

STEP II, 2003, Q6

- 6 The function f is defined by

$$f(x) = |x - 1|,$$

where the domain is \mathbf{R} , the set of all real numbers. The function $g_n = f^n$, with domain \mathbf{R} , so for example $g_3(x) = f(f(f(x)))$. In separate diagrams, sketch graphs of g_1 , g_2 , g_3 and g_4 .

The function h is defined by

$$h(x) = \left| \sin \frac{\pi x}{2} \right|,$$

where the domain is \mathbf{R} . Show that if n is even,

$$\int_0^n (h(x) - g_n(x)) \, dx = \frac{2n}{\pi} - \frac{n}{2}.$$



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