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JC MATHEMATICS (H2)

STUDY TIPS

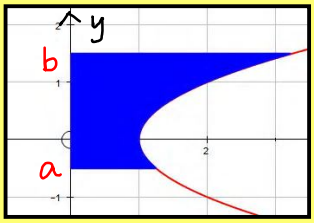
CHOOSING THE EASIER PATH: HORIZONTAL VS. VERTICAL INTEGRATION OF FIND THE AREA

PREPARED BY
Mr Jackie Lee

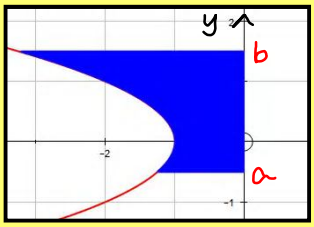
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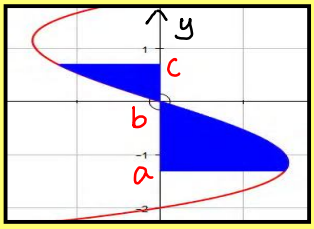
- **Area between a curve and the y-axis**



$$\int_a^b x\,dy$$

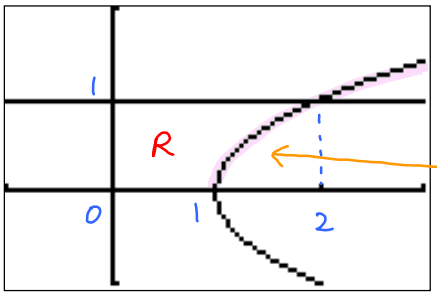


$$-\int_a^b x\,dy$$



$$\int_a^b x\,dy \downarrow - \int_b^c x\,dy$$

Quick Practice



The diagram shows the graphs of $y^2 = x-1$ and $y=1$. Find the area of the region R bounded by the two graphs and both axes.

$y^2 = x-1 \Rightarrow y = \sqrt{x-1}$ OR $x = y^2+1$

Area of $R = (1)(2) - \int_1^2 y\,dx$

$= 2 - \int_1^2 (x-1)^{1/2}\,dx$

$= 2 - \left[\frac{(x-1)^{3/2}}{3/2}\right]_1^2$

$= 2 - \frac{2}{3}(1-0) = \frac{4}{3}$ units^2 ★

OR $= \int_0^1 x\,dy$

$= \int_0^1 (y^2+1)\,dy$

$= \left[\frac{y^3}{3} + y\right]_0^1$

$= \left(\frac{1}{3}+1\right) - 0 = \frac{4}{3}$ units^2 ★

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Explanation

When finding the area of a bounded region, you often have the choice to integrate along either the horizontal axis or the vertical axis, and taking a moment to plan and compare both options before starting can save you a lot of effort.

Integrating along the horizontal axis usually requires breaking the shape into multiple pieces, such as subtracting a curve from a surrounding rectangle, whereas integrating along the vertical axis can often capture the exact same region in a single, direct step.

Additionally, rearranging the boundary equation to express one variable in terms of the other might leave you with an awkward square root in one direction, while the other direction gives you a clean, straightforward polynomial that is much simpler to calculate.

Always look at the shape of the region and the form of the equations first so you can pick the path of least resistance.

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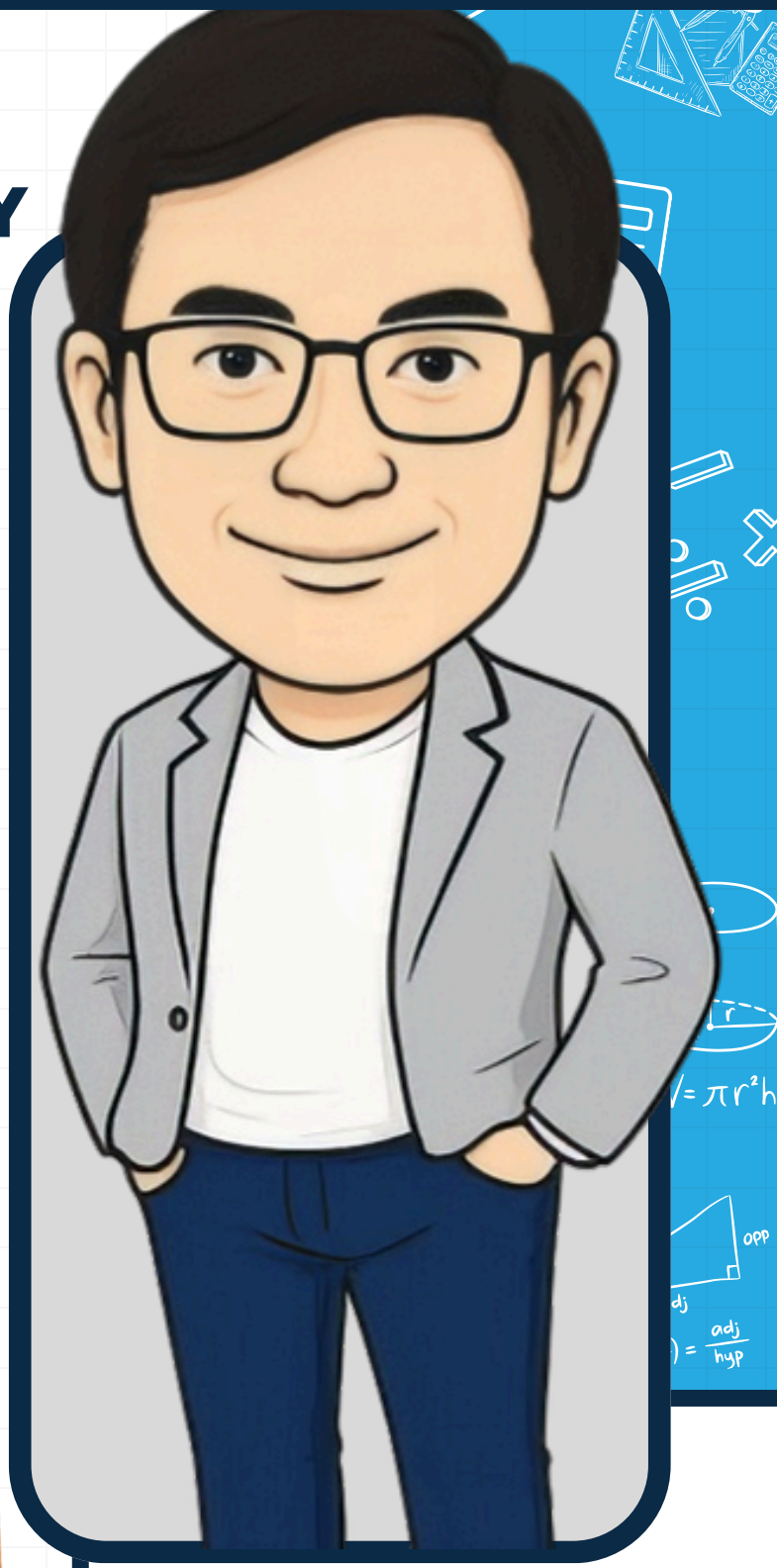
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- **Winner** of International Mathematics Competitions
- **PGDE** Qualification (NIE) with **Distinction in Mathematics**
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