)}
\end{equation}

```

$$\iiint_V f(x, y, z) \, dr \, d\theta \, d\phi \quad (22)$$

## 4.4 Looking back at the *symbol* key

---

```
\NewSymbolKeyword \NewSymbolKeyword {⟨key⟩} {⟨symbol⟩}
\RenewSymbolKeyword
\ProvideSymbolKeyword
\DeclareSymbolKeyword
```

---

new: v3.0.0

In order to typeset indefinite integrals, the package essentially offers two keys: `symbol` and `llimit`. Although they are simple to use, it is still laborious to write both of them with their values. This is why *intexgral* provides so-called *shortcut* keys, whose purpose is to combine the selection of the symbol and the limits. Unlike the two previous macros, this involves creating entirely new keys, rather than simply specific values assigned to `symbol`. On their own, these keys modify the integral symbol. The value of these keys corresponds to the lower bound. Here is the list of all *symbol-key* defined by the package:

|                        |                                     |
|------------------------|-------------------------------------|
| <code>single</code>    | used symbol = <code>\int</code>     |
| <code>double</code>    | used symbol = <code>\iint</code>    |
| <code>triple</code>    | used symbol = <code>\iiint</code>   |
| <code>quadruple</code> | used symbol = <code>\iiiiint</code> |
| <code>contour</code>   | used symbol = <code>\oint</code>    |
| <code>surface</code>   | used symbol = <code>\oiint</code>   |
| <code>volume</code>    | used symbol = <code>\oiiint</code>  |

**important:** Allowing users to create their own keys for the `\integral` macro poses a risk that will be explained in more detail in the next section. For now, just remember that all these macros<sup>1</sup> will issue a warning message if you attempt to create a new *symbol-key* with the same name as a group of defined limits.

```
\begin{equation}
\integral[contour=\mathcal{C}, diff-vec]{f(\vec{r})}
\end{equation}
```

$$\oint_{\mathcal{C}} f(\vec{r}) \cdot d\vec{r} \quad (23)$$

## 5 Special syntax

### 5.1 Presentation of the syntax

---

`\integral` `\integral` [`\limits:variables(+j):mode`] {`\integrand`}

---

new: v3.0.0

With regard to definite integrals, the user will be required to use a maximum of four keys to compose them: `limits`, `variables`, `mode` and `jacobian`. However, they can be criticised for the same reason as before; writing these four keys, which can take quite long arguments, runs counter to the main objective of this package. Thus, the user can designate as an optional argument of `\integral` a syntax called *special* that is unique to *intexgral*. The logic is as follows:

- You specify a *valid* argument for the `limits` key.
- You specify a *valid* argument for the `variables`
- You specify a *valid* argument for the `mode` key

And you separate everything with a colon. Let's look at an example to better understand.

```
\begin{equation}
  \integral[1, 2; 4, 5:y, x:nested]{x; y}
\end{equation}
```

$$\int_1^2 x \int_4^5 y \, dy \, dx \quad (24)$$

We mean by *valid argument* that all forms of values accepted by the four keys can also be likewise adopted by the special syntax. This hence includes keywords.

```
\begin{equation}
  \integral[radius;circle;scircle:spherical:product]{r;\theta;\phi}
\end{equation}
```

$$\int_0^R r \, dr \int_0^{2\pi} \theta \, d\theta \int_0^\pi \phi \, d\phi \quad (25)$$

To include the Jacobian, simply write `+j` after the argument of `variables`. The mode can also be indicated using only an initial.

```
\begin{equation}
  \integral[radius;circle;scircle:spherical+j:p]{;};
\end{equation}
```

$$\int_0^R r^2 \, dr \int_0^{2\pi} \sin \theta \, d\theta \int_0^\pi d\phi \quad (26)$$

It is important to reiterate that in the classic configuration of the optional argument, it is of course not mandatory to specify the four keys mentioned. The same applies to this syntax. Since the key `mode` is not necessary for `default`, this part can be omitted.

```
\begin{equation}
  \integral[1, 2; 3, 4:x, y]{xy}
\end{equation}
```

$$\int_1^2 \int_3^4 xy \, dx \, dy \quad (27)$$

You can also take advantage of the automatic placement of “ $dx$ ” with this syntax, ignoring `variables`.

```
\begin{equation}
  \integral[1, 10]{x}
\end{equation}
```

$$\int_1^{10} x \, dx \quad (28)$$

## 5.2 Functioning of the syntax

From the user’s point of view, it is relatively simple to choose which syntax to adopt. However, the package must be able to distinguish between the two. Without going into too much detail<sup>1</sup> about the implementation, it is brought to your attention that the package attempts to extract the first key from the optional argument<sup>2</sup> and checks whether it exists. This is why, if you create a key with `\NewSymbolKeyword` whose name can probably be used as integration limits, *intexrgal* may incorrectly evaluate the nature of the optional argument.

## 6 Additional parameters

---

`\IntegralSetup` `\IntegralSetup {⟨parameter list⟩}`

---

new: v3.0.0

This macro allows you to modify parameters related to certain keys using the syntax `⟨key=value⟩`. All assignments made are local, so the macro can be placed in a group if necessary. Here is an example of the macro with the package’s default assignments:

```
\IntegralSetup
{
  defaultvar = {x},
  defaultvar* = {r},
  vectorstyle = \vec,
  domainstyle = \mathbb,
  symbolskip = {-6mu},
  hide-diff = false
}
```

---

`defaultvar` `defaultvar= {⟨variables⟩}`

---

`defaultvar*`

This key modifies the variable automatically inserted when `variables` is not used. The argument may correspond to a keyword defined by `\NewVariableKeyword`. The starred variant of the key controls the integration parameter to be typeset with `diff-vec`.

<sup>1</sup>The more courageous among you are still invited to read the source code.

<sup>2</sup>Or at least, the group of tokens that it thinks corresponds to a key.



vectorstyle `vectorstyle=<control sequence>`

This key modifies the macro to be applied to variables when `diff-vec` is in action. It is therefore possible to alter the style of the vector: bold, underlined, or even another style from a particular package — `esvect` for example.

domainstyle `domainstyle=<control sequence>`

Similarly, you can change the macro to be applied for keys `domain(*)`.

symbolskip `symbolskip=<muexpr>`

When the `default` mode is in effect, the package inserts kerning between symbols to bring them slightly closer together. The default dimension ( $-6\mu$ ) can thus be adjusted according to the mathematical font in use.

hide-diff `hide-diff=<true|false>`

When a large part of the document requires differentials not to be included, it is possible to extend the more specific action of `variables=none` over time.

# Changelog

## 3.0.0 (09-12-2025)

### Added

- ▶ Special syntax.
- ▶ Keys `domain*` and `mode`.
- ▶ Macros `\IntegralSetup` and `\NewSymbolKeyword`.

### Removed

- ▶ Macros `\defaultdiff`, `\defaultdiff`, `\defaultvdiff` et `\vdiffstyle` in favour of `\IntegralSetup`.
- ▶ Keys controlling both symbol and limit, now managed at a higher level by `\NewSymbolKeyword`.
- ▶ `int-split` key, in favour of `mode`.
- ▶ `\NewIntegralSymbol` macro.

### Changed

- ▶ The names of some keys (`variable` in `variables`, `lower-lim` and `upper-lim` in `llimit` and `ulimit`, `int-symb` in `symbol`, `invert-differentials` and `hide-differentials` in `invert-diff` and `hide-diff`).
- ▶ `jacobian` and `diff-star` no longer require a boolean value. Simply writing them will now enable their features.
- ▶ `hide-diff` assigned to a local option rather than a package one.
- ▶ `limits-mode` assigned to a package option rather than a macro key

## v2.0.1 (13-09-2025)

### Fixed

- ▶ Compatibility issue between `unicode-math` and `amssyb` depending on the loading order ([problem #2](#)).

## 2.0.0 (09-09-2025)

### Added

- ▶ Macros `\intexgralsetup`, `\defaultdiff`, `\defaultvdiff` and `\vdiffstyle`.

### Changed

- ▶ Warning messages related to non-existing symbols. They are now only triggered when the integral is typeset.

### Removed

- ▶ `diff-vec-style` key in favour of `\vdiffstyle`.
- ▶ Warning message about misuse of semi-colon in conjunction with the `int-split` key.

### Fixed

- ▶ Bug where the integrand was not reset when `\integral` was used successively in the same  $\TeX$  group ([details here](#)).

- ▶ `exp3` log leftovers that shouldn't have been there.

**1.1.0** (29-07-2025)

**Added**

- ▶ Starred variatn for the keys controlling both symbol and limit (keys `single`, `contour` etc).

**1.0.0** (26-07-2025) — Initial version.

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# Implementation

The implementation will be explained in more detail in a later version...

