Problem:

$$\int \left(-4x\sin(x) - 2\sin(x) + \cos^2(x)\right) \mathrm{d}x$$

Apply linearity:

$$= -4\int x\sin(x)\,\mathrm{d}x - 2\int \sin(x)\,\mathrm{d}x + \int \cos^2(x)\,\mathrm{d}$$

Now solving:

$$\int x\sin(x)\,\mathrm{d}x$$

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

$$\mathrm{f} = x, \quad \mathrm{g}' = \sin(x)$$

↓ steps ↓ steps

$$\mathrm{f}' = 1, \quad \mathrm{g} = -\cos(x):$$

$$= -x\cos(x) - \int -\cos(x)\,\mathrm{d}x$$

Now solving:

$$\int -\cos(x)\,\mathrm{d}x$$

Apply linearity:

$$= -\int \cos(x)\,\mathrm{d}x$$

Now solving:

$$\int \cos(x)\,\mathrm{d}x$$

This is a standard integral:

$$= \sin(x)$$

Plug in solved integrals:

$$-\int \cos(x)\,dx$$

$$=-\sin(x)$$

Plug in solved integrals:

$$-x\cos(x)-\int -\cos(x)\,dx$$

$$=\sin(x)-x\cos(x)$$

Now solving:

$$\int \sin(x)\,dx$$

This is a standard integral:

$$=-\cos(x)$$

Now solving:

$$\int \cos^2(x)\,dx$$

Apply reduction formula:

$$\int \cos^{n}(x)\,dx=\frac{n-1}{n}\int \cos^{n-2}(x)\,dx+\frac{\cos^{n-1}(x)\sin(x)}{n}$$

with $n=2$:

$$=\frac{\cos(x)\sin(x)}{2}+\frac{1}{2}\int 1\,dx$$

... or choose an alternative:

Apply product-to-sum formulas

Now solving:

$$\int 1\,dx$$

Apply constant rule:

$$= x$$

Plug in solved integrals:

$$\frac{\cos(x)\sin(x)}{2} + \frac{1}{2}\int 1\,dx$$

$$= \frac{\cos(x)\sin(x)}{2} + \frac{x}{2}$$

Plug in solved integrals:

$$-4\int x\sin(x)\,dx - 2\int \sin(x)\,dx + \int \cos^2(x)\,dx$$

$$= \frac{\cos(x)\sin(x)}{2} - 4\sin(x) + 4x\cos(x) + 2\cos(x$$

The problem is solved:

$$\int \left(-4x\sin(x) - 2\sin(x) + \cos^2(x)\right) dx$$

$$= \frac{\cos(x)\sin(x)}{2} - 4\sin(x) + 4x\cos(x) + 2\cos(x$$

Rewrite/simplify:

$$= \frac{(\cos(x) - 8)\sin(x) + (8x + 4)\cos(x) + x}{2} + C$$

ANTIDERIVATIVE COMPUTED BY MAXIMA:

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

$$\frac{\frac{\sin(2x)}{2} + x}{2} - 4\sin(x) + (4x + 2)\cos(x) + C$$

Simplify/rewrite:

$$\frac{(\cos(x)-8)\sin(x)+(8x+4)\cos(x)+x}{2}+C$$

DEFINITE INTEGRAL:

$$\int_{0}^{2\pi} f(x)\,\mathrm{d}x =$$

$$9\pi$$

No further simplification found!

Approximation:

28.27433388230814