Marked example 2

Paper 1 style · No calculator

2 5 marks SL 5.8 ●●○ Typical

Let $f(x) = x^5 - 5x^4 + 2$.

(a) Show that $f''(x) = 20x^2(x-3)$. **[2]**

(b) Show that the graph of f has a point of inflexion at $x = 3$. **[2]**

(c) Explain why the graph of f does not have a point of inflexion at $x = 0$, even though $f''(0) = 0$. **[1]**

MARKSCHEME (a)

$f'(x) = 5x^4 - 20x^3$ **A1**

$f''(x) = 20x^3 - 60x^2$ **A1**

$= 20x^2(x-3)$ **AG**

Total 2 marks

MARKSCHEME (b)

$f''(3) = 0$ **A1**

f'' changes sign at $x = 3$: e.g. $f''(2) = -80 < 0$ and $f''(4) = 320 > 0$ (concave-down, then concave-up) **R1**

Total 2 marks

Note Award R1 for any valid argument that f'' changes sign, including a sign diagram. $f''(3) = 0$ alone earns A1R0.

MARKSCHEME (c)

$x^2 \geq 0$ and $x - 3 < 0$ near $x = 0$, so $f'' \leq 0$ on both sides of $x = 0$: the graph is concave-down on both sides (no change of concavity) **R1**

Total 1 mark

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