```
1 <*\package>
2 <@@=intexgral>
3 \NeedsTeXFormat{LaTeX2e}
4 \RequirePackage{expl3}[2025-05-14]
5 \RequirePackage{pkginfograb}
6
7 % Package declaration
8
9 \pkginfograbProvidesExplPackage{intexgral}
10 {
11   name      = {intexgral} ,
12   author    = {Valentin Dao},
13   date      = {2025-12-24} ,
14   creation  = {2025-07-26} ,
15   version   = {3.0.0} ,
16   description = {A LaTeX package for typesetting integrals.}
17 }
18
19 \msg_new:nnn { intexgral } { expl3-too-old }
20 {
21   Your~expl3~installation~is~too~old,~
22   "intexgral"~requires~expl3~dated~2025-05-14~or~later.\iow_newline:
23   Package~loading~has~been~aborted.\iow_newline:
24   \msg_see_documentation_text:n { intexgral }
25 }
26
27 % expl3 version verification
28
29 \@ifpackagelater{expl3}{2025-05-14}{}
30 { \msg_critical:nn { intexgral } { expl3-too-old } }
31
32 % Verifies if \mathbb is defined (default domain style)
33
34 \hook_gput_code:nnn { begindocument/before } { . }
35 { \cs_if_exist:Nf \mathbb { \RequirePackage{amsfonts} } }
36
37 % Definition of data types for package options
38
39 \bool_new:N \l__intexgral_invert_limits_bool
40 \bool_new:N \l__intexgral_deactivate_differentials_bool
41 \bool_new:N \l__intexgral_invert_differentials_bool
42 \tl_new:N \l__intexgral_limits_style_tl
43
44 % Package options
45
46 \keys_define:nn { intexgral }
47 {
48   invert-limits .bool_set:N = \l__intexgral_invert_limits_bool,
49   invert-limits .usage:n    = { preamble },
50   invert-limits .initial:n  = { false },
51
52   invert-diff .bool_set:N = \l__intexgral_invert_differentials_bool,
53   invert-diff .usage:n    = { preamble },
54   invert-diff .initial:n  = { false },
```

```

55
56   limits-mode .choice:,
57   limits-mode / limits .code:n =
58     { \tl_set_eq:NN \l__intexgral_limits_style_tl \tex_limits:D },
59   limits-mode / nolimits .code:n =
60     { \tl_set_eq:NN \l__intexgral_limits_style_tl \tex_nolimits:D },
61
62   limits-mode .usage:n = { preamble },
63   limits-mode .initial:n = { nolimits },
64
65   italic .choice:,
66     italic / true .code:n =
67       { \PassOptionsToPackage{italic=true}{derivative} },
68     italic / false .code:n =
69       { \PassOptionsToPackage{italic=false}{derivative} },
70
71   upright .choice:,
72     upright / true .code:n =
73       { \PassOptionsToPackage{upright=true}{derivative} },
74     upright / false .code:n =
75       { \PassOptionsToPackage{upright=false}{derivative} },
76 }
77
78 % Loads the package options and "derivative" package
79
80 \ProcessKeyOptions[intexgral]
81
82 \RequirePackage{derivative}
83
84 % Warning/Error/Info messages
85
86 \cs_new:Nn \__intexgral_warning_msg_header: {
87   (
88     integral~no.~
89     \int_use:N\g__intexgral_integral_number_int\c_space_tl
90     \msg_line_context:
91   )
92   \iow_newline:
93 }
94
95 \msg_new:nnnn { intexgral } { symb-key-alr-def }
96   { Symbol~key~"\tl_trim_spaces:n{#1}"~is~already~defined. }
97   { Use~\token_to_str:N \RenewSymbolKeyword\ instead. }
98
99 \msg_new:nnnn { intexgral } { symb-key-not-def }
100   { Symbol~key~"\tl_trim_spaces:n{#1}"~is~not~defined. }
101   { Use~\token_to_str:N \NewSymbolKeyword\ instead. }
102
103 \msg_new:nnnn { intexgral } { diff-group-alr-def }
104   { Differential~group~"\tl_trim_spaces:n{#1}"~is~already~defined. }
105   { Use~\token_to_str:N \RenewVarKeyword\ instead. }
106
107 \msg_new:nnnn { intexgral } { diff-group-not-def }
108   { Differential~group~"\tl_trim_spaces:n{#1}"~is~not~defined. }
109   { Use~\token_to_str:N \NewVarKeyword\ instead. }
110
111 \msg_new:nnnn { intexgral } { lim-group-alr-def }
112   { Limits~group~"\tl_trim_spaces:n{#1}"~is~already~defined. }

```

```

113 { Use~\token_to_str:N \RenewLimitsKeyword\ instead. }
114
115 \msg_new:nnnn { intexgral } { lim-group-not-def }
116 { Limits~group~"\tl_trim_spaces:n{#1}"~is~not~defined. }
117 { Use~\NewLimitsKeyword\ instead. }
118
119 \msg_new:nnn { intexgral } { key-exists-for-lim }
120 {
121   Symbol~key~already~defined~with~
122   \token_to_str:N \NewLimitsKeyword\ \__intexgral_warning_msg_header:
123   Key~"#1"~already~exists~for~predefined~limits.~
124   This~can~disrupt~the~functioning~of~the~special~syntax.
125 }
126
127 \msg_new:nnn { intexgral } { unknown-symb }
128 {
129   Unknown~integral~symbol~\__intexgral_warning_msg_header:
130   The~symbol~\tl_trim_spaces:n{#1}~has~been~replaced~with~
131   \token_to_str:N\int.
132 }
133
134 \msg_new:nnn { intexgral } { unequal-dim }
135 {
136   Inconsistent~structure~\__intexgral_warning_msg_header:
137   The~number~of~integrals~(#1),~integrands~(#2),~and~
138   differentials~(#3)~does~not~match.
139 }
140
141 \msg_new:nnn { intexgral } { no-jacobian }
142 {
143   Jacobian~unavailable~\__intexgral_warning_msg_header:
144   A~Jacobian~was~requested~for~the~"#1"~keyword,
145   ~but~none~was~declared~for~the~latter.
146 }
147
148 \msg_new:nnn { intexgral } { diff-not-sup }
149 {
150   Macro~\token_to_str:N\differentials\
151   not~supported~\__intexgral_warning_msg_header:
152   You~can't~use~\token_to_str:N\differentials\
153   with~"nested"~mode~alongside~inverted~differentials.~
154   I~will~simply~ignore~them.
155 }
156
157 \msg_new:nnn { intexgral } { diff-vec-not-supp }
158 {
159   Key~"diff-vec"~not~supported~\__intexgral_warning_msg_header:
160   You~can't~use~"diff-vec"~with~"#1"~mode.~I~will~simply~ignore~this~key.
161 }
162
163 \msg_new:nnn { intexgral } { use-glyph-instead }
164 {
165   Consider~using~the~dedicated~glyph~\__intexgral_warning_msg_header:
166   The~key~"nint"~was~used~with~fewer~than~
167   5~regular~integral~signs.
168 }
169
170 % Argument specifiers variants

```

