$\boxed{\text{Integration}}$

- Integration by parts: integral of a product of functions

$$\int_a^b u(x)\,v'(x)\,.dx = \Big[u(x)\,v(x)\Big]_a^b - \int_a^b u'(x)\,v(x)\,.dx$$

$$= u(b)v(b) - u(a)v(a) - \int_a^b u'(x)\,.\,v(x)\,.dx$$

$$f_X(x) = \frac{1}{\lambda} e^{-x/\lambda} \qquad 0 \leq x < \infty$$

$$\lambda > 0$$

$$\int_0^\infty \frac{1}{\lambda} x e^{-x/\lambda}\,.dx.$$

$$= \frac{x}{\cancel{\lambda}} \,.\, e^{-x/\lambda} (-\cancel{\lambda}) \Big|_0^\infty - \int_0^\infty \frac{1}{\cancel{\lambda}} \left(- e^{-x/\lambda}\right) . \cancel{\lambda}$$

$$= \Big[- x \,.\, e^{-x/\lambda}\Big]_0^\infty + (-\lambda)\Big[e^{-x/\lambda}\Big]_0^\infty$$

$$= 0 - 0 + (-\lambda)(0 - 1)$$

$$= \lambda$$