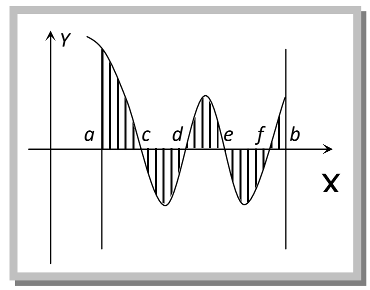
Sign convention for finding the Areas using Integration.

While applying the discussed sign convention, we will discuss the three cases.

Case I: In the expression $\int_a^b f(x)\,dx$ if $b > a$ and $f(x) > 0$ for all $a \le x \le b$, then this integration will give the area enclosed between the curve *f(x)*, *x*-axis and the line *x = a* and *x = b* which is positive. No need of any modification.

Case II: If in the expression $\int_a^b f(x)\,dx$ if *b > a* and $f(x) < 0$ for all $a \le x \le b$, then this integration will calculate to be negative. But the numerical or the absolute value is to be taken to mean the area enclosed between the curve *y = f(x)*, *x*-axis and the lines *x = a* and *x = b*.

Case III: If in the expression $\int_a^b f(x)\,dx$ where $b > a$ but *f(x)* changes its sign a numbers of times in the interval $a \le x \le b$, then we must divide the region [*a, b*] in such a way that we clearly get the points lying between [*a, b*] where *f(x)* changes its sign. For the region where *f(x)>0* we just integrate to get the area in that region and then add the absolute value of the integration calculated in the region where *f(x)<0* to get the desired area between the curve *y = f(x)*, *x*-axis and the line *x = a* and *x = b*.



Hence, if *f(x)* is as in above figure, the area enclosed by *y = f(x)*, *x*-axis and the lines *x = a* and *x = b* is given by

$$A = \int_a^c f(x)\,dx + \left|\int_c^d f(x)\,dx\right| + \int_d^e f(x)\,dx + \left|\int_e^f f(x)\,dx\right| + \int_f^b f(x)\,dx$$