Quote of the day: Whitehead, Alfred North (1861 - 1947) Familiar things happen, and mankind does not bother about them. It requires a very unusual mind to undertake the analysis of the obvious.

Homework response: On chains of equalities, consider leaving out the first f. It's sensible as a calculation, but wrong as a proof, because one of the equalities is not true. A chain is only as strong as its weakest link.

Homework response: Why *not*, after all, begin with $f(f(n+2)+2) = n$? You cannot write that down without asserting the thing, and you cannot assert it, in a proof, without justification.

Sound and unsound deductions from evidence

Today we study four logical forms often used in justifications. They are ...

Modus Ponens:	We know $p \to q$, and we know p. Therefore, q.
Affirming the Consequent:	We know $p \to q$, and we know q. Therefore, p.
Denying the Antecedent:	We know $p \to q$, and we know $\neg p$. Therefore, $\neg q$.
Modus Tollens:	We know $p \to q$, and we know $\neg q$. Therefore, $\neg p$.

Recognizing these forms in practice can be difficult. **Identify** the logical form of each brief argument below. For each, also tell whether the deduction is logically **sound or unsound**.

(1) If you have a cold, you will have the sniffles. You have the sniffles. Therefore you have a cold.

(2) "If each man had a definite set of rules of conduct by which he regulated his life he would be no better than a machine. But there are no such rules, so men cannot be machines." –Alan Turing

(3) If she is the murdered, then she is left-handed. But she is right-handed. Therefore, she is not the murderer.

(4) If it's Monday, it's time for class. It's Monday. Therefore, it's time for class.

(5) When it rains, the streets will be wet. The streets are wet. I conclude that it is raining.

(6) If $x = 5$, then $f(x) = -9$. But $x = 4$. Therefore, $f(x) \neq -9$.

(7) If there are only finitely many primes, then n has no prime divisors. But n does a prime divisor. Therefore there are infinitely many primes.

(8) If $f(x)$ is any differentiable function, then $\lim_{h \to 0} \dfrac{f(5+h) - f(5)}{h}$ exists. The function $\sin(x)$ is differentiable. Therefore, $\lim_{h \to 0} \dfrac{\sin(5+h) - \sin(5)}{h}$ exists.

(9) If the war on terror works, the terrorists will not succeed in attacking us in the United States. Recently, there have not been successful terrorist attacks in the US. We conclude that the war on terror is working.

Of the four rules, which are logically valid? Which are fallacies to be avoided?