

A LEVEL
H2 MATHEMATICS
APPLICATIONS OF INTEGRATION

CHAPTER ANALYSIS



MASTERY

- Approximation By Rectangles
- Area Under Curve
- Volume of Solid of Revolution



EXAM

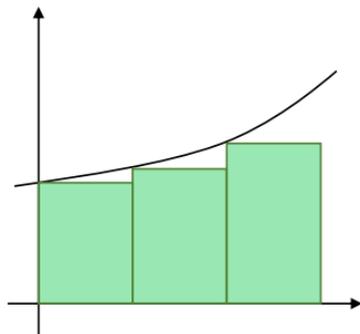
- Differentiation and integration techniques should be strong to do well in this chapter
- Chapter is often tested with parametric curves



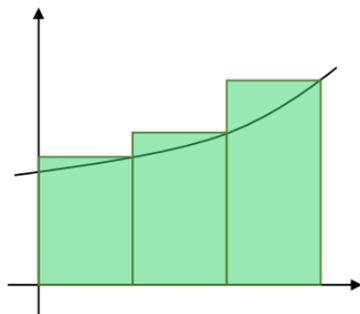
WEIGHTAGE

- Usually appears as 1 questions in the exam, tested with integration techniques and commonly parametric curves
- Chapter itself (finding area/volume) is low weightage; a part of a bigger question, around 5 marks

Approximation By Rectangles

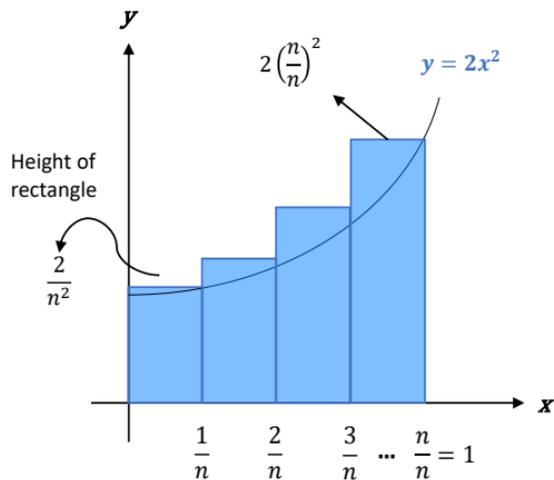


Underestimation



Overestimation

Use Summation to Approximate Area



Approximated Area

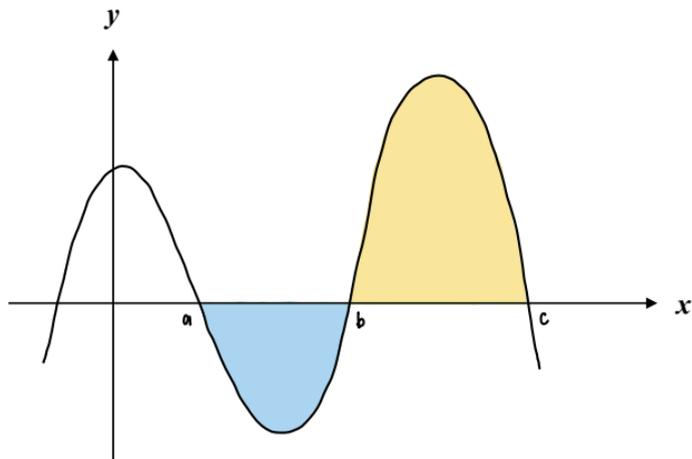
$$\begin{aligned}
 &= \left(\frac{1}{n}\right)\left(\frac{2}{n^2}\right) + \left(\frac{1}{n}\right)\left(\frac{8}{n^2}\right) + \cdots + \left(\frac{1}{n}\right)\left(2\left(\frac{n}{n}\right)^2\right) \\
 &= \frac{2}{n^3} \sum_{r=1}^n r^2 = \frac{2}{n^3} \times \frac{n(n+1)(2n+1)}{6} \\
 &= \frac{(n+1)(2n+1)}{2n^2} = \frac{2n^2 + 3n + 1}{2n^2} \\
 &= 1 + \frac{3}{2n} + \frac{1}{2n^2}
 \end{aligned}$$

$$\text{As } n \rightarrow \infty, \frac{3}{2n} \rightarrow 0 \text{ and } \frac{1}{2n^2} \rightarrow 0$$

