The **xfp** package
Floating Point Unit

The LaTeX3 Project[*]

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This package provides a LaTeX 2_ε document-level interface to the LaTeX3 floating point unit (part of expl3).

\fpeval $\star$ — The expandable command `\fpeval` takes as it's argument a floating point expression and will produce a result using the normal rules of mathematics. As this command is expandable it can be used where TeX requires a number and for example within a low-level `\edef` operation to give a purely numerical result.

Briefly, the floating point expressions may comprise:

- Basic arithmetic: addition $x + y$, subtraction $x - y$, multiplication $x * y$, division x/y, square root $\sqrt{x}$, and parentheses.

- Comparison operators: $x < y$, $x <= y$, $x >? y$, $x != y$ *etc.*

- Boolean logic: sign $\mathrm{sign}\, x$, negation $!\, x$, conjunction $x\,\&\&\,y$, disjunction $x\,||\,y$, ternary operator $x\,?\,y:z$.

- Exponentials: $\exp x$, $\ln x$, x^y.

- Trigonometry: $\sin x$, $\cos x$, $\tan x$, $\cot x$, $\sec x$, $\csc x$ expecting their arguments in radians, and $\mathrm{sind}\, x$, $\mathrm{cosd}\, x$, $\mathrm{tand}\, x$, $\mathrm{cotd}\, x$, $\mathrm{secd}\, x$, $\mathrm{cscd}\, x$ expecting their arguments in degrees.

- Inverse trigonometric functions: $\mathrm{asin}\, x$, $\mathrm{acos}\, x$, $\mathrm{atan}\, x$, $\mathrm{acot}\, x$, $\mathrm{asec}\, x$, $\mathrm{acsc}\, x$ giving a result in radians, and $\mathrm{asind}\, x$, $\mathrm{acosd}\, x$, $\mathrm{atand}\, x$, $\mathrm{acotd}\, x$, $\mathrm{asecd}\, x$, $\mathrm{acscd}\, x$ giving a result in degrees.

- Extrema: $\max(x, y, \ldots)$, $\min(x, y, \ldots)$, $\mathrm{abs}(x)$.

- Rounding functions ($n = 0$ by default, $t = \texttt{NaN}$ by default): $\mathrm{trunc}(x, n)$ rounds towards zero, $\mathrm{floor}(x, n)$ rounds towards $-\infty$, $\mathrm{ceil}(x, n)$ rounds towards $+\infty$, $\mathrm{round}(x, n, t)$ rounds to the closest value, with ties rounded to an even value by default, towards zero if $t = 0$, towards $+\infty$ if $t > 0$ and towards $-\infty$ if $t < 0$.

- Random numbers: $rand()$, $randint(m, n)$ (requires pdfTeX or LuaTeX).

- Constants: `pi`, `deg` (one degree in radians).

- Dimensions, automatically expressed in points, *e.g.*, `pc` is 12.

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[*]E-mail: latex-team@latex-project.org

- Automatic conversion (no need for `\number`) of integer, dimension, and skip variables to floating points, expressing dimensions in points and ignoring the stretch and shrink components of skips.

An example of use could be the following.

```
\LaTeX{} can now compute: $ \frac{\sin (3.5)}{2} + 2\cdot 10^{-3}
= \fpeval{sin 3.5 /2 + 2e-3} $.
```

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