11. Prove
\[
\binom{5}{0} + \binom{6}{1} + \binom{7}{2} + \cdots + \binom{5+n}{n} = \binom{6+n}{n}
\]
for all integers \( n \) with \( 0 \leq n \).

Proof by induction.

When \( n = 0 \), the formula is \( \binom{5}{0} = \binom{6}{0} \), which is true.

Assume \[
\sum_{k=0}^{n} \binom{5+k}{k} = \binom{6+n}{n}.
\]
This is TH.

Prove \[
\sum_{k=0}^{n+1} \binom{5+k}{k} = \binom{7+n}{n+1} \times
\]
The LHS of \( \ast \) is \[
\sum_{k=0}^{n+1} \binom{5+k}{k} + \binom{5+n+1}{n+1} \uparrow
\]
by IH here

is the right side of \( \ast \).

12. What is the coefficient of \( x^4 \) in \((3x+2)^9\)?

The relevant term is \( \binom{9}{4}(3x)^4 2^5 \)

So the coefficient is \( \frac{9!}{4!5!} 3^4 2^5 \)