Therefore, $\text{Area} \rightarrow 1$ from $x = 0$ to $x = 1$

Evaluating Area Bound By Curves & Axes

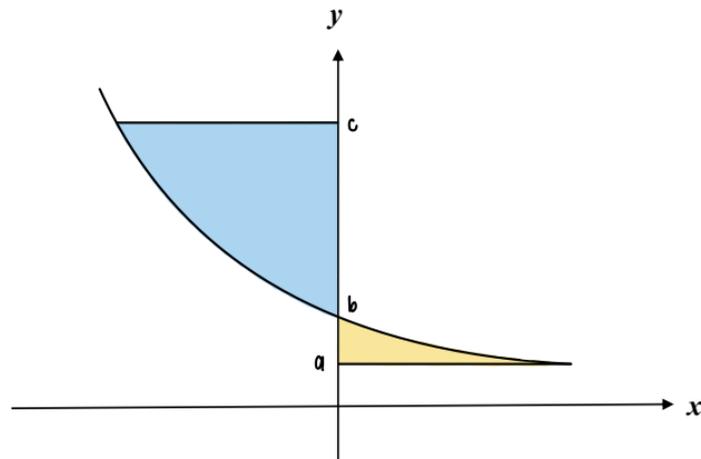
X-AXIS



$$\text{Negative Area} \\ = - \int_a^b f(x) dx = \int_a^b |f(x)| dx$$

$$\text{Positive Area} \\ = \int_b^c f(x) dx$$

Y-AXIS

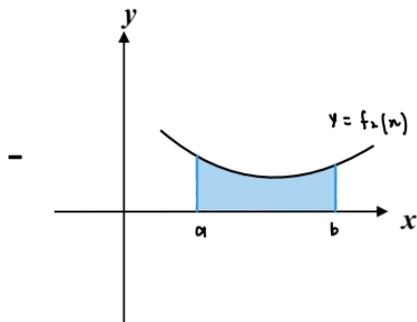
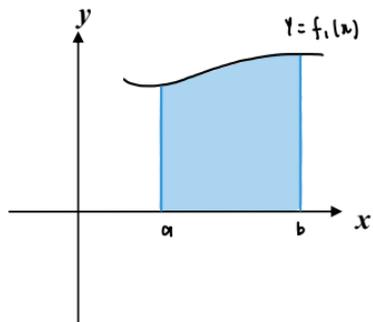
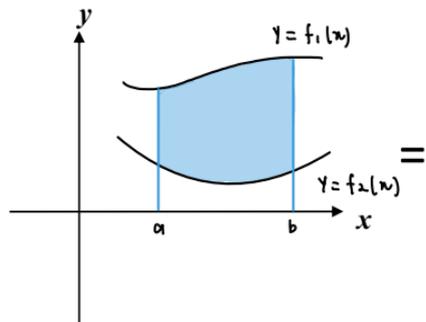


$$\text{Negative Area} \\ = - \int_b^c f(y) dy = \int_b^c |f(y)| dy$$

$$\text{Positive Area} \\ = \int_a^b f(y) dy$$

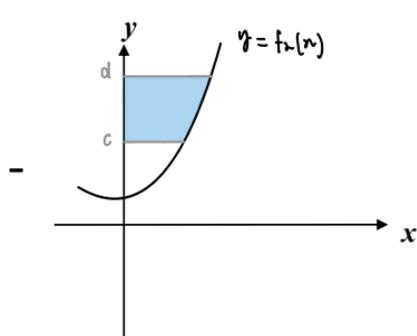
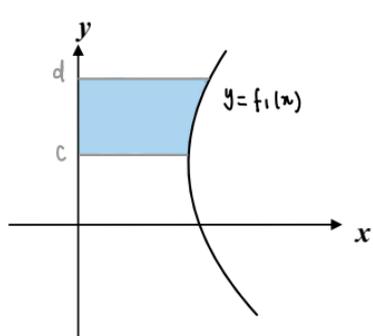
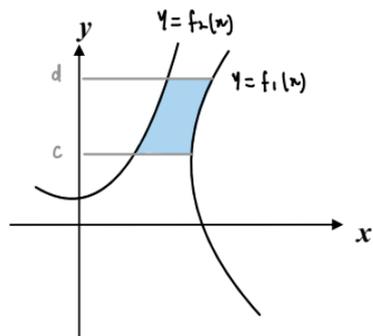
Evaluating Area Bound Between Curves

X-AXIS



$$\text{Area} = \int_a^b |f_1(x) - f_2(x)| dx$$

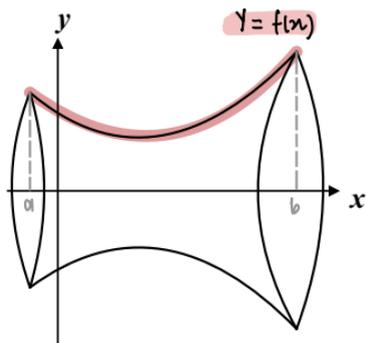
Y-AXIS



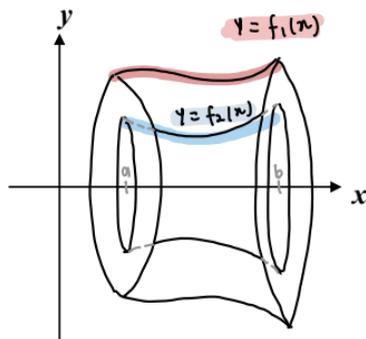
$$\text{Area} = \int_c^d |f_1(y) - f_2(y)| dy$$

Volume Of Solid Of Revolution

Rotation About X-AXIS

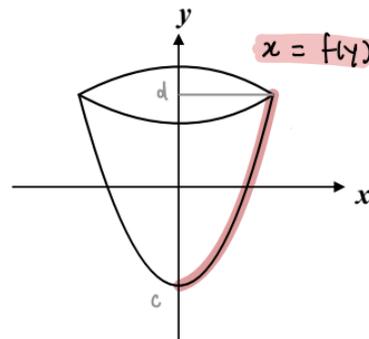


$$\text{Volume} = \pi \int_a^b [f(x)]^2 dx$$

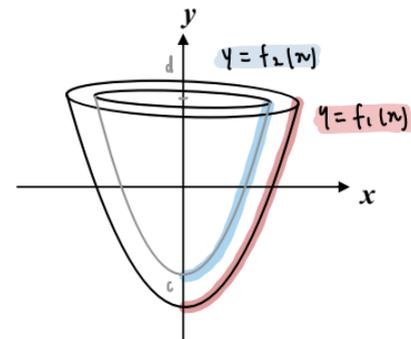


$$\text{Volume} = \pi \int_a^b [f_1(x)]^2 - [f_2(x)]^2 dx$$

Rotation About Y-AXIS



$$\text{Volume} = \pi \int_c^d [f(y)]^2 dy$$



$$\text{Volume} = \pi \int_c^d [f_1(y)]^2 - [f_2(y)]^2 dy$$

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