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Q.1 (6 marks)

The base of a solid is a semi-circle formed by the x -axis and the upper-half of the circle $x^2 + y^2 = 1$. The cross-sections perpendicular to y -axis are squares with two of their vertices on the semi-circle. Find the volume of the solid.

Q.2 (12 marks)

Find the volume of the solid generated by revolving the region bounded by the parabola $y^2 = 4x$ and the line $y = x$ about the line $y = 4$, using

(a) the washer method.

(b) the shells method.

Q.3 (6 marks)

Find the length of the curve $y = \int_0^x \sqrt{\cos 2t} dt$ from $x = 0$ to $x = \frac{\pi}{4}$.

Q.4 (6 marks)

Find the area of the surface generated by revolving the curve

$y = \sqrt{4 - x^2}$, $-1 \leq x \leq 1$, about the x -axis.