

$$\begin{aligned}x &= \frac{1}{3}\sqrt{y}(y-3) = \frac{1}{3}y^{3/2} - y^{1/2} \Rightarrow dx/dy = \frac{1}{2}y^{1/2} - \frac{1}{2}y^{-1/2} \Rightarrow 1 + \\(dx/dy)^2 &= 1 + \frac{1}{4}y - \frac{1}{2} + \frac{1}{4}y^{-1} = \frac{1}{4}y + \frac{1}{2} + \frac{1}{4}y^{-1} = \left(\frac{1}{2}y^{1/2} + \frac{1}{2}y^{-1/2}\right)^2. \text{ So} \\L &= \int_4^9 \left(\frac{1}{2}y^{1/2} + \frac{1}{2}y^{-1/2}\right) dy = \frac{1}{2} \left[\frac{2}{3}y^{3/2} + 2y^{1/2}\right]_4^9 \\&= \frac{1}{2} \left[\left(\frac{2}{3} \cdot 27 + 2 \cdot 3\right) - \left(\frac{2}{3} \cdot 8 + 2 \cdot 2\right)\right] = \frac{22}{3}.\end{aligned}$$