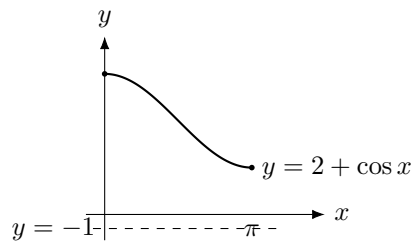


Question 2

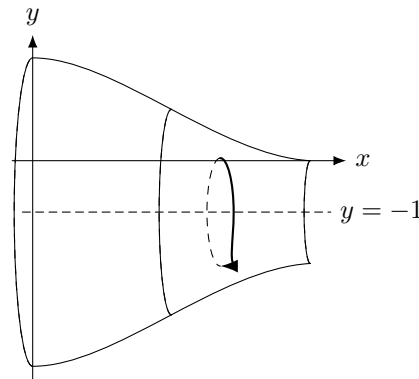
Curve: $y = 2 + \cos x$ on $0 \leq x \leq \pi$.

Axis of rotation: $y = -1$.

Task: Set up, but do not evaluate, the surface-area integral.



Question 2 – Solution



Step 1: Find the radius. The radius is the vertical distance from the curve to the axis $y = -1$:

$$r = (2 + \cos x) - (-1) = 3 + \cos x.$$

Step 2: Find the arc-length factor.

$$y' = -\sin x, \quad ds = \sqrt{1 + \sin^2 x} \, dx.$$

Step 3: Substitute into $S = 2\pi \int r \, ds$.

$$S = 2\pi \int_0^\pi (3 + \cos x) \sqrt{1 + \sin^2 x} \, dx$$