

**Solution: Exam 1, Problem 4**

11th November 2013

**Grading scheme :**

$$f(x) = \sin(x^2), g(x) = \cos(x^2)$$

Use shell method.

$$\text{Vol} = \int_{\frac{\sqrt{\pi}}{2}}^{\pi} 2\pi x(f(x) - g(x))dx = \int_{\frac{\sqrt{\pi}}{2}}^{\pi} 2\pi x(\sin(x^2) - \cos(x^2))dx \dots 15 \text{ points till here.}$$

Substitute  $u = x^2, du = 2xdx$ . Then,

$$\text{Vol} = \int_{\frac{\pi}{4}}^{\pi} \pi(\sin(u) - \cos(u))du = -\cos(u) - \sin(u) \Big|_{\frac{\pi}{4}}^{\pi}$$

$$\text{Vol} = \pi[-\cos(\pi) - \sin(\pi) - (-\cos(\pi/4) - \sin(\pi/4))] \dots 5 \text{ points till here.}$$

Thus,

$$\text{Vol} = \pi[1 - 0 - (-1/\sqrt{2} - 1/\sqrt{2})] = \pi[1 + (2/\sqrt{2})] = \pi[1 + \sqrt{2}] \dots 5 \text{ points till here.}$$