

$$S = \int 2\pi x \, ds = \int_1^4 2\pi x \sqrt{1 + \left(\frac{dx}{dy}\right)^2} dy$$

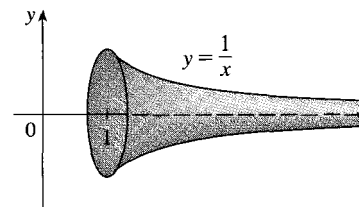
$$= \int_1^4 2\pi x \sqrt{1 + 1} dy = \int_1^4 2\pi x \sqrt{2} dy$$

$$= 2\pi \sqrt{2} \int_1^4 x dy = 2\pi \sqrt{2} \left[\frac{1}{2} y^2 \right]_1^4$$

$$= \pi (16 - 1) \sqrt{2} = 15\pi \sqrt{2}$$

9. $y = \sin x$, $0 \leq x \leq \pi$
 10. $y = \cos 2x$, $0 \leq x \leq \pi/6$
 11. $y = \cosh x$, $0 \leq x \leq 1$
 12. $2y = 3x^{2/3}$, $1 \leq x \leq 8$
 13. $x = \frac{1}{3}(y^2 + 2)^{3/2}$, $1 \leq y \leq 2$
 14. $x = 1 + 2y^2$, $1 \leq y \leq 2$

15–20 □ The given curve is rotated about the y -axis. Find the area



28. If the infinite curve $y = e^{-x}$, $x \geq 0$, is rotated about the x -axis, find the area of the resulting surface.
 29. Find the surface area generated by rotating a loop of the curve $8y^2 = x^2(1 - x^2)$ about the x -axis.
 30. A group of engineers is building a parabolic satellite dish