$\boxed{\text{Hint for pg 132 \# 6a}}$

(a) $b_p = \left(1+\frac{1}{p}\right)^p = 1 + \binom{p}{1}\frac{1}{p} + \binom{p}{2}\left(\frac{1}{p}\right)^2 + \binom{p}{3}\left(\frac{1}{p}\right)^3$

$$+ \cdots + \binom{p}{p-1}\left(\frac{1}{p}\right)^{p-1} + \binom{p}{p}\left(\frac{1}{p}\right)^p$$

$$= 1 + 1 + \frac{\cancel{p}(p-1)}{2!\; p^{\cancel{2}}} + \frac{\cancel{p}(p-1)(p-2)}{3!\; p^{\cancel{3}\,2}} + \frac{\cancel{p}(p-1)(p-2)(p-3)}{4!\; p^{\cancel{4}\,3}}$$

$$+ \cdots + \frac{\cancel{p}(p-1)(p-2)\cdots(2)}{(p-1)!\; p^{\cancel{p-1}\,p-2}} + \frac{\cancel{p}(p-1)(p-2)\cdots(1)}{p!\; (p^{\cancel{p}})^{p-1}}$$

$$= 1 + 1 + \frac{1}{2!}\left(\frac{p-1}{p}\right) + \frac{1}{3!}\left(\frac{p-1}{p}\right)\left(\frac{p-2}{p}\right) + \frac{1}{4!}\left(\frac{p-1}{p}\right)\left(\frac{p-2}{p}\right)\left(\frac{p-3}{p}\right)$$

$$+ \cdots + \frac{1}{(p-1)!}\left(\frac{p-1}{p}\right)\left(\frac{p-2}{p}\right)\left(\frac{p-3}{p}\right)\cdots\left(\frac{2}{p}\right)$$

$$+ \frac{1}{p!}\left(\frac{p-1}{p}\right)\left(\frac{p-2}{p}\right)\cdots\left(\frac{1}{p}\right)$$

notice: $\frac{2}{p} = \frac{p-(p-2)}{p}$ and $\frac{1}{p} = \frac{p-(p-1)}{p}$

$$\Rightarrow b_p = 1 + 1 + \frac{1}{2!}\left(1-\frac{1}{p}\right) + \frac{1}{3!}\left(1-\frac{1}{p}\right)\left(1-\frac{2}{p}\right) + \frac{1}{4!}\left(1-\frac{1}{p}\right)\left(1-\frac{2}{p}\right)\left(1-\frac{3}{p}\right)$$

$$+ \cdots + \frac{1}{(p-1)!}\left(1-\frac{1}{p}\right)\left(1-\frac{2}{p}\right)\left(1-\frac{3}{p}\right)\cdots\left(1-\frac{p-2}{p}\right)$$

$$+ \frac{1}{p!}\left(1-\frac{1}{p}\right)\left(1-\frac{2}{p}\right)\left(1-\frac{3}{p}\right)\cdots\left(1-\frac{p-1}{p}\right)$$

With very similar work, and noticing that

$\frac{p}{p+1} = 1 - \frac{1}{p+1}$, $\frac{p-1}{p+1} = 1 - \frac{2}{p+1}$, ...

Then you get

$$b_{p+1} = 1+1+\frac{1}{2!}\left(1-\frac{1}{p+1}\right)+\frac{1}{3!}\left(1-\frac{1}{p+1}\right)\left(1-\frac{2}{p+1}\right)$$
$$+\frac{1}{4!}\left(1-\frac{1}{p+1}\right)\left(1-\frac{2}{p+1}\right)\left(1-\frac{3}{p+1}\right)$$
$$+\dots+\frac{1}{p!}\left(1-\frac{1}{p+1}\right)\left(1-\frac{2}{p+1}\right)\cdots\left(1-\frac{p-1}{p+1}\right)$$
$$+\frac{1}{(p+1)!}\left(1-\frac{1}{p+1}\right)\left(1-\frac{2}{p+1}\right)\cdots\left(1-\frac{p}{p+1}\right)$$

To Compare b_p to b_{p+1}, compare "like" terms, meaning compare the $\frac{1}{2!}$ term in b_p to the $\frac{1}{2!}$ term in b_{p+1}, the $\frac{1}{3!}$ terms together, etc.

and note: $(p>0)$ $\quad p+1>p \iff \frac{1}{p+1}<\frac{1}{p} \iff 1-\frac{1}{p+1}>1-\frac{1}{p}$

and $1-\frac{2}{p+1}>1-\frac{2}{p}$

and $1-\frac{3}{p+1}>1-\frac{3}{p}$

etc.