Exercise 3

Paper 2 style · Graphic display calculator

3 7 marks SL 5.2 · 5.7 ●●○ Typical

Let $f(x) = x^3 \mathrm{e}^{-x}$, for $0 \leq x \leq 8$.

(a) Find the values of x for which f is increasing. **[2]**

(b) Find the coordinates of the points of inflexion of the graph of f. **[5]**

The markscheme is on the next page: try the question first. Written and verified by a practising IB mathematics teacher, produced with AI assistance; solved twice and recomputed by software. Not affiliated with or endorsed by the International Baccalaureate Organization.
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MARKSCHEME (a)

$f'(x) > 0$, or the maximum of f at $x = 3$ **(M1)**

$0 < x < 3$ **A1**

Total 2 marks

Note Accept $0 \leq x < 3$.

MARKSCHEME (b)

the turning points of the graph of f', or $f''(x) = 0$ with a change of sign **(M1)**

$x = 1.27 \ \ (1.26794\ldots)$ **A1**

$(1.27,\ 0.574)$ **A1**

$x = 4.73 \ \ (4.73205\ldots)$ **A1**

$(4.73,\ 0.933)$ **A1**

Total 5 marks

Note $x = 0$ is an end of the domain, not a point of inflexion. Exact values: $x = 3 \pm \sqrt{3}$.