

## STEP II, 2005, Q3

- 3 Give a sketch, for  $0 \leq x \leq \pi/2$ , of the curve

$$y = (\sin x - x \cos x),$$

and show that  $0 \leq y \leq 1$ .

Show that:

$$(i) \int_0^{\pi/2} y \, dx = 2 - \frac{\pi}{2};$$

$$(ii) \int_0^{\pi/2} y^2 \, dx = \frac{\pi^3}{48} - \frac{\pi}{8}.$$

Deduce that  $\pi^3 + 18\pi < 96$ .



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