(Q3)
We can express $\left(1+\frac{M}{x}\right)^{Nx}$ as $e^{Nx\cdot\ln(1+\frac{M}{x})}$.
Then:

$$\begin{aligned}
\lim_{x\to\infty} Nx\cdot\ln(1+\frac{M}{x}) &= N\cdot\frac{\ln\left(1+\frac{M}{x}\right)}{\frac{1}{x}}\\
&\overset{\text{L'H}}{=} \lim_{x\to\infty} N\cdot\frac{\frac{1}{1+\frac{M}{x}}\cdot\frac{-M}{x^2}}{-\frac{1}{x^2}}\\
&= \lim_{x\to\infty} N\cdot\frac{M}{\frac{M+x}{x}}\\
&= \lim_{x\to\infty} N\cdot M\cdot\frac{x}{x+M}\\
&\overset{\text{L'H}}{=} \lim_{x\to\infty} N\cdot M\cdot\frac{1}{1}\\
&= \lim_{x\to\infty} M\cdot N
\end{aligned}$$

Thus, $\lim\limits_{x\to\infty}\left(1+\dfrac{M}{x}\right)^{Nx} = e^{MN}$.