Exit[]

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

$$\begin{split} \left\{ \left\{ g \to \text{Function} \left[\left\{ x \right\}, \, -\frac{1}{\sqrt{2} \ \sqrt{c \ \text{Log} \left[\frac{L^2}{u} \right] + c \ \text{Log} \left[u \right] - c \ \text{Log} \left[x \right]}} \, \right] \right\}, \\ \left\{ g \to \text{Function} \left[\left\{ x \right\}, \, \frac{1}{\sqrt{2} \ \sqrt{c \ \text{Log} \left[\frac{L^2}{u} \right] + c \ \text{Log} \left[u \right] - c \ \text{Log} \left[x \right]}} \, \right] \right\} \right\} \end{split}$$

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

$$-\frac{1}{\sqrt{\frac{1-2 \text{ c gu}^2 \text{ Log}[\mathbf{u}] + 2 \text{ c gu}^2 \text{ Log}[\mathbf{x}]}{\text{gu}^2}} }$$