10 **(a)** The functions f and g are defined for $x \geqslant 0$ by

$$\mathrm{f} : x \mapsto (ax + b)^{\frac{1}{3}}, \text{ where } a \text{ and } b \text{ are positive constants,}$$
$$\mathrm{g} : x \mapsto x^2.$$

Given that $\mathrm{fg}(1) = 2$ and $\mathrm{gf}(9) = 16$,

(i) calculate the values of a and b, [4]

(ii) obtain an expression for $\mathrm{f}^{-1}(x)$ and state the domain of f^{-1}. [4]

(b) A point P travels along the curve $y = (7x^2 + 1)^{\frac{1}{3}}$ in such a way that the x-coordinate of P at time t minutes is increasing at a constant rate of 8 units per minute. Find the rate of increase of the y-coordinate of P at the instant when P is at the point (3, 4). [5]