2 **(a)** Given that $y = \tan x - x$, find $\frac{\mathrm{d}y}{\mathrm{d}x}$. Write your answer in terms of $\tan x$. [2]

(b) Hence find $\int_0^{\frac{\pi}{4}} \tan^2 x \mathrm{d}x$. Give your answer in exact form. [2]

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3 **(a)** Solve the equation $8^{\frac{1}{x}} - 2 \times 8^{-\frac{1}{x}} = 1$. [4]

(b) It is given that $\left(a - \sqrt{3}\right)^2 = b + \left(3 - b\right)\sqrt{3}$, where a and b are integers. Find the possible values of a and b. [6]

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