```

171
172 \cs_generate_variant:Nn \regex_if_match:nnTF { nVTF }
173 \cs_generate_variant:Nn \__intexgral_new_limits_group:nn { nV }
174 \cs_generate_variant:Nn \str_if_eq:nnTF { neTF }
175 \cs_generate_variant:Nn \str_if_eq:nnF { neF }
176 \cs_generate_variant:Nn \keys_if_exist:nnTF { nVTF }
177 \cs_generate_variant:Nn \seq_use:Nn { Ne }
178 \cs_generate_variant:Nn \str_if_eq_p:nn { en }
179
180 % DATA TYPES
181
182 \tl_new:N \l__intexgral_key_name_tl
183 \tl_new:N \l__intexgral_integrand_tl
184 \tl_new:N \l__intexgral_domain_style_tl
185 \tl_new:N \l__intexgral_lower_limit_tl
186 \tl_new:N \l__intexgral_upper_limit_tl
187 \tl_new:N \l__intexgral_integral_symbol_tl
188 \tl_new:N \l__intexgral_differential_options_i_tl
189 \tl_new:N \l__intexgral_differential_options_ii_tl
190 \tl_new:N \l__intexgral_vectorial_differential_style_tl
191 \tl_new:N \l__intexgral_independent_differential_options_tl
192 \tl_new:N \l__intexgral_domain_char_tl
193 \tl_new:N \l__intexgral_domain_dimension_tl
194 \tl_new:N \l__intexgral_default_differential_tl
195 \tl_new:N \l__intexgral_default_vector_differential_tl
196 \tl_const:Nn \c__intexgral_left_bracket_tl { [ }
197 \tl_const:Nn \c__intexgral_right_bracket_tl { ] }
198
199 \tl_set_eq:NN \l__intexgral_integral_symbol_tl \int
200
201 \bool_new:N \l__intexgral_manual_differentials_bool
202 \bool_new:N \l__intexgral_custom_variables_bool
203 \bool_new:N \l__intexgral_separate_integral_bool
204 \bool_new:N \l__intexgral_vectorial_differential_bool
205 \bool_new:N \l__intexgral_jacobian_bool
206 \bool_new:N \l__intexgral_starred_differential_bool
207 \bool_new:N \l__intexgral_has_order_bool
208 \bool_new:N \l__intexgral_has_var_bool
209
210 \bool_set_false:N \l__intexgral_vectorial_differential_bool
211 \bool_set_false:N \l__intexgral_manual_differentials_bool
212 \bool_set_false:N \l__intexgral_custom_variables_bool
213 \bool_set_false:N \l__intexgral_separate_integral_bool
214 \bool_set_false:N \l__intexgral_has_order_bool
215 \bool_set_false:N \l__intexgral_has_var_bool
216
217 \clist_new:N \l__intexgral_variable_i_clist
218 \clist_new:N \l__intexgral_variable_ii_clist
219
220 \seq_new:N \l__intexgral_integrand_seq
221 \seq_new:N \l__intexgral_integral_symbol_seq
222 \seq_new:N \l__intexgral_jacobian_seq
223 \seq_new:N \l__intexgral_differential_seq
224 \seq_new:N \l__intexgral_limits_seq
225 \seq_new:N \l__intexgral_upper_limits_seq
226 \seq_new:N \l__intexgral_lower_limits_seq
227 \seq_new:N \l__intexgral_differential_var_i_seq
228 \seq_new:N \l__intexgral_differential_var_ii_seq

```

```

229 \seq_new:N \l__intexgral_differential_order_i_seq
230 \seq_new:N \l__intexgral_differential_order_ii_seq
231 \seq_new:N \l__intexgral_domain_seq
232
233 \str_new:N \l__intexgral_display_mode_str
234
235 \muskip_new:N \l__intexgral_inline_symbol_muskip
236
237 \prop_new:N \g__intexgral_limits_keyword_prop
238 \prop_new:N \g__intexgral_differential_group_keyword_prop
239
240 \int_new:N \l__intexgral_integral_sequence_int
241 \int_gzero_new:N \g__intexgral_integral_number_int
242
243 % TeX macros adapted to expl3 syntax
244
245 \cs_new_protected:Npn \__intexgral_mkern:N #1
246 { \tex_mkern:D #1 \scan_stop: }
247
248 \cs_new_protected:Npn \__intexgral_mathchoice:nnnn #1#2#3#4
249 { \mathchoice{#1}{#2}{#3}{#4} }
250
251 % SYMBOL
252
253 % General form of the symbol (glyph, limits mode, lower limit, upper limit)
254
255 \cs_new_protected:Npn \__intexgral_parse_integral_symbol:
256 {
257   \tl_use:N \l__intexgral_integral_symbol_tl
258   \tl_use:N \l__intexgral_limits_style_tl
259   \c_math_subscript_token
260   { \l__intexgral_lower_limit_tl }
261   \c_math_superscript_token
262   { \l__intexgral_upper_limit_tl }
263 }
264
265 % Generates the symbols after <limits> is executed
266
267 \cs_new_protected:Nn \__intexgral_generate_integral_sequence:
268 {
269   \int_set:Nn \l__intexgral_integral_sequence_int
270   {
271     \seq_if_empty:NTF \l__intexgral_lower_limits_seq
272     { \seq_count:N \l__intexgral_upper_limits_seq }
273     { \seq_count:N \l__intexgral_lower_limits_seq }
274   }
275   \exp_args:NV
276   \int_step_inline:nn \l__intexgral_integral_sequence_int
277   {
278     \seq_put_right:Nn \l__intexgral_integral_symbol_seq
279     {
280       \__intexgral_set_limits:nn
281       { \seq_item:Nn \l__intexgral_lower_limits_seq { ##1 } }
282       { \seq_item:Nn \l__intexgral_upper_limits_seq { ##1 } }
283       \__intexgral_parse_integral_symbol:
284     }
285   }
286 }

```

```

287
288 % LIMITS
289
290 % Inverts the limit order convention
291
292 \cs_new_protected:Npn \__intexgral_set_limits:nn #1#2
293 {
294   \bool_if:NTF \l__intexgral_invert_limits_bool
295   {
296     \tl_set:Nn \l__intexgral_lower_limit_tl { #2 }
297     \tl_set:Nn \l__intexgral_upper_limit_tl { #1 }
298   }
299   {
300     \tl_set:Nn \l__intexgral_lower_limit_tl { #1 }
301     \tl_set:Nn \l__intexgral_upper_limit_tl { #2 }
302   }
303 }
304
305 % Creates a keyword containing predefined limits
306
307 \cs_new_protected:Npn \__intexgral_new_limits_group:nn #1#2
308 { \prop_put:Nnn \g__intexgral_limits_keyword_prop { #1 } { #2 } }
309
310 % Verifies if the argument corresponds to a valid keyword
311
312 \cs_new:Npn \__intexgral_parse_integral_limit:n #1
313 {
314   \prop_if_in:NnTF \g__intexgral_limits_keyword_prop { #1 }
315   { \prop_item:Nn \g__intexgral_limits_keyword_prop { #1 } }
316   { #1 }
317 }
318
319 % Splits the argument of the key to prepare for parsing
320
321 \cs_new_protected:Npn \__intexgral_parse_limits:n #1
322 {
323   \tl_set:Nn \l_tmpa_tl { #1 }
324   \seq_clear:N \l__intexgral_lower_limits_seq
325   \seq_clear:N \l__intexgral_upper_limits_seq
326   \seq_set_split:NnV \l__intexgral_limits_seq { ; } \l_tmpa_tl
327 }
328
329 % Limits under regular form
330
331 \cs_new_protected:Nn \__intexgral_set_limits_regular:
332 {
333   \seq_map_inline:Nn \l__intexgral_limits_seq
334   {
335     \clist_set:Ne \l_tmpa_clist
336     { \__intexgral_parse_integral_limit:n { ##1 } }
337     \seq_put_right:Ne \l__intexgral_lower_limits_seq
338     { \clist_item:Nn \l_tmpa_clist { 1 } }
339     \seq_put_right:Ne \l__intexgral_upper_limits_seq
340     { \clist_item:Nn \l_tmpa_clist { 2 } }
341   }
342 }
343
344 % Limits under interval form

```

