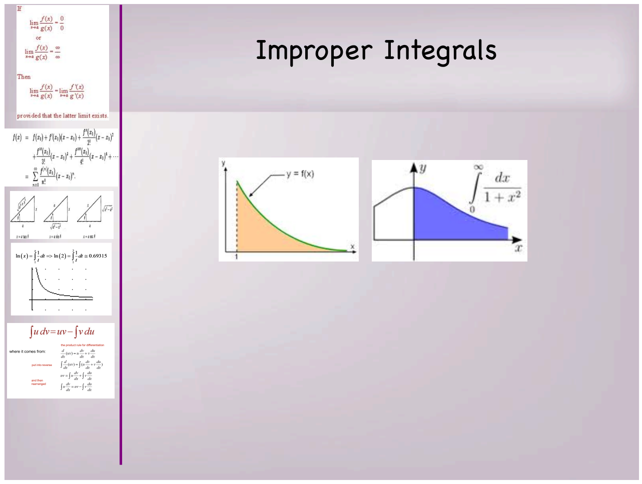


Improper Integral   It is like a definite integral except one or both of the limits of integration are ±∞.

Definition
$$\int_{-\infty}^{b} f(x)dx = \lim_{a\to-\infty}\int_{a}^{b} f(x)dx$$
$$\int_{a}^{\infty} f(x)dx = \lim_{b\to\infty}\int_{a}^{b} f(x)dx$$

converge if the limit exists and is finite.

diverge if the limit does not exist (or goes to ± ∞ ).

EX 1 $\int_{-\infty}^{2} e^{x}dx$

EX 2 $\int_1^\infty \frac{1}{\sqrt{\pi x}}\,dx$

EX 3 $\int_1^\infty \frac{x}{(1+x^2)^2}\,dx$

**Definition** If $\int_{-\infty}^0 f(x)dx$ and $\int_0^\infty f(x)dx$ converge,

then $\int_{-\infty}^\infty f(x)dx$ converges and

$$\int_{-\infty}^\infty f(x)dx = \int_{-\infty}^0 f(x)dx + \int_0^\infty f(x)dx$$

otherwise, $\int_{-\infty}^\infty f(x)dx$ diverges.

EX 4 $\int_1^\infty \frac{1}{x^p}\,dx$

EX 5 $\int_{-\infty}^{\infty} \frac{dx}{(x^2 + 16)}$

EX 6 $\int_{-\infty}^{\infty} \frac{x}{\sqrt{x^2 + 16}} dx$