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Exercice: 10

$$u = 9y + 1$$

$$\text{Interval, } I = [0, 3]$$

$$\begin{aligned}\text{radius, } r &= u_2 - u_1 = (9y + 1) - (-1) \\ &= 9y + 2.\end{aligned}$$

$$\therefore \frac{du}{dy} = \frac{d}{dy}(9y + 1)$$

$$\Rightarrow \frac{du}{dy} = 9 + 0$$

$$\Rightarrow \frac{du}{dy} = 9$$

$$\Rightarrow \left(\frac{du}{dy}\right)^2 = (9)^2$$

$$\therefore \left(\frac{du}{dy}\right)^2 = 81$$

$$\therefore \text{Surface Area} = \int_a^b 2\pi g(y) \sqrt{1 + \left[\frac{dy}{dx}\right]^2} dy.$$

$$= \int_0^3 2\pi (9y+2) \sqrt{1+81} dy.$$

$$= 2\pi \int_0^3 (9y+2) \sqrt{82} dy.$$

$$= 2\sqrt{82}\pi \int_0^3 (9y+2) dy.$$

$$= 2\sqrt{82}\pi \left[ \frac{9}{2}y^2 + 2y \right]_0^3.$$

$$= 2\sqrt{82}\pi \left[ \left[ \frac{9}{2}(3)^2 + 2(3) \right] - \left[ \frac{9}{2}(0)^2 + 2(0) \right] \right]$$

$$= 2\sqrt{82}\pi \left[ \frac{81}{2} + 6 - 0 - 0 \right]$$

$$= 6\sqrt{82}\pi \left[ 2 + \frac{27}{2} \right]$$

$$= 6\sqrt{82}\pi \left[ \frac{4+27}{2} \right]$$

$$= 6\sqrt{82}\pi \left[ \frac{31}{2} \right] = 93\sqrt{82}\pi \text{ unit}^2 \text{ (Ans).}$$