B.22 The density of $\chi^2(n)$ distribution can be found, for example, in Mood et al. (1974); it reads

$$g(x) = \frac{x^{n/2-1}e^{-x/2}}{2^{n/2}\Gamma(n/2)}.$$

On comparing it with the gamma density,

$$f(x) = \frac{\beta^\alpha}{\Gamma(\alpha)}x^{\alpha-1}e^{-\beta x},$$

we observe that $\chi^2(n)$ is equal to the gamma distribution with $\alpha = n/2$ and $\beta = 1/2$.