# A004782(N)=A014847(N) + 1

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## 1. Sequences

1.1. **A014847.**
Numbers n such that n-th Catalan number C(2n,n)/(n+1) is divisible by n

1.2. **A004782.**
2(2n-3)!/n!(n-1)! is an integer.

1.3. **A000984.**
Central binomial coefficients: $C(2*n,n) = (2*n)!/(n!)^2$.

## 2. Theorem

**Theorem 2.1.** *A004782*$(n) =$ *A014847*$(n) + 1$

*Proof.*

$f(n+1)$ is equal to $g(n)$, where:

$$f(n) = \frac{2 \cdot (2n-3)!}{n! \cdot (n-1)!} \tag{2.1}$$

$$g(n) = \binom{2n}{n} \cdot \frac{1}{(n+1) \cdot n} \tag{2.2}$$

$$f(n+1) = \frac{2 \cdot (2n-1)!}{(n+1) \cdot (n!)^2} = \frac{2n \cdot (2n-1)!}{n \cdot (n+1) \cdot (n!)^2} = \tag{2.3}$$

$$= \frac{(2n)!}{n \cdot (n+1) \cdot (n!)^2} = \binom{2n}{n} \cdot \frac{1}{(n+1) \cdot n} = g(n) \tag{2.4}$$

$f(n+1) \in \mathbb{Z} \iff g(n) \in \mathbb{Z} \iff (n+1) \in$ A004782 $\iff n \in$ A014847
And then: A004782$(n) =$ A014847$(n) + 1$

□

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