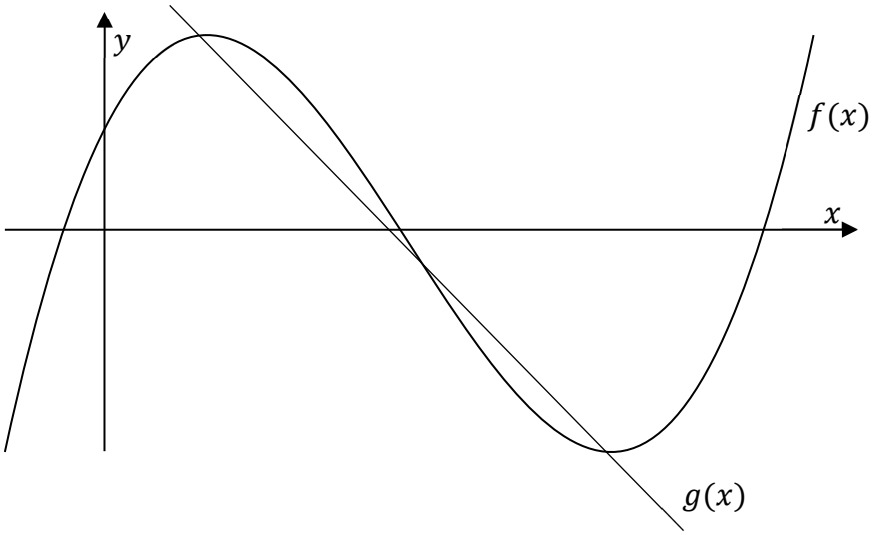
Question 4 **(25 marks)**

The diagram below shows two functions $f(x)$ and $g(x)$.

The function $f(x)$ is given by the formula $f(x) = x^3 + kx^2 + 15x + 8$, where $k \in \mathbb{Z}$, and $x \in \mathbb{R}$.



(a) Given that $f'(3) = -12$, show that $k = -9$, where $f'(3)$ is the derivative of $f(x)$ at $x = 3$.

(b) The function $g(x)$ is the line that passes through the two turning points of $f(x) = x^3 - 9x^2 + 15x + 8$, as shown on the previous page.

Find the equation of $g(x)$.

(c) Show that the graph of $g(x)$ contains the point of inflection of $f(x)$.