Q5: Using the binomial theorem, we expand:

$$
\begin{aligned}
(1+\frac{z}{n})^n &= \sum_{k=0}^{n} \binom{n}{k} \cdot 1^{n-k} \frac{z^k}{n^k} \\
&= \sum_{k=0}^{n} \frac{n(n-1)\cdots(n-k+1)(n-k)!}{k! \cdot (n-k)!} \frac{z^k}{n^k} \\
&= \sum_{k=0}^{n} \frac{n(n-1)\cdots(n-k+1)}{n^k} \cdot \frac{z^k}{k!} \\
&= 1 + z + \sum_{k=2}^{n} \frac{n(n-1)\cdots(n-k+1)}{n^k} \cdot \frac{z^k}{k!} \\
&= 1 + z + \sum_{k=2}^{n} (1-\frac{1}{n})\cdots(1-\frac{k-1}{n}) \frac{z^k}{k!}
\end{aligned}
$$

As desired. Taking the limits, we get that

$$
\lim_{n\to\infty} (1+\frac{z}{n})^n = \lim_{n\to\infty} 1 + z + \sum_{k=2}^{n} (1-\frac{1}{n})\cdots(1-\frac{k-1}{n}) \frac{z^k}{k!} = \sum_{k=0}^{n} \frac{z^k}{k!}
$$

Since as n get arbitrarily large, the partial sums approach $\sum_{k=0}^{n} \frac{z^k}{k!}$.