

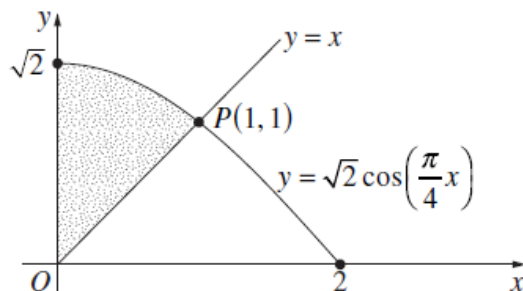


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2016 13 d

The curve $y = \sqrt{2} \cos\left(\frac{\pi}{4}x\right)$ meets the line $y = x$ at $P(1, 1)$, as shown in the diagram.

Find the exact value of the shaded area.



3

$$\begin{aligned}
 \text{Shaded area} &= \int_0^1 \sqrt{2} \cos\left(\frac{\pi}{4}x\right) dx - \frac{1}{2} \times 1 \times 1 \\
 &= \left[\frac{4\sqrt{2}}{\pi} \sin\frac{\pi}{4}x \right]_0^1 - \frac{1}{2} \\
 &= \frac{4\sqrt{2}}{\pi} \left[\sin\frac{\pi}{4} - \sin 0 \right] - \frac{1}{2} \\
 &= \frac{4\sqrt{2}}{\pi} \left[\frac{1}{\sqrt{2}} - 0 \right] - \frac{1}{2} \\
 &= \frac{4}{\pi} - \frac{1}{2} \\
 &= \frac{8 - \pi}{2\pi} \quad \therefore \text{the area is } \frac{8 - \pi}{2\pi} \text{ units}^2
 \end{aligned}$$

State Mean:
1.77

* These solutions have been provided by [projectmaths](#) and are not supplied or endorsed by BOSTES.

BOSTES: Notes from the Marking Centre

This information is released by BOSTES in late Term 1 2017.