Example: Say X has probability density function $f_X(x) = 5^2 x e^{-5x}$ for $x > 0$
$= 0$ otherwise

Find $P(X > \frac{1}{2})$.

$$P(X > \tfrac{1}{2}) = \int_{1/2}^{\infty} 5^2 x e^{-5x}\,dx = (5^2 x)\left(\frac{e^{-5x}}{-5}\right)\Big|_{x=1/2}^{\infty} - \int_{1/2}^{\infty} \frac{5^2 e^{-5x}}{-5}\,dx$$

int by parts

$u = 5^2 x \qquad du = 5^2$

$dv = e^{-5x}\,dx \qquad v = \frac{e^{-5x}}{-5}$

$$= 5^2\left(\tfrac{1}{2}\right)\frac{e^{-5/2}}{5} + \int_{1/2}^{\infty} 5e^{-5x}\,dx$$

$$= \frac{5}{2}e^{-5/2} + \frac{5e^{-5x}}{-5}\Big|_{x=1/2}^{\infty}$$

$$= \frac{5}{2}e^{-5/2} + e^{-5/2}$$

$$= \frac{7}{2}e^{-5/2} \approx 0.287297$$