# ctheorems

sahasatvik

## 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

> **Theorem 2.1** (Euclid): There are infinitely many primes.

> **Lemma 2.2**: If $n$ divides both $x$ and $y$, it also divides $x - y$.

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

### 2.1. Proofs

*Proof of [Theorem 2.1](#):* Suppose to the contrary that $p_1, p_2, ..., p_n$ is a finite enumeration of all primes. Set $P = p_1 p_2 ... p_n$. 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 2.1.1**: There are arbitrarily long stretches of composite numbers.

*Proof:* For any $n > 2$, consider

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

## 2.2. Suppressing numbering

*Example*: The numbers 2, 3, and 17 are prime.

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

## 2.3. Limiting depth

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

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

## 2.4. Custom formatting

**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. □

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

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

**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 .

You can reference future environments too, like [Cor. 2.5.1.1](#).

> **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

*Remark 2.6.1*:  There are infinitely many composite numbers.

> **Corollary 2.5.1.1**:  All primes greater than 2 are odd.

*Remark 2.5.1.1.1*:  Two is a *lone prime*.