Math 347:
How NOT to do proofs:
"Proofs" that $x = x + 2$

Proof 1: "Proof" without words

$$
\begin{aligned}
x &= x + 2 \\
x - 1 &= x + 1 \\
(x-1)^2 &= (x+1)^2 \\
x^2 - 2x + 1 &= x^2 + 2x + 1 \\
-2x &= 2x \\
(-2x)^2 &= (2x)^2 \\
4x^2 &= 4x^2 \\
0 &= 0 \\
&\text{TRUE!}
\end{aligned}
$$

Proof 2: "Proof" with explanations. Better, but still wrong.

$x = x + 2$	
$x - 1 = x + 1$	(subtract 1 from each side)
$(x-1)^2 = (x+1)^2$	(square each side)
$x^2 - 2x + 1 = x^2 + 2x + 1$	(multiply out)
$-2x = 2x$	(subtract $x^2 + 1$ from each side)
$(-2x)^2 = (2x)^2$	(square each side)
$4x^2 = 4x^2$	(multiply out)
$0 = 0$	(subtract $4x^2$ from each side)
TRUE!	

Proof 3: "Proof" with connecting words. Better than a proof without words, but still wrong.

Let	$x = x + 2.$
Then	$x - 1 = x + 1.$
Hence	$(x - 1)^2 = (x + 1)^2,$
so	$x^2 - 2x + 1 = x^2 + 2x + 1,$
and therefore	$-2x = 2x.$
It follows that	$(-2x)^2 = (2x)^2,$
thus	$4x^2 = 4x^2,$
and therefore	$0 = 0.$

The latter is a TRUE statement, so the result is proved.

Same, as a single paragraph of prose:
Let $x = x + 2$. Then $x - 1 = x + 1$. Hence $(x - 1)^2 = (x+1)^2$, so $x^2-2x+1 = x^2+2x+1$, and therefore $-2x = 2x$. It follows that $(-2x)^2 = (2x)^2$, thus $4x^2 = 4x^2$, and therefore $0 = 0$. The latter is a TRUE statement, so the result is proved.

Proof 4. "Pro-style" proof, with complete sentences, proper punctuation, and appropriate explanations. Very professional looking, but, alas, still wrong.

- Let $x = x + 2$.
- Subtracting 1 from each side, we get $x - 1 = x + 1$.
- Squaring both sides gives $(x - 1)^2 = (x + 1)^2$.
- Multiplying out, we obtain $x^2 - 2x + 1 = x^2 + 2x + 1$.
- Subtracting $x^2 + 1$ from both sides gives $-2x = 2x$.
- Squaring again, we get $(-2x)^2 = (2x)^2$.
- Simplifying, we obtain $4x^2 = 4x^2$.
- Subtracting $4x^2$ from both sides, we get $0 = 0$.
- The latter is a TRUE statement, so the result is proved.

Same, as a single paragraph of prose:
Let $x = x+2$. Subtracting 1 from each side, we get $x-1 = x+1$. Squaring both sides gives $(x - 1)^2 = (x + 1)^2$. Multiplying out, we obtain $x^2-2x+1 = x^2+2x+1$. Subtracting x^2+1 from both sides gives $-2x = 2x$. Squaring again, we get $(-2x)^2 = (2x)^2$. Simplifying, we obtain $4x^2 = 4x^2$. Subtracting $4x^2$ from both sides, we get $0 = 0$, which is a TRUE statement.

Proof 5. In correct order, fixes the error in the previous "proofs", but introduces another error in the process ...

Obviously	$4x^2 = 4x^2.$
Therefore	$(-2x)^2 = (2x)^2.$
Hence	$-2x = 2x.$
Thus	$-2x + x^2 + 1 = 2x + x^2 + 1.$
So	$(x-1)^2 = (x+1)^2.$
Hence	$x - 1 = x + 1.$
Therefore	$x = x + 2.$