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$$\begin{aligned}\frac{d}{dx} (x e^{\sqrt{xy}}) &= x \cdot e^{\sqrt{xy}} \frac{1}{2}(xy)^{-1/2} (y) + e^{\sqrt{xy}} \\ &= e^{\sqrt{xy}} \left(1 + \frac{\sqrt{xy}}{2}\right)\end{aligned}$$

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$$\begin{aligned}&\int_R \sqrt{x^2 + y^2} \, dx \, dy \quad \text{where } R \text{ is } 4 \leq x^2 + y^2 \leq 9 \\ &= \int_R \sqrt{r^2} \cdot r \, dr \, d\theta \quad \text{Convert to polar} \\ &= \int_0^{2\pi} \int_2^3 r^2 \, dr \, d\theta = \int_0^{2\pi} \left. \frac{r^3}{3} \right|_2^3 \, d\theta = \int_0^{2\pi} \frac{19}{3} \, d\theta = \boxed{\frac{38\pi}{3}}\end{aligned}$$