```

345
346 \cs_new_protected:Npn \__intexgral_set_limits_starred:
347 {
348   \seq_map_indexed_inline:Nn \l__intexgral_limits_seq
349   {
350     \clist_set:Nc \l_tmpa_clist
351       { \__intexgral_parse_integral_limit:n { ##2 } }
352     \bool_if:NTF \l__intexgral_invert_limits_bool
353     {
354       \tl_set:Nc \l__intexgral_lower_limit_tl
355       {
356         \clist_item:Nn \l_tmpa_clist { 2 }
357         \tex_mathpunct:D,
358         \clist_item:Nn \l_tmpa_clist { 1 }
359       }
360     }
361     {
362       \tl_set:Nc \l__intexgral_lower_limit_tl
363       {
364         \clist_item:Nn \l_tmpa_clist { 1 }
365         \tex_mathpunct:D,
366         \clist_item:Nn \l_tmpa_clist { 2 }
367       }
368     }
369     \bool_if:NTF \l__intexgral_invert_limits_bool
370     { \seq_put_right:Nc \l__intexgral_upper_limits_seq }
371     { \seq_put_right:Nc \l__intexgral_lower_limits_seq }
372   }
373   \str_case_e:nnF { \clist_item:Nn \l_tmpa_clist { 1 } }
374   {
375     { -\infty } { \tex_left:D \c__intexgral_right_bracket_tl }
376   }
377   { \tex_left:D \c__intexgral_left_bracket_tl }
378   \tl_use:N \l__intexgral_lower_limit_tl
379   \str_case_e:nnF { \clist_item:Nn \l_tmpa_clist { 2 } }
380   {
381     { +\infty } { \tex_right:D \c__intexgral_left_bracket_tl }
382   }
383   { \tex_right:D \c__intexgral_right_bracket_tl }
384 }
385 }
386 }
387
388 % VARIABLES
389
390 % Creates a keyword containing predefined variables
391
392 \cs_new_protected:Npn \__intexgral_new_differential_group:nnn #1#2#3
393 {
394   \prop_put:Nnn \g__intexgral_differential_group_keyword_prop
395     { #1 } { #2 }
396   \tl_if_blank:nF { #3 }
397   {
398     \clist_set:Nn \l_tmpa_clist { #3 }
399     \seq_set_from_clist:cN
400       { g__intexgral_#1_jacobian_seq }
401     \l_tmpa_clist
402   }

```



```

403 }
404
405 % expl3 equivalent of \odif(*)
406
407 \cs_new:Npn \__intexgral_differentials:nn #1#2
408 {
409     \bool_if:NTF \l__intexgral_starred_differential_bool
410     { \odif*[#1]{#2} }
411     { \odif[#1]{#2} }
412 }
413
414 % Extracts the whole "order" <keyval>
415
416 \cs_new_protected:Npn \__intexgral_extract_differential_order:n #1
417 {
418     \regex_extract_once:nnNT
419     { order\s*=\s*\{?\s*(\d+(?:\s*,\s*\d+)*)\s*\}? }
420     { #1 } \l__intexgral_differential_order_i_seq
421     { \bool_set_true:N \l__intexgral_has_order_bool }
422     \clist_set:Ne \l_tmpa_clist
423     { \seq_item:Nn \l__intexgral_differential_order_i_seq { 2 } }
424     \seq_set_from_clist:NN
425     \l__intexgral_differential_order_ii_seq
426     \l_tmpa_clist
427 }
428
429 % Extracts the whole "var" <keyval>
430
431 \cs_new_protected:Npn \__intexgral_extract_differential_var:n #1
432 {
433     \regex_extract_once:nnNTF
434     { var\s*=\s*(none|all|\{\s*(\d+(?:\s*,\s*\d+)*\s*)\}) }
435     { #1 }
436     \l__intexgral_differential_var_i_seq
437     { \bool_set_true:N \l__intexgral_has_var_bool }
438     {
439         \str_if_in:nnT { #1 } { var }
440         {
441             \seq_put_left:Nn \l__intexgral_differential_var_i_seq { var }
442             \bool_set_true:N \l__intexgral_has_var_bool
443         }
444     }
445     \clist_set:Ne \l_tmpa_clist
446     { \seq_item:Nn \l__intexgral_differential_var_i_seq { 3 } }
447     \seq_set_from_clist:NN
448     \l__intexgral_differential_var_ii_seq
449     \l_tmpa_clist
450 }
451
452 % Extracts all keys other than "order" and "var"
453
454 \cs_new_protected:Npn \__intexgral_remove_differential_order_and_var:n #1
455 {
456     \tl_set:Nn \l__intexgral_independent_differential_options_tl { #1 }
457     \regex_replace_all:nnN
458     {
459         order\s*=\s*\{?\s*\d+(\s*,\s*\d+)*\s*\}?\s*,?
460         |

```

```

461     [^-]var(?:\s*=\s*(?:none|all|\{\s*\d+(?:\s*,\s*\d+)*\s*\}))?,?
462   }
463   { }
464   \l__intexgral_independent_differential_options_tl
465 }
466
467 % Reassembles the variables
468
469 \cs_new_protected:Npn \__intexgral_parse_variable:nn #1#2
470 {
471   \clist_set:Nn \l_tmpa_clist { #2 }
472   \seq_set_from_clist:NN \l_tmpa_seq \l_tmpa_clist
473   \tl_if_empty:nF { #1 }
474   {
475     \__intexgral_extract_differential_order:n { #1 }
476     \__intexgral_extract_differential_var:n { #1 }
477     \__intexgral_remove_differential_order_and_var:n { #1 }
478   }
479   \seq_map_indexed_inline:Nn \l_tmpa_seq {
480     \tl_if_empty:nF { #1 }
481     {
482       \tl_put_right:NV
483         \__intexgral_differential_options_ii_tl
484         \__intexgral_independent_differential_options_tl
485       \bool_if:NT \__intexgral_has_order_bool
486       {
487         \tl_put_right:Ne \__intexgral_differential_options_ii_tl
488         {
489           ,order=
490           \seq_item:Nn \__intexgral_differential_order_ii_seq { ##1 }
491         }
492       }
493       \bool_if:NT \__intexgral_has_var_bool
494       {
495         \int_compare:nNnTF
496         { \seq_count:N \__intexgral_differential_var_i_seq }
497         =
498         { 1 }
499         {
500           \tl_put_right:Nn
501             \__intexgral_differential_options_ii_tl
502             { var }
503         }
504         {
505           \str_if_eq:neF { none }
506           { \seq_item:Nn \__intexgral_differential_var_i_seq { 2 } }
507           {
508             \str_if_eq:neTF { all }
509             { \seq_item:Nn
510               \__intexgral_differential_var_i_seq
511               { 2 }
512             }
513             {
514               \tl_put_right:Nn
515                 \__intexgral_differential_options_ii_tl
516                 { var }
517             }
518           }
519         }

```

