1. Q) Convergent/Divergent? $\int_2^\infty e^{-2p} dp$

A) $= \lim_{t \to \infty} \int_2^t e^{-2p} dp$

$\int e^{-2p} dp = -\frac{1}{2} \int e^u du$, for $u = -2p$ and $dp = -\frac{1}{2} du = -\frac{1}{2} e^u + C$

$= -\frac{1}{2} e^{-2p} + C$

$\therefore \left[-\frac{1}{2} e^{-2p} + C \right]_2^t$

$= -\frac{1}{2} \left[e^{-2t} - e^{-4} \right]$

$= -\frac{1}{2} \left[\frac{1}{e^{2t}} - \frac{1}{e^4} \right]$

$\therefore -\frac{1}{2} \lim_{t \to \infty} \left[\frac{1}{e^{2t}} - \frac{1}{e^4} \right]$

$= -\frac{1}{2} (\lim_{t \to \infty} \frac{1}{e^{2t}} - \frac{1}{e^4})$

$= -\frac{1}{2} (0 - \frac{1}{e^4})$

$= \frac{1}{2e^4}$