these are quick induction review notes for exam2

(you can watch the zoom recording of Nov 14 lesson to watch along too)

If you're reading this during the exam, good luck! You got this :)

Algebraic Induction: How to tackle the induction step S(n) ⟶ S(n+1)

$$S(N+1) = \sum_{K=1}^{N+1} 2K = (N+1)(N+2)$$

1. ~~1.~~ write: "Induction: S(n) ⟶ S(n+1)"
2. ~~2.~~ write: We assume S(n)
   - probably best to write out exact meaning if not given elsewhere
3. ~~3.~~ note to self: express S(n+1) (just plug in an n+1 for n in S(n))
4. ~~4.~~ Start from more complex side of S(n+1), argue to simpler side (i.e. summation first).
   - leave room for work to come
5. ~~5.~~ prepare to apply S(n)
   - for proof of sums, often "snip final term" (see also day 19 page 11 of pdf)
6. ~~6.~~ apply S(n)
7. ~~7.~~ complete argument towards simpler side of S(N+1) ... each will be different

(SEE PAGE 9 OF DAY 19 FOR COMPLETE PROOF)

$$S(N) = \sum_{K=1}^{N} 2K = N(N+1)$$

INDUCTION STEP $S(N) \rightarrow S(N+1)$

ASSUME $\sum_{K=1}^{N} 2K = N(N+1)$

$$\sum_{K=1}^{N+1} 2K = 2(N+1) + \sum_{K=1}^{N} 2K$$

$$= 2(N+1) + N(N+1)$$

$$= (N+1)(N+2)$$

Algebraic Induction: How to tackle the induction step $S(n) \longrightarrow S(n+1)$ $S(N+1) \equiv 2^{N+1} < (N+1)!$

1. ~~1.~~ write: "Induction: $S(n) \longrightarrow S(n+1)$"
2. ~~2.~~ write: We assume $S(n)$
   - probably best to write out exact meaning if not given elsewhere
3. ~~3.~~ note to self: express $S(n+1)$ (just plug in an $n+1$ for n in $S(n)$)
4. ~~4.~~ Start from more complex side of $S(n+1)$, argue to simpler side (i.e. summation first).
   - leave room for work to come
5. ~~5.~~ prepare to apply $S(n)$
   - for proof of sums, often "snip final term" (see also day 19 page 11 of pdf)
6. ~~6.~~ apply $S(n)$
7. ~~7.~~ complete argument towards simpler side of $S(N+1)$ ... each will be different

$S(N) \equiv 2^N < N!$

INDUCTION STEP $S(N) \rightarrow S(N+1)$

ASSUME $2^N < N!$

$$
\begin{aligned}
(N+1)! &= N!\,(N+1) \\
&> 2^N (N+1) \\
&> 2^N \cdot 2 \\
&= 2^{N+1}
\end{aligned}
$$

(SEE PAGE 15 OF DAY 19 FOR COMPLETE PROOF)