

$\int_{-2}^2 dy \int_0^{\sqrt{4-y^2}} x e^{(4-x^2)^{3/2}} dx$

$x = \sqrt{4-y^2}$
 $x^2 = 4-y^2$
 $x^2 - 4 = -y^2$
 $\pm \sqrt{4-x^2} = y$

$x^2 + y^2 = 4$

$$\int_0^2 dx \int_{-\sqrt{4-x^2}}^{+\sqrt{4-x^2}} x e^{(4-x^2)^{3/2}} dy = (\dots)$$

$$\int_{-\sqrt{4-x^2}}^{+\sqrt{4-x^2}} x e^{(4-x^2)^{3/2}} dy = \left[x e^{(4-x^2)^{3/2}} y \right]_{-\sqrt{4-x^2}}^{+\sqrt{4-x^2}} =$$

$$= \left[x e^{(4-x^2)^{3/2}} (\sqrt{4-x^2} + \sqrt{4-x^2}) \right] = \left[2 x e^{(4-x^2)^{3/2}} \sqrt{4-x^2} \right]$$

$2 \int_0^2 x e^{(4-x^2)^{3/2}} \sqrt{4-x^2} dx = \left. \begin{array}{l} t = 4-x^2 \\ dt = -2x dx \\ x dx = \frac{dt}{-2} \end{array} \right| =$

$= 2 \int_4^0 e^{t^{3/2}} \cdot \frac{dt}{-2} = \int_0^4 e^{t^{3/2}} dt$

$w = t^{3/2}$
 $dw = \frac{3}{2} t^{1/2} dt = \frac{3}{2} \sqrt{t} dt$

$= \int_0^4 e^w \cdot \frac{2}{3} dw = \left. \frac{2}{3} e^w \right|_0^4 = \frac{2}{3} e^4 - \frac{2}{3} e^0 = \frac{2}{3} (e^4 - 1)$