

Assignment: Mathematical Writing Practice

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1 Task

Suppose that f is a function of x given by $f(x) = x^3 - Ax^2 + 3x - B$, where A and B are real constants, which passes through $(0, -4)$ and has a critical point at $x = 1$.

Find $f(x)$ exactly.

Ensure that you write ‘properly’. That means using complete sentences, justifying all logic, and aiming for clarity!

2 Hints

A list of things to think about:

- Write down the information that you are given in algebraic form.
- What information can you use straight away?

3 Example Answer

We are given that the graph of $y = f(x)$ passes through $(0, -4)$; this means that we can substitute this point into our equation for $f(x)$, yielding

$$-4 = 0^3 - A \cdot 0^2 + 3 \cdot 0 - B = -B,$$

so we have that $B = 4$.

We also know that the derivative is zero at $x = 1$ (why?). Computing the derivative of $f(x)$ we obtain

$$\frac{d}{dx} [x^3 - Ax^2 + 3x - 4] = 3x^2 - 2Ax + 3$$

and setting it to zero,

$$0 = 3 \cdot 1^2 - 2A \cdot 1 + 3 \Rightarrow A = 3.$$

Hence, $f(x) = x^3 - 3x^2 + 3x - 4$.