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JC MATHEMATICS (H2)

STUDY TIPS

HOW TO DETERMINE THE NATURE OF A STATIONARY POINT WHEN THE SECOND DERIVATIVE ENDS UP ZERO

PREPARED BY
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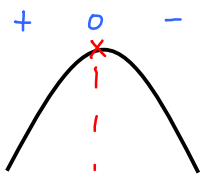
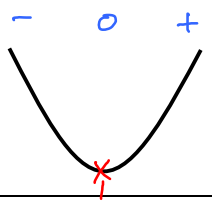
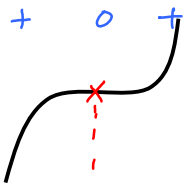
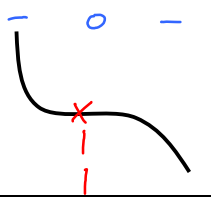
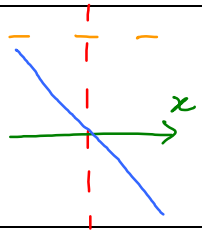
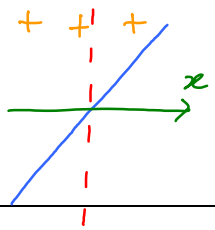
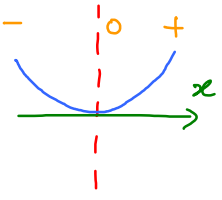
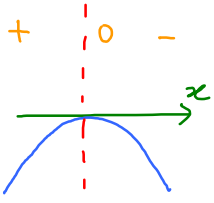
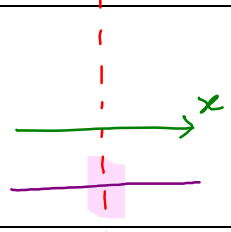
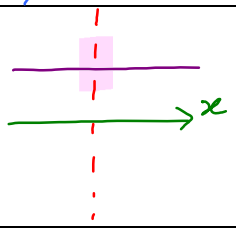
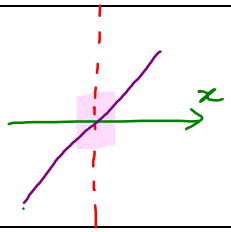
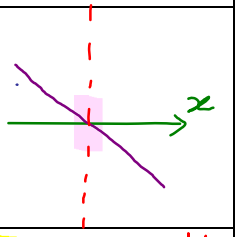
www.h2maths.com

JC_H2Maths_029

• Second Derivative Test

Steps: 1. Find the value(s) of a such that $f'(a)=0$.
2. Check the sign of $f''(a)$.

	Maximum Turning Point	Minimum Turning Point	Stationary Point of Inflexion	
$f'(x)$ / $f(x)$				
$f''(x)$ / $f'(x)$				
$f''(x)$				
	<0 −ve.	>0 +ve.	0 and change in signs** of $f'(x)$	

Good to know

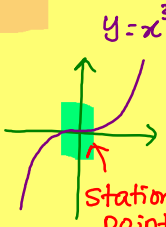
Consider the stationary points of $y=x^3$ vs $y=x^4$.

$y=x^3 \Rightarrow \frac{dy}{dx}=3x^2=0$, $x=0$

$\frac{d^2y}{dx^2}=6x \Rightarrow \left.\frac{d^2y}{dx^2}\right|_{x=0}=0$

x	0^-	0	0^+
$\frac{d^2y}{dx^2}$	−	0	+

change in signs of $f'(x)$

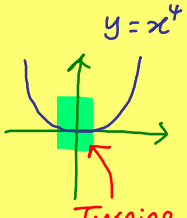


$y=x^4 \Rightarrow \frac{dy}{dx}=4x^3=0$, $x=0$

$\frac{d^2y}{dx^2}=12x^2 \Rightarrow \left.\frac{d^2y}{dx^2}\right|_{x=0}=0$

x	0^-	0	0^+
$\frac{d^2y}{dx^2}$	+	0	+

No change in signs of $f'(x)$



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Explanation

When the first and second derivatives both equal zero, the second derivative test fails and cannot prove a stationary point of inflection.

To safely confirm an inflection point, you must check that the second derivative actually changes signs from positive to negative, or vice versa, as it passes through that location. Without this sign change, the curve might simply be a flat maximum or minimum turning point rather than an inflection point.

Always look at the behaviour immediately before and after the point to ensure the concavity truly flips before making your final conclusion.

