Program 8

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\documentclass{article}
\usepackage{amsthm}
% Define theorem-like environments
\newtheorem{theorem}{Theorem}
\newtheorem{definition}{Definition}
\newtheorem{corollary}{Corollary}
\newtheorem{lemma}{Lemma}
\begin{document}
\title{Numbered Theorems, Definitions, Corollaries, and Lemmas in the Document}
\date{}
\maketitle
\begin{theorem}
(Pythagorean Theorem) In a right-angled triangle, the square of the length of the hypotenuse
is equal to the sum of the squares of the lengths of the other two sides.
\begin{equation}
a^2 + b^2 = c^2
\end{equation}
\end{theorem}
% Presenting a definition with an example
\begin{definition}
(Prime Number) A prime number is a natural number greater than 1 that is not divisible by
any number other than 1 and itself.
\begin{itemize}
\item Example: 2, 3, 5, and 7 are prime numbers.
\end{itemize}
\end{definition}
% Presenting a corollary with an example
\begin{corollary}
(Euclid's Corollary) There are infinitely many prime numbers.
\begin{itemize}
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\item Proof: Assume there are finitely many primes. Let them be $p_1, p_2, \ldots, p_n$.

Consider the number $N = p_1 \cdot p_2 \cdots p_n + 1$.

This number is not divisible by any of the primes p_1 through p_n.

Therefore, there must be a prime factor not in the list, contradicting the assumption that there are only finitely many primes.

\end{itemize}

\end{corollary}

% Presenting a lemma with an example

\begin{lemma}

(Basic Arithmetic Identity) For any real numbers a and b, we have:

16

17

\begin{equation}

(a + b)^2 = a^2 + 2ab + b^2.

\end{equation}

\end{lemma}

\end{document}