YOUR INPUT:

$f(x) =$

$$x^2 e^{-x^2}$$

Simplify

"MANUALLY" COMPUTED ANTIDERIVATIVE:

$\int f(x)\,dx = F^{\star}(x) =$

"Manual" integration with steps:
The calculator finds an antiderivative in a comprehensible way. Note that due to some simplifications, it might only be valid for parts of the function.

$$\frac{\sqrt{\pi}\,\mathrm{erf}(x) - 2x e^{-x^2}}{4} + C$$

Hide steps

Problem:

$$\int x^2 e^{-x^2}\,dx$$

Integrate by parts: $\int \mathrm{f}\mathrm{g}' = \mathrm{f}\mathrm{g} - \int \mathrm{f}'\mathrm{g}$

$$\mathrm{f} = x, \quad \mathrm{g}' = x e^{-x^2}$$

↓ steps ↓ steps

$$\mathrm{f}' = 1, \quad \mathrm{g} = -\frac{e^{-x^2}}{2}:$$

$$= -\frac{x e^{-x^2}}{2} - \int -\frac{e^{-x^2}}{2}\,dx$$

Now solving:

$$\int -\frac{e^{-x^2}}{2}\,dx$$

Apply linearity:

$$= -\frac{\sqrt{\pi}}{4}\int \frac{2e^{-x^2}}{\sqrt{\pi}}\,dx$$

Now solving:

$$\int \frac{2e^{-x^2}}{\sqrt{\pi}}\,dx$$

This is a special integral (Gauss error function):

$$= \operatorname{erf}(x)$$

Plug in solved integrals:

$$-\frac{\sqrt{\pi}}{4}\int \frac{2e^{-x^2}}{\sqrt{\pi}}\,dx$$

$$= -\frac{\sqrt{\pi}\operatorname{erf}(x)}{4}$$

Plug in solved integrals:

$$-\frac{xe^{-x^2}}{2} - \int -\frac{e^{-x^2}}{2}\,dx$$

$$= \frac{\sqrt{\pi}\operatorname{erf}(x)}{4} - \frac{xe^{-x^2}}{2}$$

Plug in solved integrals:

$$-\frac{xe^{-x^2}}{2}-\int-\frac{e^{-x^2}}{2}\,dx$$

$$=\frac{\sqrt{\pi}\operatorname{erf}(x)}{4}-\frac{xe^{-x^2}}{2}$$

The problem is solved:

$$\int x^2e^{-x^2}\,dx$$

$$=\frac{\sqrt{\pi}\operatorname{erf}(x)}{4}-\frac{xe^{-x^2}}{2}+C$$

Rewrite/simplify:

$$=\frac{\sqrt{\pi}\operatorname{erf}(x)-2xe^{-x^2}}{4}+C$$

ANTIDERIVATIVE COMPUTED BY MAXIMA:

$$\int f(x)\,dx=F(x)=$$

$$\frac{\sqrt{\pi}\operatorname{erf}(x)}{4}-\frac{xe^{-x^2}}{2}+C$$

Simplify

DEFINITE INTEGRAL:

$$\int_0^{\infty} f(x)\,dx=$$

$$\frac{\sqrt{\pi}}{4}$$