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JC MATHEMATICS (H2)

STUDY TIPS

HOW TO CORRECTLY APPLY NEGATIVE SIGN WHEN INTEGRATING A FUNCTION INVOLVING MODULUS

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JC_H2Maths_033

- **Area under a curve involving modulus function** $\int_a^b |f(x)|\,dx$

Step 1: Find the root(s) of $f(x)=0$.

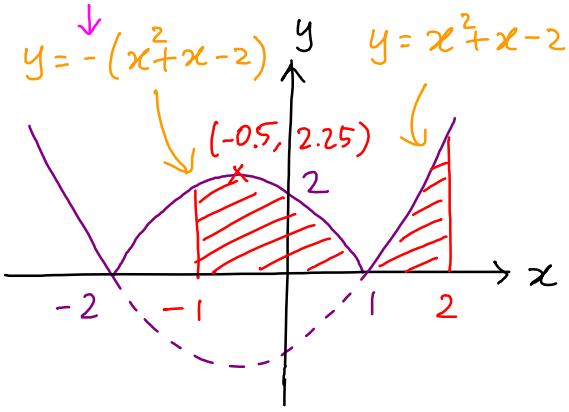
Step 2: Identify the region(s) where $f(x)$ is below the x-axis.

Step 3: Break down the integral and insert "-" for those region(s) identified in Step 2 (below the x-axis).

Example 31

Sketch the curve $y=|x^2+x-2|$. $= |(x+2)(x-1)|$

Find the exact area of the region under the curve $y=|x^2+x-2|$, where $-1\le x\le 2$ and $y\ge 0$.



Required Area $= \int_{-1}^{2} |x^2+x-2|\,dx$

$= \int_{-1}^{1} -(x^2+x-2)\,dx + \int_{1}^{2} (x^2+x-2)\,dx$

$= -\left[\frac{x^3}{3}+\frac{x^2}{2}-2x\right]_{-1}^{1} + \left[\frac{x^3}{3}+\frac{x^2}{2}-2x\right]_{1}^{2}$

$= -\left(\frac{1}{3}+\frac{1}{2}-2\right) + \left(-\frac{1}{3}+\frac{1}{2}+2\right) + \left(\frac{8}{3}+\frac{4}{2}-4\right) - \left(\frac{1}{3}+\frac{1}{2}-2\right)$

$= \frac{31}{6}$ units^2

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Explanation

The primary skill demonstrated on this page is calculating the precise area under a curve that contains a modulus or absolute value function. This process requires first finding the horizontal intercepts of the internal function by determining where it equals zero, which provides the boundary points for splitting the integration interval.

To successfully set up the separate integrals after this split, one must analyze the behaviour of the graph to see which sections fall below the horizontal axis, then determines which integral needs a minus sign by identifying the intervals where the original function drops below the horizontal axis.

Because the curve is naturally negative in that specific region, placing a minus sign in front of that component flips the value, ensuring that the calculated area remains positive. Finally, the process involves applying integration techniques to evaluate each separate section, substituting the boundaries, and combining the values to find the final total area.

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MATHS TUITION BY MR JACKIE LEE

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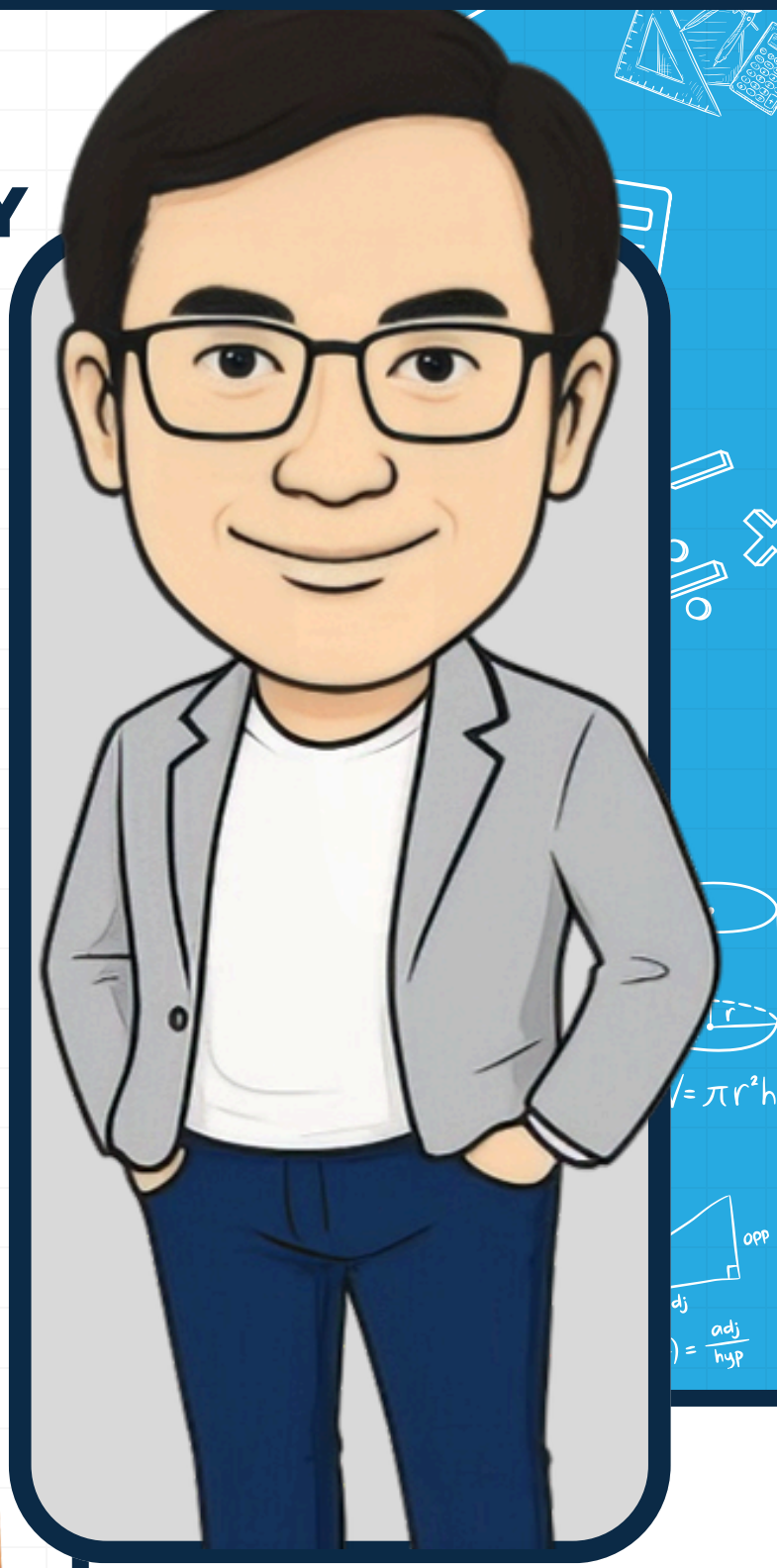

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