PROOF OF FORMULA 3.381.4

$$\int_0^\infty x^{b-1}e^{-ax}\,dx = a^{-b}\Gamma(b)$$

Let $t = ax$ to produce

$$\int_0^\infty x^{b-1}e^{-ax}\,dx = a^{-b}\int_0^\infty t^{b-1}e^{-t}\,dt.$$

Now use the integral representation of the gamma function to conclude.