```

519         \seq_if_in:NnT
520         \l__intexgral_differential_var_ii_seq
521         { ##1 }
522         {
523             \seq_pop_left:NN
524             \l__intexgral_differential_var_ii_seq
525             \l_tmpa_tl
526             \tl_put_right:Nn
527             \l__intexgral_differential_options_ii_tl
528             { ,var }
529         }
530     }
531 }
532 }
533 }
534 }
535 \seq_put_right:Ne \l__intexgral_differential_seq
536 {
537     \__intexgral_differentials:nn
538     { \exp_not:V \l__intexgral_differential_options_ii_tl }
539     { \seq_item:Nn \l_tmpa_seq { ##1 } }
540 }
541 \tl_clear:N \l__intexgral_differential_options_ii_tl
542 }
543 }
544
545 % Executes all previous macros to push tokens into the variable sequence
546
547 \cs_new_protected:Npn \__intexgral_parse_differentials:
548 {
549     \bool_if:NTF \l__intexgral_vectorial_differential_bool
550     {
551         \clist_map_inline:Nn \l__intexgral_variable_i_clist
552         {
553             \clist_put_right:Nn \l__intexgral_variable_ii_clist
554             { \l__intexgral_vectorial_differential_style_tl{##1} }
555         }
556         \bool_if:NTF \l__intexgral_custom_variables_bool
557         {
558             \exp_args:NVV \__intexgral_parse_variable:nn
559             \l__intexgral_differential_options_i_tl
560             \l__intexgral_variable_ii_clist
561         }
562         {
563             \exp_args:NV \__intexgral_parse_variable:nn
564             \l__intexgral_differential_options_i_tl
565             {
566                 \l__intexgral_vectorial_differential_style_tl
567                 { \l__intexgral_default_vector_differential_tl }
568             }
569         }
570     }
571 }
572 \bool_if:NTF \l__intexgral_custom_variables_bool
573 {
574     \exp_args:NVV \__intexgral_parse_variable:nn
575     \l__intexgral_differential_options_i_tl
576     \l__intexgral_variable_i_clist

```

```

577     }
578     {
579         \exp_args:NV \__intexgral_parse_variable:nn
580         \l__intexgral_differential_options_i_tl
581         { \l__intexgral_default_differential_tl }
582     }
583 }
584 }
585
586 % SPECIAL SYNTAX
587
588 % Cuts off the value of a key
589
590 \cs_new:Npn \__intexgral_retrieve_key_name:w #1=#2\q_stop { #1 }
591
592 % Extracts first key name of optional argument
593
594 \cs_new_protected:Npn \__intexgral_extract_first_key_name:n #1
595 {
596     \clist_set:Nn \l_tmpa_clist { #1 }
597     \tl_set:Ne \l_tmpa_tl { \clist_item:Nn \l_tmpa_clist { 1 } }
598     \tl_if_in:NnTF \l_tmpa_tl { = }
599     {
600         \tl_set:Ne \l__intexgral_key_name_tl
601         {
602             \exp_last_unbraced:NV
603             \__intexgral_retrieve_key_name:w \l_tmpa_tl \q_stop
604         }
605     }
606     { \tl_set_eq:NN \l__intexgral_key_name_tl \l_tmpa_tl }
607 }
608
609 % Sets the keys as usual, or sets them up manually if special syntax is in use
610
611 \cs_new_protected:Npn \__intexgral_parse_macro_keys:n #1
612 {
613     \keys_if_exist:nVTF { integral } \l__intexgral_key_name_tl
614     { \keys_set:nn { integral } { #1 } }
615     {
616         \regex_split:nnN { : } { #1 } \l_tmpa_seq
617         \int_compare:nNnT { \seq_count:N \l_tmpa_seq } < { 2 }
618         {
619             \seq_put_right:NV
620             \l_tmpa_seq
621             \l__intexgral_default_differential_tl
622         }
623         \int_compare:nNnT { \seq_count:N \l_tmpa_seq } < { 3 }
624         { \seq_put_right:Nn \l_tmpa_seq { d } }
625         \seq_set_split:Nne \l_tmpa_seq
626         { + }
627         { \seq_item:Nn \l_tmpa_seq { 2 } }
628         \keys_set:ne { integral }
629         {
630             limits = { \seq_item:Nn \l_tmpa_seq { 1 } },
631             variables = { \seq_item:Nn \l_tmpa_seq { 1 } },
632             mode =
633             {
634                 \str_case:enF { \seq_item:Nn \l_tmpa_seq { 3 } }

```

```

635         {
636             { d      } { default }
637             { n      } { nested  }
638             { p      } { product  }
639             { default } { default }
640             { nested  } { nested  }
641             { product } { product }
642         }
643     { default }
644 },
645 \bool_if:nT
646 {
647     \int_compare_p:nNn { \seq_count:N \l_tmpb_seq } > { 1 }
648     &&
649     \str_if_eq_p:en { \seq_item:Nn \l_tmpb_seq { 2 } } { j }
650 }
651 { jacobian }
652 }
653 }
654 }
655
656 % PRELIMINARY CONFIGURATIONS
657
658 % Verifies that <limits> and <variables> (and <integrand>) have the same size
659
660 \cs_new_protected:Nn \__intexgral_check_sequence_size:
661 {
662     \int_compare:nNnTF
663     { \seq_count:N \l__intexgral_integral_symbol_seq }
664     =
665     { \seq_count:N \l__intexgral_integrand_seq }
666     {
667         \int_compare:nNnF
668         { \seq_count:N \l__intexgral_integrand_seq }
669         =
670         { \seq_count:N \l__intexgral_differential_seq }
671         {
672             \msg_warning:nneee { intexgral } { unequal-dim }
673             { \seq_count:N \l__intexgral_integral_symbol_seq }
674             { \seq_count:N \l__intexgral_integrand_seq }
675             { \seq_count:N \l__intexgral_differential_seq }
676         }
677     }
678     {
679         \msg_warning:nneee { intexgral } { unequal-dim }
680         { \seq_count:N \l__intexgral_integral_symbol_seq }
681         { \seq_count:N \l__intexgral_integrand_seq }
682         { \seq_count:N \l__intexgral_differential_seq }
683     }
684 }
685
686 % Performs preparatory actions before executing the main macro
687
688 \cs_new_protected:Nn \__intexgral_integral_preconfiguration:
689 {
690     \int_gincr:N \g__intexgral_integral_number_int
691
692     \bool_if:NT \l__intexgral_separate_integral_bool

```

