

Mathematics 10260

SUMMARY FOR INTEGRATION

The following is a list of integral formulae and statements that you have to know.

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C; \quad n \neq -1$$

$$\int x^{-1} dx = \int \frac{1}{x} dx = \ln |x| + C \qquad \int \frac{1}{ax+b} dx = \frac{1}{a} \ln |ax+b| + C$$

$$\int e^x dx = e^x + C \qquad \int e^{kx} dx = \frac{1}{k} e^{kx} + C$$

Fundamental Theorem of Calculus

Let F an antiderivative of f i.e. $F'(x) = f(x)$. Then we have:

$$(1) \int_a^b f(x) dx = F(b) - F(a)$$

$$(2) \text{ Total change in } F \text{ if } x \text{ changes from } a \text{ to } b = F(b) - F(a) = \int_a^b F'(x) dx$$

Substitution Rule:

Let $F'(x) = f(x)$ then we have:

$$(1) \int f(g(x))g'(x) dx = \int f(u) du = F(u) + C = F(g(x)) + C \quad \text{where } u = g(x).$$

$$(2) \int_a^b f(g(x))g'(x) dx = \int_{g(a)}^{g(b)} f(u) du = F(g(b)) - F(g(a)) \quad \text{where } u = g(x).$$

Integration by Parts:

$$(1) \int u dv = uv - \int v du \qquad (2) \int_a^b u dv = uv|_a^b - \int_a^b v du$$

Average of a continuous function: Let $f(x)$ be a continuous function over the interval $[a, b]$.

The average of $f(x)$ over $a \leq x \leq b$ is the value: $\frac{\int_a^b f(x) dx}{b-a}$