Show that $1+2+3+\dots+n=\frac{1}{2}n(n+1)$, for $n=1,2,3,\dots$

i) basic induction:

$n=1$

$1=\frac{1}{2}(1)(1+1)=\frac{1}{2}1.2$

$1=1$

claim is proven for $n=1$

ii) step induction

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

is claimed to be true then

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

proving

$[1+2+3+\dots+n]+(n+1)=\left[\frac{1}{2}n(n+1)\right]+(n+1)$

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

$=\frac{1}{2}(n+2)(n+1)$ → proven

iii) Since basic & step inductions are correct then $1+2+3+\dots+n=\frac{1}{2}n(n+1)$