5 **(a)** Show that $\dfrac{1+\cot^2\theta}{\cot^2\theta} = \sec^2\theta$. [1]

(b) Write down the derivative of $\tan\theta$ with respect to θ. [1]

(c) Using **part (a)** and **part (b)**, find the exact value of $\displaystyle\int_0^{\frac{\pi}{3}}\left(\frac{1+\cot^2\theta}{\cot^2\theta} - \sin\theta\right)\mathrm{d}\theta$. [4]

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6 **(a)** Find, in descending powers of x, the first 3 terms in the expansion of $\left(x+\frac{2}{x^2}\right)^{10}$. Simplify each term as far as possible. [3]

(b) Find the term independent of x in the expansion of $\left(4x^2+\frac{1}{2x^2}\right)^8$. [2]