

40. Volume of the solid is $V = \pi \int_0^1 [(2-x)^2 - (1)^2] dx = \pi \int_0^1 (x^2 - 4x + 3) dx$

$$= \pi \left(\frac{x^3}{3} - 2x^2 + 3x \right) \Big|_0^1 = \boxed{\frac{4\pi}{3}}$$

The correct choice is (E).

41. Find y' and substitute into the differential equations to check them:

$$\frac{dy}{dx} = \cos x - \sin x$$

Equations I and II: $y + \frac{dy}{dx} = (\sin x + \cos x) + (\cos x - \sin x) = 2 \cos x$ so the equation is not a solution of I and is a solution of II.

Equation III: $\frac{dy}{dx} - y = (\cos x - \sin x) - (\sin x + \cos x) = -2 \sin x$. This is a solution of III.

The correct choice is (E).