Question 6 (12 marks) Use a SEPARATE writing booklet.

(a) Sketch the graph of $y = \sqrt{4 - x^2}$, and state the range. **2**

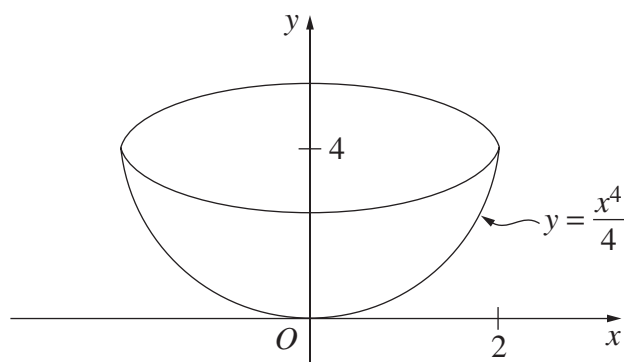(b) The gradient function of a curve is given by

$$f'(x) = 3(x+1)(x-3)$$

and the curve $y = f(x)$ passes through the point $(0, 12)$.

    (i) Find the equation of the curve $y = f(x)$. **2**

    (ii) Sketch the curve $y = f(x)$, clearly labelling turning points and the y intercept. **3**

    (iii) For what values of x is the curve concave up? **1**

(c) **4**

A bowl is formed by rotating the part of the curve $y = \dfrac{x^4}{4}$ between $x = 0$ and $x = 2$ about the y axis.

Find the volume of the bowl.