Rules and laws for Calculus I

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1 Differential equations

$\int u'v = uv - \int uv'$

1.1 Linear

1.1.1 First order

$y_* = e^{-\int p(x)dx} \int f(x) e^{\int p(x)dx}$

1.1.2 Second order

$y'' + ay' + by = 0$
y to remain similar after derivation
(ex. $y = C^{kx}, y' = kC^{kx}$)
convert into $k^2 + ak + b = 0$

$y = C_1 e^{k_1 x} + C_2 e^{k_2 x}$ if $k_1 \neq k_2$
$y = (C_1 + C_2 x) e^{-\frac{a}{2}x}$ if $k_1 = k_2$
$y = e^{\alpha x}(C_1 \cos \beta x + C_2 \sin \beta x)$ if $k = \alpha \pm \beta i$