6. Given that $y = \sec x$

(a) show that

$$\frac{\mathrm{d}^3 y}{\mathrm{d}x^3} = \sec x \tan x \left(p \sec^2 x + q \right)$$

where p and q are integers to be determined.

(4)

(b) Hence determine the Taylor series expansion about $\frac{\pi}{3}$ of sec x in ascending powers of $\left(x - \frac{\pi}{3} \right)$, up to and including the term in $\left(x - \frac{\pi}{3} \right)^3$, giving each coefficient in simplest form.

(3)

(c) Use the answer to part (b) to determine, to four significant figures, an approximate value of $\sec\left(\frac{7\pi}{24} \right)$

(2)

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Question 6 continued

(Total for Question 6 is 9 marks)