

Exit[]

DSolve[{D[g[x], x] / D[Log[x], x] == c * g[x] ^ 3, g[u] ^ 2 == 1 / 2 / c / Log[L ^ 2 / u]}, g, x]

$$\left\{ \left\{ g \rightarrow \text{Function}\left[\{x\}, -\frac{1}{\sqrt{2} \sqrt{c \log\left[\frac{L^2}{u}\right] + c \log[u] - c \log[x]}}\right]\right\}, \right.$$

$$\left. \left\{ g \rightarrow \text{Function}\left[\{x\}, \frac{1}{\sqrt{2} \sqrt{c \log\left[\frac{L^2}{u}\right] + c \log[u] - c \log[x]}}\right]\right\} \right\}$$

$$\text{Function}\left[\{x\}, -\frac{1}{\sqrt{\frac{1-2 c g u^2 \log[u]+2 c g u^2 \log[x]}{g u^2}}}\right][x]$$

$$-\frac{1}{\sqrt{\frac{1-2 c g u^2 \log[u]+2 c g u^2 \log[x]}{g u^2}}}$$