(a) Given that $y = \tan^2 x$, show that $\frac{dy}{dx} = 2\tan x + 2\tan^3 x$. [2]

(b) Find the exact value of $\int_{\frac{1}{4}\pi}^{\frac{1}{3}\pi} (\tan x + \tan^2 x + \tan^3 x)\, dx$. [6]

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