7) Compare the two functions n^2 and $20n+4$ for various values of n. Determine when the second function becomes smaller than the first

$n^2 \geq 20n+4$. When ?

$\boxed{\text{Claim:}}$ $n^2 \geq 20n+4$ for $n \in \mathbb{N}$, $n \geq 21$

$\boxed{\text{Proof:}}$ $\boxed{\text{Base Case:}}$ $n=21$. $n^2 = 21^2 = 441$ $\quad 20n+4 = 424$. $\therefore$ Base Case holds

$\boxed{\text{I.H:}}$ $n=K$, and $K^2 \geq 20K+4$ holds for $K > 21$.

$\boxed{\text{Induction Step:}}$ $n=K+1$. $(K+1)^2 = K^2+2K+1 \geq (20K+4)+(2K+1) = 22K+5$

$= 20K+(2K+5) \geq 20K+(2\times21+5) = 20K+47 \geq 20K+24$

$(\because K > 21)$ $\qquad = 20(K+1)+4$

$\boxed{\therefore n^2 > 20n+4}$ when $n \geq 21$.

$n=20$, $20^2 = 400$ $\quad 20n+4 = 404$.