$$f(n) = \begin{cases} 0 & \text{if } n = 0 \quad 1 \\ 2n - 1 + f(n-1) & \text{if } n > 0 \quad 2 \end{cases}$$

$f(n) = n^2$ $(n \in \mathbb{N})$ for all n

Base Case $(n=0)$

WTP: $f(0) = 0^2$

$f(0) = 0$ (1)

$= 0^2$ ■

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Inductive Case $(n = k+1)$

I.H.) $f(k) = k^2$

WTP) $f(k+1) = (k+1)^2$

$f(k+1)$

$= 2(k+1) - 1 + f(k)$ (2)

$= 2k + 2 - 1 + f(k)$

$= 2k + 1 + f(k)$

$= 2k + 1 + k^2$ (I.H.)

$= k^2 + 2k + 1$

$= (k+1)^2$ ■

```haskell
sum :: [Int] -> Int
sum []     = 0          -- 1
sum (x:xs) = x + sum xs -- 2

foldr :: (a -> b -> b) -> b -> [a] -> b
foldr f z []     = z               -- A
foldr f z (x:xs) = x `f` foldr f z xs   -- B
```

Sum ls = foldr (+) 0 ls

GOAL ↑

Base Case (ls = [])

WTP) Sum [] = 0

= 0

= foldr (+) 0 [] □

1

A

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Inductive Case (ls = x:xs)

I.H) Sum xs = foldr (+) 0 xs ←

WTP) Sum (x:xs) = Foldr (+) 0 (x:xs)

Sum (x:xs) = x + Sum xs

= x + foldr (+) 0 xs

= foldr (+) 0 (x:xs) □

2

I.H

B