$$\int_0^{\frac{1}{2}} \int_{\frac{y}{2}}^{\frac{y+4}{2}} y^3(2x-y)\, e^{2x-y^2}\, dx\, dy$$

$y=0$, $y=\frac{1}{2}$, $x=\frac{y}{2}$, $x=\frac{y}{2}+2$

$$\frac{1}{|J|} = \begin{vmatrix} 1 & -\frac{1}{2} \\ 0 & 1 \end{vmatrix} = 1-0$$

$$|J| = 1$$

let $u = x - \frac{y}{2}$ & $v = y$

$\Rightarrow$ $0 \le u \le 2$, $0 \le v \le \frac{1}{2}$

$$\int_{u=0}^{2} \int_{v=0}^{\frac{1}{2}} v^3 \frac{u}{2}\, e^{2u} \times e^{v}\, du\, dv = \frac{1}{2} \int_{u=0}^{2} \int_{v=0}^{\frac{1}{2}} v^3 e^{v}\, u e^{2v}\, du\, dv$$

Simple integration calculation

solve yourself