```

693     {
694         \seq_set_split:NnV
695         \l__intexgral_integrand_seq
696         { ; }
697         \l__intexgral_integrand_tl
698     }
699
700     \seq_if_empty:NT \l__intexgral_integral_symbol_seq
701     {
702         \seq_put_right:Nn \l__intexgral_integral_symbol_seq
703         { \__intexgral_parse_integral_symbol: }
704     }
705
706     \seq_if_empty:NT \l__intexgral_integrand_seq
707     {
708         \seq_put_right:NV
709         \l__intexgral_integrand_seq
710         \l__intexgral_integrand_tl
711     }
712
713     \bool_if:NF \l__intexgral_deactivate_differentials_bool
714     { \__intexgral_parse_differentials: }
715
716     \regex_if_match:nVTF { \c{differentials} } \l__intexgral_integrand_tl
717     { \bool_set_true:N \l__intexgral_manual_differentials_bool }
718     { \bool_set_false:N \l__intexgral_manual_differentials_bool }
719
720     \bool_if:NT \l__intexgral_separate_integral_bool
721     { \__intexgral_check_sequence_size: }
722 }
723
724 % Default mode
725
726 \cs_new_protected:Nn \__intexgral_print_default_integral:
727 {
728     \bool_if:NT \l__intexgral_manual_differentials_bool
729     {
730         \cs_set_protected:Npn \differentials
731         { \seq_use:Nn \l__intexgral_differential_seq { } }
732     }
733     \seq_use:Nn \l__intexgral_integral_symbol_seq
734     { \__intexgral_mkern:N \l__intexgral_inline_symbol_muskip }
735     \bool_if:nT
736     {
737         \l__intexgral_invert_differentials_bool
738         &&
739         !\l__intexgral_manual_differentials_bool
740     }
741     {
742         \seq_use:Nn \l__intexgral_differential_seq { } \tex_mathop:D{} \!
743         \bool_if:NT \l__intexgral_vectorial_differential_bool { \cdot \: }
744     }
745     \seq_use:Nn \l__intexgral_integrand_seq { }
746     \bool_if:NT \l__intexgral_jacobian_bool
747     { \seq_use:Nn \l__intexgral_jacobian_seq { } }
748     \bool_if:nT
749     {
750         !\l__intexgral_invert_differentials_bool

```

```

751      &&
752      !\l__intexgral_manual_differentials_bool
753    }
754    {
755      \bool_if:NT \l__intexgral_vectorial_differential_bool { \cdot }
756      \seq_use:Nn \l__intexgral_differential_seq { }
757    }
758  }
759
760 % Nested mode
761
762 \cs_new_protected:Nn \l__intexgral_print_nested_integral:
763 {
764   \bool_if:NT \l__intexgral_manual_differentials_bool
765   {
766     \cs_set_protected:Npn \differentials
767     { \seq_use:Nn \l__intexgral_differential_seq { } }
768   }
769   \bool_if:NT \l__intexgral_vectorial_differential_bool
770   { \msg_warning:nnn { intexgral } { diff-vec-not-supp } { nested } }
771   \int_step_inline:nn { \seq_count:N \l__intexgral_integral_symbol_seq }
772   {
773     \seq_item:Nn \l__intexgral_integral_symbol_seq { ##1 }
774     \bool_if:NTF \l__intexgral_invert_differentials_bool
775     {
776       \bool_if:NT \l__intexgral_manual_differentials_bool
777       {
778         \msg_warning:nn { intexgral } { diff-not-sup }
779         \cs_set_eq:NN \differentials \scan_stop:
780       }
781       \seq_item:Nn \l__intexgral_differential_seq { ##1 }
782       \tex_mathop:D{} \!
783     }
784     {
785       \seq_item:Nn \l__intexgral_integrand_seq { ##1 }
786       \bool_if:NT \l__intexgral_jacobian_bool
787       { \seq_item:Nn \l__intexgral_jacobian_seq { ##1 } }
788     }
789   }
790   \bool_if:NTF \l__intexgral_invert_differentials_bool
791   {
792     \seq_use:Nn \l__intexgral_integrand_seq {}
793     \bool_if:NT \l__intexgral_jacobian_bool
794     { \seq_use:Nn \l__intexgral_jacobian_seq { } }
795   }
796   {
797     \bool_if:NF \l__intexgral_manual_differentials_bool
798     {
799       \seq_use:Nn \l__intexgral_differential_seq {}
800     }
801   }
802 }
803
804 % Product mode
805
806 \cs_new_protected:Nn \l__intexgral_print_product_integral:
807 {
808   \bool_if:NT \l__intexgral_manual_differentials_bool

```

```

809     {
810         \cs_set_protected:Npn \differentials
811         {
812             \seq_gpop_left:NN \l_tmpa_tl
813             \tl_use:N \l_tmpa_tl
814         }
815     }
816     \bool_if:NT \l__intexgral_vectorial_differential_bool
817     { \msg_warning:nnn { intexgral } { diff-vec-not-supp } { product } }
818     \int_step_inline:nn { \seq_count:N \l__intexgral_integral_symbol_seq }
819     {
820         \seq_item:Nn \l__intexgral_integral_symbol_seq { ##1 }
821         \bool_if:nT
822         {
823             \l__intexgral_invert_differentials_bool
824             &&
825             !\l__intexgral_manual_differentials_bool
826         }
827         {
828             \seq_item:Nn
829             \l__intexgral_differential_seq { ##1 }
830             \tex_mathop:D{} \!
831         }
832         \seq_item:Nn \l__intexgral_integrand_seq { ##1 }
833         \bool_if:NT \l__intexgral_jacobian_bool
834         { \seq_item:Nn \l__intexgral_jacobian_seq { ##1 } }
835         \bool_if:nT
836         {
837             !\l__intexgral_invert_differentials_bool
838             &&
839             !\l__intexgral_manual_differentials_bool
840         }
841         { \seq_item:Nn \l__intexgral_differential_seq { ##1 } }
842     }
843 }
844
845 % General macro for typesetting
846
847 \cs_new_protected:Nn \__intexgral_print_integral:
848 {
849     \__intexgral_integral_preconfiguration:
850     \str_case:VnF \l__intexgral_display_mode_str
851     {
852         { default } { \__intexgral_print_default_integral: }
853         { nested } { \__intexgral_print_nested_integral: }
854         { product } { \__intexgral_print_product_integral: }
855     }
856     { \__intexgral_print_default_integral: }
857     \seq_gclear:N \l__intexgral_differential_seq
858 }
859
860 % KEYS
861
862 \keys_define:nn { integral } {
863
864     % LIMITS
865
866     mode .choice:,

```



```

867 mode / default .code:n =
868 {
869     \bool_set_false:N \l__intexgral_separate_integral_bool
870     \str_set:Nn \l__intexgral_display_mode_str { default }
871 },
872 mode / nested .code:n =
873 {
874     \bool_set_true:N \l__intexgral_separate_integral_bool
875     \str_set:Nn \l__intexgral_display_mode_str { nested }
876 },
877 mode / product .code:n =
878 {
879     \bool_set_true:N \l__intexgral_separate_integral_bool
880     \str_set:Nn \l__intexgral_display_mode_str { product }
881 },
882 mode .default:n = { default },
883
884 limits .code:n =
885 {
886     \__intexgral_parse_limits:n { #1 }
887     \__intexgral_set_limits_regular:
888     \__intexgral_generate_integral_sequence:
889 },
890
891 limits* .code:n =
892 {
893     \__intexgral_parse_limits:n { #1 }
894     \__intexgral_set_limits_starred:
895     \__intexgral_generate_integral_sequence:
896 },
897
898 llimit .tl_set:N = \l__intexgral_lower_limit_tl,
899
900 ulimit .tl_set:N = \l__intexgral_upper_limit_tl,
901
902 symbol .code:n =
903 {
904     \cs_if_exist:NTF #1
905     { \tl_set_eq:NN \l__intexgral_integral_symbol_tl #1 }
906     {
907         \msg_warning:nnn { intexgral } { unknown-symb } { #1 }
908         \tl_set_eq:NN \l__intexgral_integral_symbol_tl \int
909     }
910 },
911
912 % SYMBOL SHORTCUT
913
914 nint .code:n =
915 {
916     \int_compare:nNnT { #1 } < { 5 }
917     { \msg_warning:nn { intexgral } { use-glyph-instead } }
918
919     \tl_clear:N \l__intexgral_integral_symbol_tl
920
921     \int_step_inline:nn { #1 }
922     {
923         \tl_put_right:Nn \l__intexgral_integral_symbol_tl
924         { \int }

```

