(a) Given $f(x) = e^{2x}$, obtain the Maclaurin expansion for $f(x)$ up to, and including, the term in x^3. **2**

(b) On a suitable domain, let $g(x) = \tan x$.

    (i) Show that the third derivative of $g(x)$ is given by

       $g'''(x) = 2\sec^4 x + 4\tan^2 x \sec^2 x$. **3**

    (ii) Hence obtain the Maclaurin expansion for $g(x)$ up to and including the term in x^3. **2**

(c) Hence, or otherwise, obtain the Maclaurin expansion for $e^{2x} \tan x$ up to, and including, the term in x^3. **2**

(d) Write down the first three non-zero terms in the Maclaurin expansion for $2e^{2x} \tan x + e^{2x} \sec^2 x$. **1**

Answers/method:

(a) $1 + 2x + 2x^2 + \dfrac{4}{3}x^3 \ldots$

(b) (i) Differentiate three times and simplify.

    (ii) $g(x) = x + \dfrac{1}{3}x^3 \ldots$

(c) $x + 2x^2 + \dfrac{7}{3}x^3 \ldots$

(d) $1 + 4x + 7x^2$