CLASS 12 MATHEMATICS — FORMULA SHEET

Chapter 8 : Application of Integrals (NCERT)

8.1 Area Under a Curve

Concept	Formula
Area under curve y = f(x)	$A = \int_a^b y\,dx$ (between x = a and x = b)
Area w.r.t. y-axis	$A = \int_c^d x\,dy$ (between y = c and y = d)
Curve above x-axis	y is positive ; area = $\int y\,dx$
Curve below x-axis	y is negative ; take absolute value $\lvert\int y\,dx\rvert$
Area partly above & below	Split at x-intercepts ; add the absolute values

8.2 Area Between Two Curves

Concept	Formula
Between y = f(x) and y = g(x)	$A = \int_a^b [f(x) - g(x)]\,dx$, $f \geq g$
Upper minus lower	Always (top curve − bottom curve)
Intersection points	Solve f(x) = g(x) to get the limits a and b
Curves crossing	Split the interval where the curves cross
Between curves w.r.t. y	$A = \int_c^d [\text{right} - \text{left}]\,dy$

8.3 Standard Areas

Region	Area
Circle $x^2 + y^2 = a^2$	πa^2
Quarter circle (first quadrant)	$(1/4)\,\pi a^2$
Ellipse $x^2/a^2 + y^2/b^2 = 1$	$\pi a b$
Parabola $y^2 = 4ax$ (with a chord)	Use $\int x\,dy$ or $\int y\,dx$ as needed
Area of a triangle (vertices)	From coordinates via integration or determinant

8.4 Working Steps

Step	Action
Step 1	Draw a rough sketch of the curves/region
Step 2	Find intersection points (limits of integration)
Step 3	Decide strip direction (vertical dx or horizontal dy)
Step 4	Write area = $\int$ (top − bottom) dx (or right − left dy)
Step 5	Integrate and apply the limits ; take |value| if needed

★ QUICK MEMORY AIDS & TRICKS

Basic area	Area under y = f(x) from a to b is ∫(a to b) y dx.
Below the axis	If the curve dips below the x-axis, the integral is negative — take |value|.
Between curves	Always integrate (TOP − BOTTOM). Find intersections for the limits first.
Sketch first	A rough sketch prevents sign errors and shows which curve is on top.
Symmetry	Use symmetry: e.g. circle area = 4 × (first-quadrant area).
Circle & ellipse	Circle: πa^2. Ellipse: πab. Handy checks for your answer.
dx vs dy	Pick horizontal strips (dy) when the region is simpler w.r.t. the y-axis.
Split regions	If curves cross inside the interval, split and add absolute areas.