The continuous random variable X has probability density function f given by

$$\mathrm{f}(x) = \begin{cases} \frac{3}{28}\left(\mathrm{e}^{\frac{1}{2}x} + 4\mathrm{e}^{-\frac{1}{2}x}\right) & 0 \leqslant x \leqslant 2\ln 3, \\ 0 & \text{otherwise.} \end{cases}$$

(a) Find the cumulative distribution function of X. [3]

The random variable Y is defined by $Y = \mathrm{e}^{\frac{1}{2}(X)}$.

(b) Find the probability density function of Y. [3]

(c) Find the 30th percentile of Y. [3]

(d) Find $\mathrm{E}(Y^4)$. [2]