4 **(a)** Find and simplify the term independent of x in the expansion of $\left(x^2 - \frac{1}{2x^3}\right)^{10}$. [2]

(b) **DO NOT USE A CALCULATOR IN THIS PART OF THE QUESTION.**

(i) Use the binomial theorem to show that $\left(1+2\sqrt{2}\right)^4 - \left(1-2\sqrt{2}\right)^4 = k\sqrt{2}$, where k is an integer to be found. [4]

(ii) Hence write $\dfrac{\left(1+2\sqrt{2}\right)^4 - \left(1-2\sqrt{2}\right)^4}{1+\sqrt{2}}$ in the form $a+b\sqrt{2}$, where a and b are integers. [2]

5 **(a)** The function f is defined by $\mathrm{f}(x) = \dfrac{1+2\sin^2 x}{\cos^2 x}$ for $-\dfrac{\pi}{2} < x < \dfrac{\pi}{2}$.

(i) Show that $\mathrm{f}(x)$ can be written as $a\tan^2 x + b$, where a and b are integers. [2]

(ii) Hence solve the equation $\mathrm{f}(x) = 4$. [3]

(iii) Hence also find the gradient of the curve $y = \mathrm{f}(x)$ at each of the points where $y = 4$. [4]

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