```

925     \int_compare:nNnT { ##1 } < { #1 }
926     {
927         \tl_put_right:Nn \l__intexgral_integral_symbol_tl
928         {
929             \__intexgral_mathchoice:nnnn
930             { \tex_mkern:D -12mu \scan_stop: }
931             { \tex_mkern:D -8mu \scan_stop: }
932             { \tex_mkern:D -4mu \scan_stop: }
933             { \tex_mkern:D -2mu \scan_stop: }
934         }
935     }
936 },
937
938
939 % LIMITS SHORTCUTS
940
941 domain .code:n =
942 {
943     \tl_set:Nn \l_tmpa_tl { #1 }
944     \seq_set_split:NnV \l__intexgral_domain_seq { * } \l_tmpa_tl
945     \seq_map_inline:Nn \l__intexgral_domain_seq
946     {
947         \tl_if_empty:NF \l__intexgral_lower_limit_tl
948         { \tl_put_right:Nn \l__intexgral_lower_limit_tl { \times } }
949         \tl_set:Ne \l__intexgral_domain_char_tl
950         { \exp_args:Ne \str_uppercase:n { \tl_head:n { ##1 } } }
951         \tl_set:Ne \l__intexgral_domain_dimension_tl
952         { \tl_tail:n { ##1 } }
953         \tl_put_right:Ne \l__intexgral_lower_limit_tl
954         {
955             \exp_not:N \l__intexgral_domain_style_tl
956             { \l__intexgral_domain_char_tl }
957             \c_math_superscript_token { \l__intexgral_domain_dimension_tl }
958         }
959     }
960 },
961
962 domain* .code:n =
963 {
964     \tl_set:Nn \l_tmpa_tl { #1 }
965     \seq_set_split:NnV \l__intexgral_domain_seq { * } \l_tmpa_tl
966     \seq_map_inline:Nn \l__intexgral_domain_seq
967     {
968         \tl_if_empty:NF \l__intexgral_lower_limit_tl
969         { \tl_put_right:Nn \l__intexgral_lower_limit_tl { \times } }
970         \tl_set:Ne \l__intexgral_domain_char_tl
971         { \exp_args:Ne \str_uppercase:n { \tl_head:n { ##1 } } }
972         \tl_set:Ne \l__intexgral_domain_dimension_tl
973         { \tl_tail:n { ##1 } }
974         \tl_put_right:Ne \l__intexgral_lower_limit_tl
975         {
976             \exp_not:N \l__intexgral_domain_style_tl
977             { \l__intexgral_domain_char_tl }
978             \c_math_subscript_token { \l__intexgral_domain_dimension_tl }
979         }
980     }
981 },
982

```

```

983 boundary .code:n =
984   { \tl_set:Nn \l__integragr_lower_limit_tl { \partial #1 } },
985
986 % VARIABLES
987
988 variables .code:n =
989   {
990     \bool_set_true:N \l__integragr_custom_variables_bool
991     \str_if_eq:nnTF { #1 } { none }
992       { \bool_set_true:N \l__integragr_deactivate_differentials_bool }
993       {
994         \prop_get:NnNTF
995           \g__integragr_differential_group_keyword_prop { #1 } \l_tmpa_tl
996           {
997             \clist_set:NV \l__integragr_variable_i_clist \l_tmpa_tl
998             \seq_if_exist:cTF { g__integragr_#1_jacobian_seq }
999               {
1000                 \seq_set_eq:Nc
1001                   \l__integragr_jacobian_seq
1002                   { g__integragr_#1_jacobian_seq }
1003               }
1004               { \msg_warning:nnn { integragr } { no-jacobian } { #1 } }
1005           }
1006           { \clist_set:Nn \l__integragr_variable_i_clist { #1 } }
1007       }
1008   },
1009
1010 jacobian .code:n =
1011   { \bool_set_true:N \l__integragr_jacobian_bool },
1012 diff-vec .code:n =
1013   { \bool_set_true:N \l__integragr_vectorial_differential_bool },
1014 diff-star .code:n =
1015   { \bool_set_true:N \l__integragr_starred_differential_bool },
1016
1017 diff-symb .code:n =
1018   {
1019     \cs_set:Npn \__integragr_differentials:nn ##1##2 {
1020       \bool_if:NTF \l__integragr_starred_differential_bool
1021         { #1*{##1}{##2} }
1022         { #1[##1]{##2} }
1023     }
1024   },
1025
1026 diff-options .tl_set:N = \l__integragr_differential_options_i_tl,
1027 }
1028
1029 \keys_define:nn { IntegralSetup }
1030 {
1031   defaultvar .code:n =
1032   {
1033     \prop_get:NnNTF
1034       \g__integragr_differential_group_keyword_prop
1035       { #1 }
1036       \l_tmpa_tl
1037       {
1038         \tl_set_eq:NN
1039           \l__integragr_default_differential_tl
1040           \l_tmpa_tl

```

```

1041     }
1042     { \tl_set:Nn \l__integragr_default_differential_tl { #1 } }
1043 },
1044 defaultvar* .code:n =
1045 {
1046     \prop_get:NnNTF
1047     \g__integragr_differential_group_keyword_prop
1048     { #1 }
1049     \l_tmpa_tl
1050     {
1051         \tl_set_eq:NN
1052         \l__integragr_default_vector_differential_tl
1053         \l_tmpa_tl
1054     }
1055     { \tl_set:Nn \l__integragr_default_vector_differential_tl { #1 } }
1056 },
1057 vectorstyle .tl_set:N = \l__integragr_vectorial_differential_style_tl,
1058 domainstyle .tl_set:N = \l__integragr_domain_style_tl,
1059 symbolskip .tl_set:N = \l__integragr_inline_symbol_muskip,
1060 hide-diff .bool_set:N = \l__integragr_deactivate_differentials_bool,
1061 }
1062
1063 % END USER MACROS
1064
1065 % Limits keywords
1066
1067 \NewDocumentCommand\NewLimitsKeyword{ m m }
1068 {
1069     \prop_get:NnNTF \g__integragr_limits_keyword_prop { #1 } \l_tmpa_tl
1070     { \msg_error:nnn { integragr } { lim-group-alr-def } { #1 } }
1071     {
1072         \bool_if:NTF \l__integragr_invert_limits_bool
1073         {
1074             \clist_set:Nn \l_tmpa_clist { #2 }
1075             \clist_reverse:N \l_tmpa_clist
1076             \__integragr_new_limits_group:nV { #1 } \l_tmpa_clist
1077         }
1078         { \__integragr_new_limits_group:nn { #1 } { #2 } }
1079     }
1080 }
1081
1082 \NewDocumentCommand\RenewLimitsKeyword{ m m }
1083 {
1084     \prop_pop:NnNTF \g__integragr_limits_keyword_prop { #1 } \l_tmpa_tl
1085     {
1086         \bool_if:NTF \l__integragr_invert_limits_bool
1087         {
1088             \clist_set:Nn \l_tmpa_clist { #2 }
1089             \clist_reverse:N \l_tmpa_clist
1090             \__integragr_new_limits_group:nV { #1 } \l_tmpa_clist
1091         }
1092         { \__integragr_new_limits_group:nn { #1 } { #2 } }
1093     }
1094     { \msg_error:nnn { integragr } { lim-group-not-def } }
1095 }
1096
1097 \NewDocumentCommand\ProvideLimitsKeyword{ m m }
1098 {

