Derivative sign and increasing/decreasing intervals

6 questions | 18 marks

Equivalent correct methods earn the corresponding marks.

1. Find the increasing/decreasing intervals of $f(x) = x^2 + 6x$. [3 marks]

$f'(x) = 2x + 6$ changes from − to + at -3.

Answer: Decreasing $x < -3$; increasing $x > -3$.

2. Analyse $f'(x) = 4 - 2x$. [3 marks]

The derivative is positive before 2 and negative after 2.

Answer: Increasing $x < 2$; decreasing $x > 2$.

3. Find the sign intervals of $f'(x) = 3(x - 2)(x + 1)$. [3 marks]

Roots are -1 and 2. Testing -2, 0 and 3 gives +, −, +.

Answer: Positive $x < -1$ or $x > 2$; negative $-1 < x < 2$.

4. If $g'(x) = -(x - 1)(x - 4)$, where is g increasing? [3 marks]

The leading minus gives derivative signs −, +, − across 1 and 4.

Answer: $1 < x < 4$

5. $h'(x) = 3x^2$. Is h decreasing anywhere? [3 marks]

$3x^2$ is positive for $x \neq 0$ and 0 at $x = 0$; it is never negative.

Answer: No. It is increasing on both sides of 0.

6. A graph is below the x-axis but has positive tangent gradients. Is it increasing or decreasing? [3 marks]

Its values rise as x increases, even while those values remain negative.

Answer: Increasing