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0.1 Summation of natural numbers

0.1.1 Goal

Let's prove that:

$$\sum_{i=0}^n i = \frac{n(n+1)}{2}$$

0.1.2 Proof by induction

We use the inference rules Modus Ponens, which says that if X is true, and $X \rightarrow Y$ is true, then Y is true.

0.1.3 True for $n = 0$

We know this is true for $n = 0$:

$$0 = \frac{0(0+1)}{2}$$

$$0 = 0$$

0.1.4 If it's true for n , it's true for $n + 1$

We can also prove that if it true for n , it is true for $n + 1$.

$$\sum_{i=0}^{n+1} i = \frac{(n+1)(n+2)}{2}$$

$$(n+1) + \sum_{i=0}^n i = \frac{n^2+3n+2}{2}$$

If it is true for n , then:

$$(n+1) + \frac{n(n+1)}{2} = \frac{n^2+3n+2}{2}$$

$$\frac{n^2+3n+2}{2} = \frac{n^2+3n+2}{2}$$

$$1 = 1$$

0.1.5 Result

So we know that it is true for $n = 0$, and if it is true for n , then it is true for $n + 1$. As a result it is true for all natural numbers.