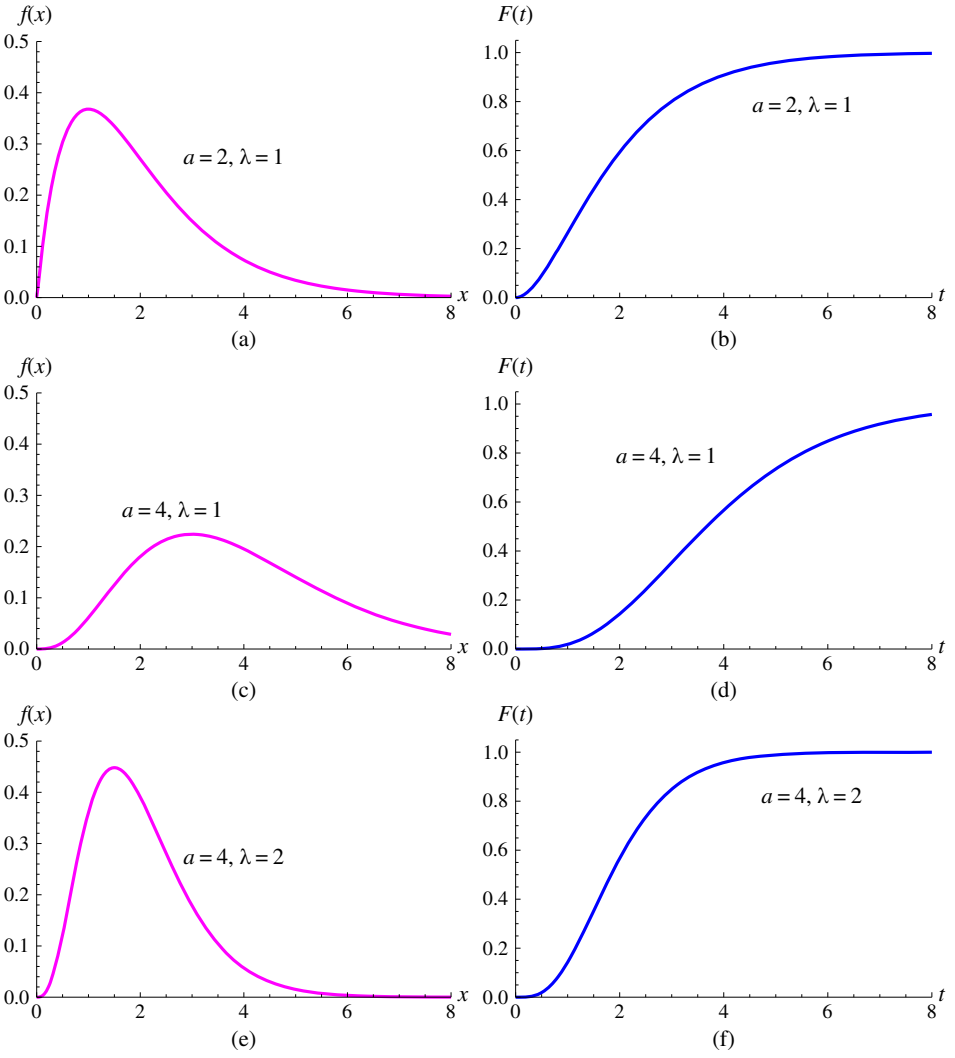

Figure 7.14 The density function (left) and cumulative distribution function (right) of the Gamma distribution for various values of the parameters a and λ.

The distribution function of X is given by

$$F(t) = P(X \le t) = \int_0^t 4x\mathrm{e}^{-2x}\,\mathrm{d}x = \int_0^t 2x(-\mathrm{e}^{-2x})'\,\mathrm{d}x$$
$$= [-2x\mathrm{e}^{-2x}]_0^t + \int_0^t 2\mathrm{e}^{-2x}\,\mathrm{d}x$$
$$= -2t\mathrm{e}^{-2t} + [-\mathrm{e}^{-2x}]_0^t = -2t\mathrm{e}^{-2t} + (1 - \mathrm{e}^{-2t}) = 1 - (2t+1)\mathrm{e}^{-2t}.$$