

Application of Integrals

CBSE Class 12 Maths · Knowledge organiser

KEY DEFINITIONS

Area under a curve

The area between $y = f(x)$, the x-axis and two vertical lines: $\int_a^b y \, dx$.

Vertical strip

A thin rectangle of width dx used to build up the area.

Region

The part of the plane bounded by the given curves and lines; sketch it first.

YOU SHOULD BE ABLE TO...

- Find the area under a curve with vertical strips and the areas of circles and ellipses using symmetry.
- Choose vertical or horizontal strips and find the area between a curve and a line from their intersection points.
- Write full-marks 5-mark area answers and case studies: sketch, shading, limits, integral and sq units.
- Handle regions that need two integrals, parts of circles and ellipses and area questions where symmetry is only partial.

COMMON MISTAKES

- ✗ Reporting a negative or zero “area” because part of the curve is below the axis.
- ✗ Forgetting to double when using symmetry — or doubling a region that is not symmetric.
- ✗ Wrong limits: using the intercepts of the line instead of the intersection points with the curve.
- ✗ Integrating y with respect to y (mixing up vertical and horizontal strips).

KEY FORMULAS

Area $\int_a^b |y| \, dx, \int_c^d |x| \, dy$

Circle $x^2 + y^2 = a^2$: area πa^2 ; ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$: area πab

Region between a curve and a line: integrate (upper – lower) between the intersection points

WORKED EXAMPLE

Area bounded by $y^2 = 4x$ and $x = 1$: by symmetry,

$$2 \int_0^1 2\sqrt{x} \, dx = \frac{8}{3} \text{ sq units.}$$