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1099 \prop_get:NnNF \g__integragl_limits_keyword_prop { #1 } \l_tmpa_tl
1100 {
1101   \bool_if:NTF \l__integragl_invert_limits_bool
1102   {
1103     \clist_set:Nn \l_tmpa_clist { #2 }
1104     \clist_reverse:N \l_tmpa_clist
1105     \__integragl_new_limits_group:nV { #1 } \l_tmpa_clist
1106   }
1107   { \__integragl_new_limits_group:nn { #1 } { #2 } }
1108 }
1109 }
1110
1111 \NewDocumentCommand\DeclareLimitsKeyword{ m m }
1112 {
1113   \prop_pop:NnNT \g__integragl_limits_keyword_prop { #1 } \l_tmpa_tl
1114   {
1115     \bool_if:NTF \l__integragl_invert_limits_bool
1116     {
1117       \clist_set:Nn \l_tmpa_clist { #2 }
1118       \clist_reverse:N \l_tmpa_clist
1119       \__integragl_new_limits_group:nV { #1 } \l_tmpa_clist
1120     }
1121     { \__integragl_new_limits_group:nn { #1 } { #2 } }
1122   }
1123 }
1124
1125 % Variable keywords
1126
1127 \NewDocumentCommand\NewVariableKeyword{ m m o }
1128 {
1129   \prop_get:NnNTF \g__integragl_differential_group_keyword_prop { #1 }
1130   \l_tmpa_tl
1131   { \msg_error:nnn { integragl } { diff-group-alr-def } { #1 } }
1132   { \__integragl_new_differential_group:nnn { #1 } { #2 } { #3 } }
1133 }
1134
1135 \NewDocumentCommand\RenewVariableKeyword{ m m o }
1136 {
1137   \prop_pop:NnNTF \g__integragl_differential_group_keyword_prop { #1 }
1138   \l_tmpa_tl
1139   {
1140     \seq_clear:c { g__integragl_#1_jacobian_seq }
1141     \__integragl_new_differential_group:nnn { #1 } { #2 } { #3 }
1142   }
1143   { \msg_error:nnn { integragl } { diff-group-not-def } { #1 } }
1144 }
1145
1146 \NewDocumentCommand\ProvideVariableKeyword{ m m o }
1147 {
1148   \prop_get:NnNF \g__integragl_differential_group_keyword_prop { #1 }
1149   \l_tmpa_tl
1150   { \__integragl_new_differential_group:nnn { #1 } { #2 } { #3 } }
1151 }
1152
1153 \NewDocumentCommand\DeclareVariableKeyword{ m m o }
1154 {
1155   \prop_pop:NnNT \g__integragl_differential_group_keyword_prop { #1 }
1156   \l_tmpa_tl

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1157     {
1158         \seq_clear:c { g__intexgral_#1_jacobian_seq }
1159         \__intexgral_new_differential_group:nnn { #1 } { #2 } { #3 }
1160     }
1161 }
1162
1163 % Symbol keys
1164
1165 \NewDocumentCommand\NewSymbolKeyword{ m m }
1166 {
1167     \prop_if_in:NnT \g__intexgral_limits_keyword_prop { #1 }
1168     { \msg_warning:nnn { intexgral } { key-exists-for-lim } { #1 } }
1169     \keys_if_exist:nnTF { integral } { #1 }
1170     { \msg_error:nnn { intexgral } { symb-key-alr-def } { #1 } }
1171     {
1172         \keys_define:nn { integral }
1173         {
1174             #1 .meta:n =
1175             {
1176                 symbol=#2,
1177                 llimit=##1
1178             },
1179         }
1180     }
1181 }
1182
1183 \NewDocumentCommand\RenewSymbolKeyword{ m m }
1184 {
1185     \prop_if_in:NnT \g__intexgral_limits_keyword_prop { #1 }
1186     { \msg_warning:nnn { intexgral } { key-exists-for-lim } { #1 } }
1187     \keys_if_exist:nnTF { integral } { #1 }
1188     {
1189         \keys_define:nn { integral }
1190         {
1191             #1 .undefine:
1192             #1 .meta:n =
1193             {
1194                 symbol=#2,
1195                 llimit=##1
1196             }
1197         }
1198     }
1199     { \msg_error:nnn { intexgral } { symb-key-not-def } }
1200 }
1201
1202 \NewDocumentCommand\ProvideSymbolKeyword{ m m }
1203 {
1204     \prop_if_in:NnT \g__intexgral_limits_keyword_prop { #1 }
1205     { \msg_warning:nnn { intexgral } { key-exists-for-lim } { #1 } }
1206     \keys_if_exist:nnF { integral } { #1 }
1207     {
1208         \keys_define:nn { integral }
1209         {
1210             #1 .meta:n =
1211             {
1212                 symbol=#2,
1213                 llimit=##1
1214             },

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```

1215     }
1216   }
1217 }
1218
1219 \NewDocumentCommand\DeclareSymbolKeyword{ m m }
1220 {
1221   \keys_define:nn { integral }
1222   {
1223     #1 .undefine:
1224     #1 .meta:n =
1225     {
1226       symbol=#2,
1227       llimit=##1
1228     },
1229   }
1230 }
1231
1232 \NewDocumentCommand\IntegralSetup{ m }
1233 { \keys_set:nn { IntegralSetup } { #1 } }
1234
1235 \NewDocumentCommand\integral{ 0{} m }
1236 {
1237   \group_begin:
1238   \tl_if_empty:nF { #1 }
1239   {
1240     \__intexgral_extract_first_key_name:n { #1 }
1241     \__intexgral_parse_macro_keys:n { #1 }
1242   }
1243   \tl_set:Nn \l__intexgral_integrand_tl { #2 }
1244   \__intexgral_print_integral:
1245   \group_end:
1246 }
1247
1248 % Preamble only
1249
1250 \@onlypreamble\intexgralsetup
1251
1252 % Included keywords
1253
1254 % Symbol keywords
1255 \NewSymbolKeyword{single}      {\int}
1256 \NewSymbolKeyword{double}     {\iint}
1257 \NewSymbolKeyword{triple}     {\iiint}
1258 \NewSymbolKeyword{quadruple}  {\iiiiint}
1259 \NewSymbolKeyword{contour}    {\oint}
1260 \NewSymbolKeyword{surface}    {\oiint}
1261 \NewSymbolKeyword{volume}     {\oiint}
1262
1263 % Limits keywords
1264 \NewLimitsKeyword{ab}         {a, b}
1265 \NewLimitsKeyword{real}       {-\infty, \infty}
1266 \NewLimitsKeyword{positive}   {0, \infty}
1267 \NewLimitsKeyword{negative}   {-\infty, 0}
1268 \NewLimitsKeyword{unit}       {0, 1}
1269 \NewLimitsKeyword{circle}     {0, 2\pi}
1270 \NewLimitsKeyword{scircle}    {0, \pi}
1271 \NewLimitsKeyword{qcircle}    {0, \frac{\pi}{2}}
1272 \NewLimitsKeyword{height}     {0, H}

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```

1273 \NewLimitsKeyword{radius}      {0, R}
1274 \NewLimitsKeyword{length}     {0, L}
1275 \NewLimitsKeyword{time}       {0, T}
1276
1277 % Variable keywords
1278 \NewVariableKeyword{cartesian}  {x, y, z}
1279 \NewVariableKeyword{planar}    {x, y}
1280 \NewVariableKeyword{polar}     {r, \theta}      [r]
1281 \NewVariableKeyword{cylindrical}{r, \theta, z}   [r]
1282 \NewVariableKeyword{spherical} {r, \theta, \phi} [r^2, \sin\theta]
1283
1284 % Default parameters
1285
1286 \IntegralSetup
1287 {
1288     defaultvar = {x},
1289     defaultvar* = {r},
1290     vectorstyle = \vec,
1291     domainstyle = \mathbb,
1292     symbolskip = {-6mu},
1293     hide-diff = false
1294 }
1295
1296 \ExplSyntaxOff

```