

Increasing & Decreasing

AP Calculus AB | Unit 5 | the sign of f' , sign charts, the graph of f'

1. The sign of f' decides

The rule

$f'(x) > 0$ on an interval $\Rightarrow f$ is **increasing** there.

$f'(x) < 0$ on an interval $\Rightarrow f$ is **decreasing** there.

Only the *sign* of f' matters, never its shape.

2. The procedure

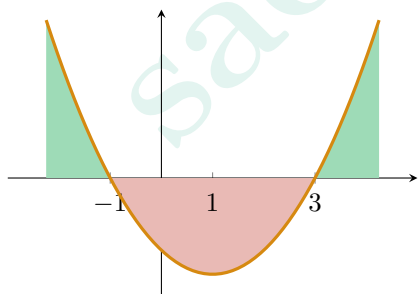
For $f(x) = \frac{1}{3}x^3 - x^2 - 3x + 2$:

1. Differentiate and factor: $f'(x) = x^2 - 2x - 3 = (x+1)(x-3)$.
2. Find where $f' = 0$ or is undefined: $x = -1$ and $x = 3$. The sign can change only there.
3. Test one point in each interval: $f'(-2) = 5$, $f'(0) = -3$, $f'(4) = 5$.
4. Conclude.

	$x < -1$	$-1 < x < 3$	$x > 3$
$f'(x)$	+	-	+
f	increasing	decreasing	increasing

3. Reading the graph of f'

the graph of $y = f'(x)$



When the graph shown is f' , do **not** ask where it goes up. Ask where it is **above** or **below** the x -axis.

- Above the axis: $f' > 0$, so f is increasing ($x < -1$ and $x > 3$).
- Below the axis: $f' < 0$, so f is decreasing ($-1 < x < 3$).

At $x = 2$ the graph of f' is rising, but $f'(2) = -3 < 0$: f is *decreasing* there. A rising f' is about concavity, not about f increasing.

4. Writing the justification

What earns the point

“ f is increasing on $(-\infty, -1)$ and $(3, \infty)$ because $f'(x) > 0$ on those intervals.”

The reason is always a statement about the sign of f' , in a sentence. A sign chart alone is scratch work. Open or closed intervals are both accepted at the endpoints.

Where students lose points

1. Reading where the graph of f' goes up instead of where it is above the axis.
2. No reason, or a reason that never mentions f' (“the graph goes up”, “the slope is positive”).
3. A sign chart as the whole justification.
4. Forgetting points where f' is undefined.
5. Plugging the test points into f instead of f' .

Now practise it

Theory sticks once you use it. On **sad-academy.com** you'll find practice questions for this exact subtopic in the AP format, and an AI that grades your free-response answers against the scoring guidelines, the way an AP reader would.

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