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5. $$I_n = \int \sec^n x \, dx \qquad n \geqslant 0$$

(a) Prove that for $n \geqslant 2$

$$(n-1)I_n = \tan x \sec^{n-2} x + (n-2)I_{n-2}$$

(6)

(b) Hence, showing each step of your working, find the exact value of

$$\int_0^{\frac{\pi}{4}} \sec^6 x \, dx$$

(4)

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Question 5 continued

(Total 10 marks)

Q5