

## STEP II, 2008, Q5

5 Evaluate the integrals

$$\int_0^{\pi/2} \frac{\sin 2x}{1 + \sin^2 x} dx \quad \text{and} \quad \int_0^{\pi/2} \frac{\sin x}{1 + \sin^2 x} dx .$$

Show, using the binomial expansion, that  $(1 + \sqrt{2})^5 < 99$ . Show also that  $\sqrt{2} > 1.4$ . Deduce that  $2^{\sqrt{2}} > 1 + \sqrt{2}$ . Use this result to determine which of the above integrals is greater.



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