12 A curve has equation $y = a^{3x^2}$, where a is a constant greater than 1.

(a) Show that $\dfrac{dy}{dx} = 6xa^{3x^2}\ln a$. [3]

(b) The tangent at the point $(1, a^3)$ passes through the point $(\frac{1}{2}, 0)$.

Find the value of a, giving your answer in an exact form. [4]

(c) By considering $\dfrac{d^2y}{dx^2}$ show that the curve is convex for all values of x. [5]