Homework 2: Combinations and Pascal’s Triangle

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1 Homework

Problem 1.
How many ways are there to descend from the top of Pascal’s triangle to the n-th row?

Problem 2.
Let \( A, B \) be points on a circle, and \( T \) be a point on the line \( AB \) outside of the circle. Let \( TC \) be the tangent from \( T \) to the circle. Show that \( TC^2 = TA \cdot TB \)

2 Reading

Problem 3.
\( a) \)  Show that identity

\[
\binom{n}{k} = \binom{n-1}{k-1} + \binom{n-1}{k}
\]

algebraically.

\[
\binom{n-1}{k-1} + \binom{n-1}{k} = \frac{(n-1)!}{(n-k)! (k-1)!} + \frac{(n-1)!}{(n-k-1)! (k)!} = \frac{(n-1)! k}{(n-k)! k!} + \frac{(n-1)! (n-k)}{(n-k)! k!} = \frac{(n-1)! (n-k+k)}{(n-k)! k!} = \frac{n!}{(n-k)! k!} = \binom{n}{k}
\]