typst-theorems

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https://github.com/sahasatvik/typst-theorems

Contents

1. Introduction

This document only includes the examples given in the manual; each one of these has been explained in full detail there.

2. Feature demonstration

```
#let theorem = thm-plain("Theorem")
```

`#theorem("Euclid")[ There are infinitely many primes. ] <euclid>`	**Theorem 2.1** (Euclid). *There are infinitely many primes.*

```
#let lemma = thm-plain(
  "Lemma",                // head
  identifier: "Theorem",  // identifier - same as that of Theorem
                          // options for styling the block
  fill: rgb("#e8e8f8"),
  outset: 0.7em,
  padding: (y: 0.5em)
)
```

`#lemma[ If $n$ divides both $x$ and $y$, it also divides $x - y$. ]`	**Lemma 2.2.** *If n divides both x and y, it also divides $x - y$.*

```
#let corollary = thm-plain(
  "Corollary",            // head
  base: "Theorem",        // base - use the theorem counter
)
```

```
#corollary(numbering: "1.1")[
  If $n$ divides two consecutive natural
  numbers, then $n = 1$.
]
```

Corollary 2.2.1. *If n divides two consecutive natural numbers, then $n = 1$.*

2.1. Proofs

```
#let proof = thm-proof("Proof")
```

```
#proof([of @euclid])[
  Suppose to the contrary that $p_1,
  p_2, dots, p_n$ is a finite
  enumeration of all primes. Set $P
  = p_1 p_2 dots p_n$. Since $P + 1$
  is not in our list, it cannot be
  prime. Thus, some prime factor
  $p_j$ divides $P + 1$. Since $p_j$
  also divides $P$, it must divide
  the difference $(P + 1) - P = 1$, a
  contradiction.
]
```

Proof of Theorem 2.1. Suppose to the contrary that $p_1, p_2, \dots, p_n$ is a finite enumeration of all primes. Set $P = p_1 p_2 \dots p_n$. Since $P + 1$ is not in our list, it cannot be prime. Thus, some prime factor p_j divides $P + 1$. Since p_j also divides P, it must divide the difference $(P + 1) - P = 1$, a contradiction. ∎

```
#theorem[
  There are arbitrarily long stretches
  of composite numbers.
]
#proof[
  For any $n > 2$, consider $
    n! + 2, quad n! + 3, quad ...,
    quad n! + n #qedhere
  $
]
```

Theorem 2.1.1. *There are arbitrarily long stretches of composite numbers.*

Proof. For any $n > 2$, consider

$$n! + 2, \quad n! + 3, \quad \dots, \quad n! + n$$ ∎

2.2. Suppressing numbering

```
#let conjecture = thm-plain(
  "Conjecture",
  numbering: none
)
```

```
#conjecture[
  The numbers $2$, $3$, and $17$ are
  prime.
]
```

Conjecture. *The numbers 2, 3, and 17 are prime.*

`#lemma(numbering: none)[ The square of any even number is divisible by $4$. ]` `#lemma[ The square of any odd number is one more than a multiple of $4$. ]`	**Lemma.** *The square of any even number is divisible by* 4. **Lemma 2.2.1.** *The square of any odd number is one more than a multiple of* 4.

```
#lemma(numbering: none)[
  The square of any even number is
  divisible by $4$.
]
#lemma[
  The square of any odd number is one
  more than a multiple of $4$.
]
```

Lemma. *The square of any even number is divisible by* 4.