SIGN UP NOW BEFORE IT'S TOO LATE

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MATHS TUITION BY MR JACKIE LEE

Online • Face-to-Face • 1-to-1 • Group

- Former **MOE Scholar**
- **Winner** of International Mathematics Competitions
- **PGDE** Qualification (NIE) with **Distinction in Mathematics**
- Former **School Maths Teacher** in
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  - Raffles Institution
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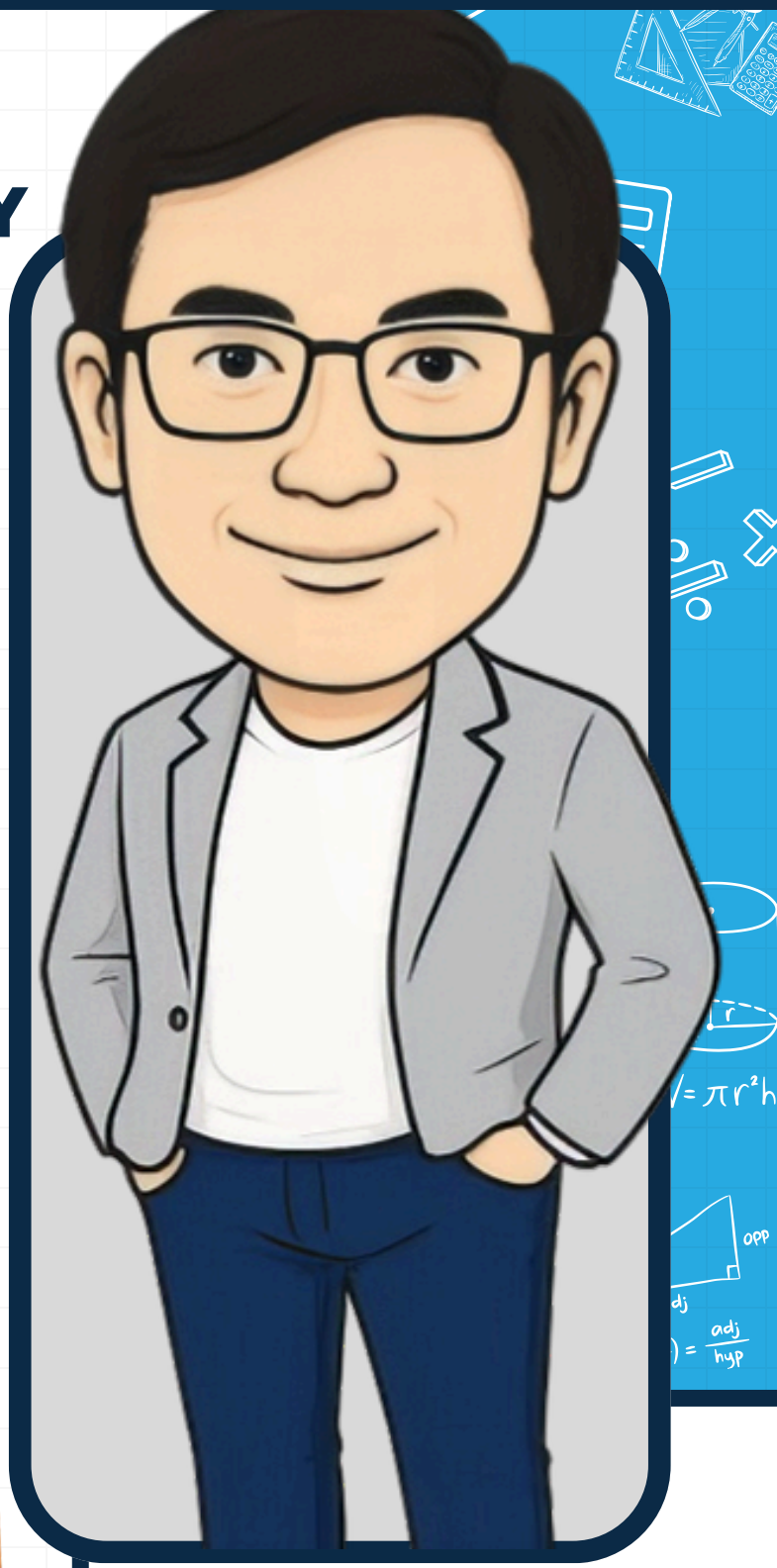

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