Proof By Cases

Let $A = \{x : \texttt{Prime}(x)\}$, $B = \{x : \texttt{Odd}(x) \vee \texttt{PowerOfTwo}(x)\}$

Where $\texttt{PowerOfTwo}(x) \coloneqq \exists c(\texttt{Integer}(c) \wedge x = 2\hat{}c)$

Prove $A \subseteq B$

We need two different arguments – one for 2 and one for all the other primes…

Divides

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For integers x, y we say $x|y$ ("x divides y") iff there is an integer z such that $xz = y$.

Which of these are true?

$2|4$ $\quad$ $4|2$ $\quad$ $2|-2$

$5|0$ $\quad$ $0|5$ $\quad$ $1|5$

Claim: for all $a, b, c, n \in \mathbb{Z}, n \geq 0$: $a \equiv b \pmod{n} \rightarrow a + c \equiv b + c \pmod{n}$

Before we start, we must know:

1. What every word in the statement means.
2. What the statement as a whole means.
3. Where to start.
4. What your target is.

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Equivalence in modular arithmetic

Let $a \in \mathbb{Z}, b \in \mathbb{Z}, n \in \mathbb{Z}$ and $n > 0$.
We say $a \equiv b\ (mod\ n)$ if and only if $n|(b - a)$

You Try!

Claim: for all $a, b, c, n \in \mathbb{Z}, n > 0$: If $a \equiv b\ (mod\ n)$ then $ac \equiv bc\ (mod\ n)$

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