

$$\begin{aligned}
 p(x; m, \omega) &= \frac{2m^m}{\Gamma(m)\omega^m} x^{2m-1} e^{-\frac{m}{\omega}x^2} \\
 &= 2x \left(\left(\frac{m}{\omega}\right)^m \frac{x^{2(m-1)}}{\Gamma(m)} e^{-\frac{m}{\omega}x^2} \right)
 \end{aligned}$$

Notation change: $y = x^2, \theta = \omega/m$

$$\begin{aligned}
 &= 2x \left(\frac{y^{m-1}}{\Gamma(m)\theta^m} e^{-\frac{y}{\theta}} \right) \\
 &= 2x \ p_{\text{gamma}}(y; m, \theta) \\
 &= 2x \ p_{\text{gamma}}(x^2; m, \frac{\omega}{m})
 \end{aligned}$$