PERFECT SOLUTION EDUCATION GROUP

JC MATHEMATICS (H2)

STUDY TIPS

MASTERING INTEGRATION BY PARTS WITH AN INVISIBLE PARTNER

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JC_H2Maths_011

- **Letting dv/dx=1**

Example 27

Find $\int \sin^{-1} x \, dx$.

$= \int (1) \sin^{-1} x \, dx$

L I A T E

$u = \sin^{-1} x$ $\quad \frac{dv}{dx} = 1$

$\frac{du}{dx} = \frac{1}{\sqrt{1-x^2}}$ $\quad v = x$

$= x \sin^{-1} x - \int \frac{x}{\sqrt{1-x^2}} \, dx$

$= -\frac{1}{2} \int \frac{-2x}{\sqrt{1-x^2}} \, dx$

$\int \frac{f'(x)}{\sqrt{f(x)}} dx = 2\sqrt{f(x)}$

$= x \sin^{-1} x + \frac{1}{2}(2\sqrt{1-x^2}) + C$ ☆

$2\sqrt{f(x)}$

Quick Practice

Find $\int \tan^{-1} x \, dx$.

$= \int (1) \tan^{-1} x \, dx = x \tan^{-1} x - \int x \left(\frac{1}{1+x^2}\right) dx$

L I A T E

$u = \tan^{-1} x$ $\quad \frac{dv}{dx} = 1$

$\frac{du}{dx} = \frac{1}{1+x^2}$ $\quad v = x$

$= x \tan^{-1} x - \frac{1}{2} \int \frac{2x}{1+x^2} dx$ ($2x$: $f'(x)$, $1+x^2$: $f(x)$)

$= x \tan^{-1} x - \frac{1}{2} \ln|1+x^2| + C$ ☆

$\ln|f(x)|$

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Explanation

When you encounter an integral that contains only a single term—such as a lonely inverse trigonometric function or a solitary logarithm—it can look impossible to solve using integration by parts.

The secret trick is to realize that the term is never truly alone because it is always multiplied by an invisible number one. By rewriting the expression to include this hidden partner, you instantly create the two separate terms needed for the formula.

You can then easily assign the complex, original function as the part to be differentiated, while treating the invisible number one as the algebraic part to be integrated.

In calculus, as in life, the most powerful solutions often come from recognizing the profound impact of the things that appear completely invisible.

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
  - Nan Hua High School
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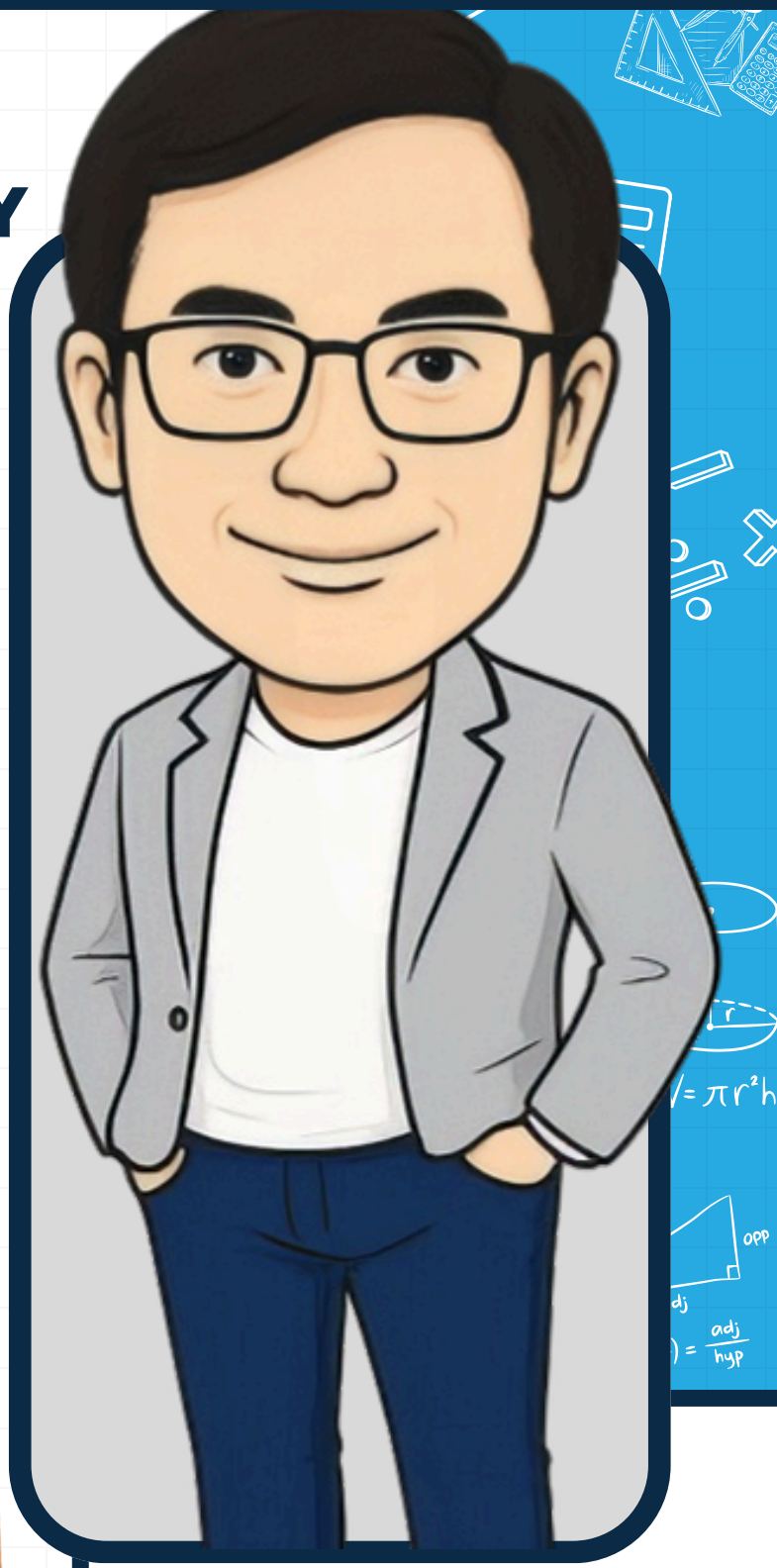

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