Derive the MLE for the Exponential Distribution

Exponential pdf:

$$f(x) = \lambda e^{-\lambda x}$$

Data: $\mathcal{D} = \{x^{(i)}\}_{i=1}^{N}$

Figure out each derivation step, given the provided justification

	Justification
$\mathcal{L}(\lambda) = p(D \mid \theta)$ $= p\left(x^{(1)}, \ldots, x^{(N)} \mid \lambda^{(1)}, \ldots, \lambda^{(N)}\right)$	
$= \prod_{i=1}^{N}$	$i.i.d.$ (don't plug in exponential pdf yet)
$\ell(\lambda) =$	Log likelihood
$=$	Distribute log over product
$=$	Plug in exponential pdf
$=$	Distribute log over pdf expression
$= N\log(\lambda) - \lambda \sum_{i}^{N} x^{(i)}$	Distribute/simplify summations
$\frac{d\ell}{d\lambda} = \frac{d}{d\lambda}\left[N\log(\lambda) - \lambda \sum_{i}^{N} x^{(i)}\ \right]$	Derivative with respect to parameter
$0 =$	Take derivative of each term (and set equal to zero)
$\hat{\lambda}_{MLE} =$	Solve for λ