Lemma 2.2.1. *The square of any odd number is one more than a multiple of* 4.

```
#lemma(number: "42")[
 The square of any natural number cannot
be two more than a multiple of 4.
]
```

Lemma 42. *The square of any natural number cannot be two more than a multiple of 4.*

2.3. Limiting depth

```
#let definition = thm-def(
  "Definition",
  base_level: 1           // take only the first level from the base
)
```

```
#definition("Prime numbers")[
  A natural number is called a _prime
  number_ if it is greater than $1$ and
  cannot be written as the product of
  two smaller natural numbers.
] <prime>
```

Definition 2.1 (Prime numbers)**.** A natural number is called a *prime number* if it is greater than 1 and cannot be written as the product of two smaller natural numbers.

```
#definition("Composite numbers")[
  A natural number is called a
  _composite number_ if it is greater
  than $1$ and not prime.
]
```

Definition 2.2 (Composite numbers)**.** A natural number is called a *composite number* if it is greater than 1 and not prime.

```
#let example = thm-rem(
  "Example",
  numbering: "1.1"
)
```

```
#example(base_level: 4)[
  The numbers $4$, $6$, and $42$
  are composite.
]
```

Example 2.3.0.0.1. The numbers 4, 6, and 42 are composite.

2.4. Custom formatting

```
#let proof-custom = thm-box(
  "Proof",
  titlefmt: smallcaps,
  bodyfmt: body => [
```

```
    #body #h(1fr) $square$    // float a QED symbol to the right
  ],
  numbering: none
)
```

```
#lemma[
  All even natural numbers greater than
  2 are composite.
]
#proof-custom[
  Every even natural number $n$ can be
  written as the product of the natural
  numbers $2$ and $n\/2$. When $n > 2$,
  both of these are smaller than $2$
  itself.
]
```

Lemma 2.4.1. *All even natural numbers greater than 2 are composite.*

Proof. Every even natural number n can be written as the product of the natural numbers 2 and $n/2$. When $n > 2$, both of these are smaller than 2 itself. □

```
#let notation = thm-env(
  "notation",               // identifier
  none,                     // base - do not attach, count globally
  none,                     // base_level - use the base as-is
  (name, number, body, color: black) => [
                            // fmt - format content using the environment
                            // name, number, body, and an optional color
    #text(color)[#h(1.2em) *Notation (#number) #name*]:
    #h(0.2em)
    #body
    #v(0.5em)
  ]
).with(numbering: "I")      // use Roman numerals
```

```
#notation[
  The variable $p$ is reserved for
  prime numbers.
]
#notation("for Reals", color: green)[
  The variable $x$ is reserved for
  real numbers.
]
```

Notation (I) : The variable p is reserved for prime numbers.

Notation (II) for Reals: The variable x is reserved for real numbers.

```
#lemma(title: "Lem.", stroke: 1pt)[
  All multiples of 3 greater than 3
  are composite.
]
```

Lem. 2.4.2. *All multiples of 3 greater than 3 are composite.*

2.5. Labels and references

```
Recall that there are infinitely many
prime numbers via @euclid.
```

Recall that there are infinitely many prime numbers via Theorem 2.1.

```
You can reference future environments
too, like @oddprime[Cor.].
```

You can reference future environments too, like Cor. 2.6.1.

```
#lemma(
  supplement: "Lem.",
  refnumbering: "(1.1)"
)[
  All primes apart from $2$ and $3$ are
  of the form $6k plus.minus 1$.
] <primeform>

You can modify the supplement and
numbering to be used in references, like
@primeform.
```

Lemma 2.5.1. *All primes apart from* 2 *and* 3 *are of the form* $6k \pm 1$.

You can modify the supplement and numbering to be used in references, like Lem. (2.5.1).

2.6. Overriding `base`

```
#let remark = thm-rem(
  "Remark",
  base: "heading",
  numbering: "1.1"
)
```

```
#remark[
  There are infinitely many composite
  numbers.
]
```

Remark 2.6.1. There are infinitely many composite numbers.

```
#lemma[
  All primes greater than $2$ are odd.
] <oddprime>

#remark(base: "Theorem")[
  Two is a _lone prime_.
]
```

Lemma 2.6.1. *All primes greater than* 2 *are odd.*

Remark 2.6.1.1. Two is a *lone prime*.