



PERFECT  
SOLUTION  
EDUCATION  
GROUP

# JC MATHEMATICS (H2) STUDY TIPS

---

**DERIVING INVERSE  
TRIGONOMETRIC DERIVATIVES  
USING IMPLICIT  
DIFFERENTIATION**

**PREPARED BY**  
Mr Jackie Lee



[www.h2maths.com](http://www.h2maths.com)

JC\_H2Maths\_046



**Quick Practice**

(i) Using implicit differentiation, prove that  $\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$ .

(ii) Hence, find  $\frac{d}{dx}(\tan^{-1} \sqrt{1+x^2})$ .

(i) Let  $y = \tan^{-1} x \Rightarrow x = \tan y$

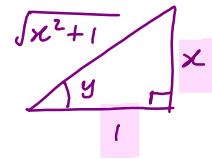
Differentiate both sides w.r.t  $x$ :

$$1 = (\sec^2 y) \frac{dy}{dx}$$

$$\frac{dy}{dx} = \cos^2 y$$

$$= \left( \frac{1}{\sqrt{x^2+1}} \right)^2$$

$$= \frac{1}{x^2+1}$$



$$(ii) \frac{d}{dx}(\tan^{-1} \sqrt{1+x^2}) = \frac{1}{(\sqrt{1+x^2})^2 + 1} \left( \frac{2x}{2\sqrt{1+x^2}} \right)$$

$$= \frac{x}{(2+x^2)\sqrt{1+x^2}}$$



PERFECT  
SOLUTION  
EDUCATION  
GROUP

# JC MATHEMATICS (H2)

# STUDY TIPS

---

## Explanation

To find the derivative of an inverse trigonometric function, you first equate a dependent variable to the inverse function.

Next, apply the regular trigonometric function to both sides to isolate the independent variable.

You then differentiate both sides implicitly with respect to that independent variable. The isolated side differentiates to one. The trigonometric side requires the chain rule, creating a trigonometric derivative multiplied by the desired derivative. Isolate this desired derivative by dividing one by that new trigonometric expression.

Finally, use trigonometric identities or reference triangles to substitute the terms back into the original independent variable.

This content is extracted from our lesson resources. Welcome to contact us for more tailor-made and in-depth learning.



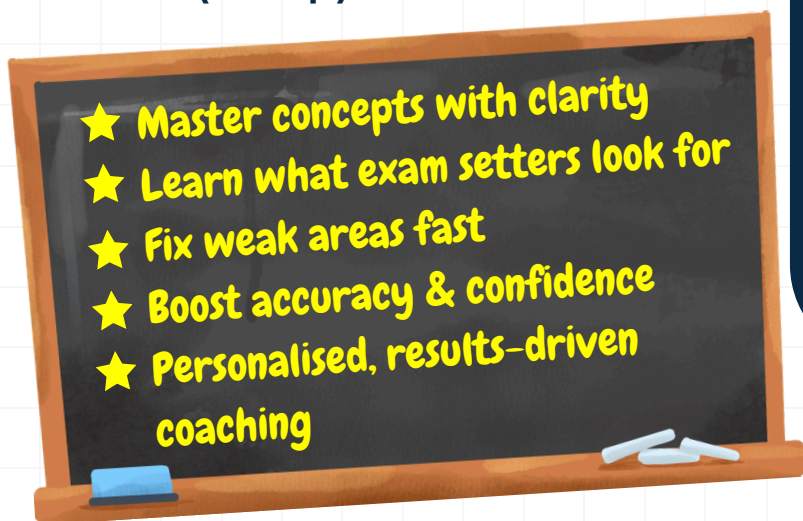
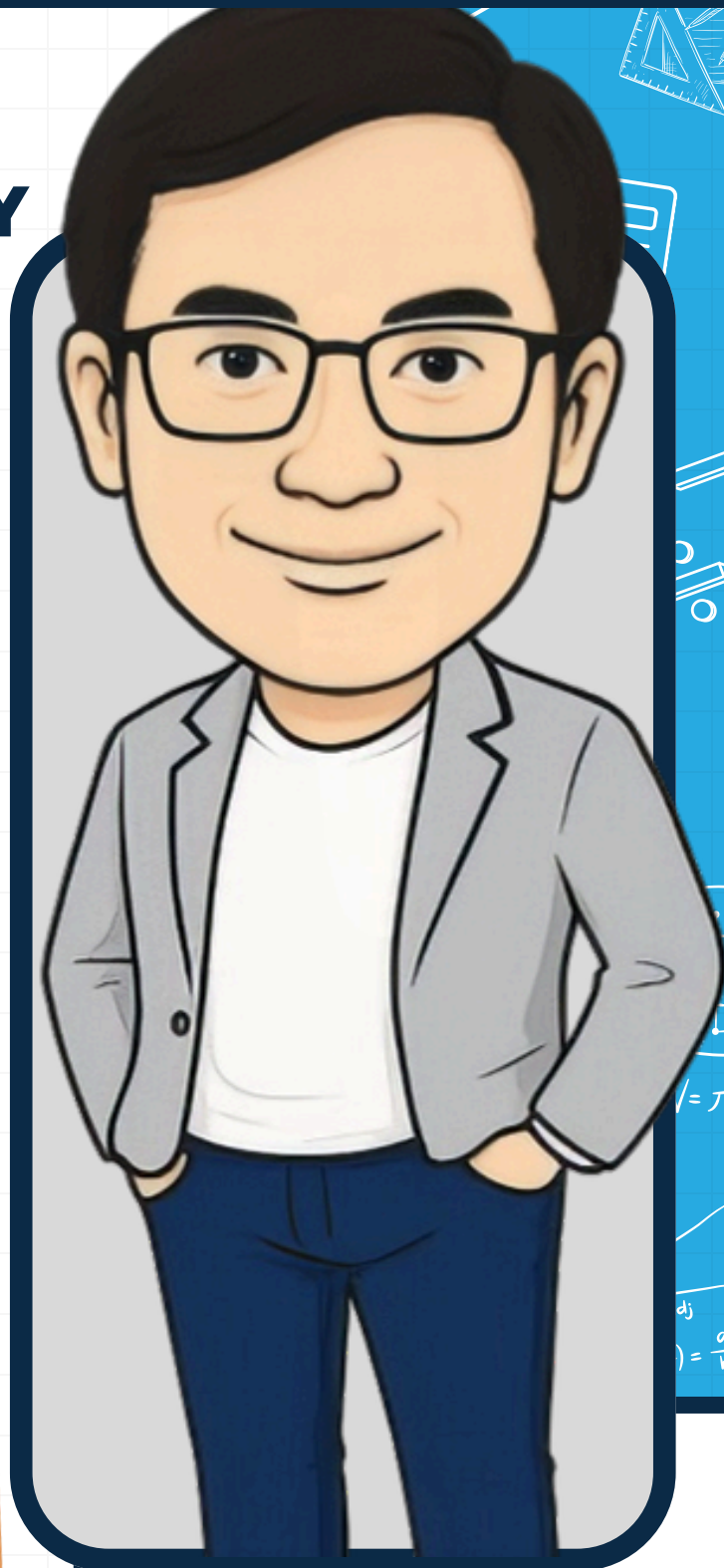
# SIGN UP NOW BEFORE IT'S TOO LATE



## 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
  - Nan Hua High School
  - Raffles Institution
  - Anglo Chinese School (Indep)



Find out more about our  
classes and courses at

**[www.h2maths.com](http://www.h2maths.com)**



Scan to  
WhatsApp



# 90705626