Formula Sheet. TMA4130/35 Matematikk 4N/D, Autumn 2022.

List of Fourier Transforms.

$f(x)$	$\hat{f}(\omega)$
e^{-ax^2}	$\frac{1}{\sqrt{2a}} e^{-\frac{\omega^2}{4a}}$
$e^{-a\lvert x\rvert}$	$\sqrt{\frac{2}{\pi}} \frac{a}{\omega^2 + a^2}$
$\frac{1}{x^2 + a^2}$ for $a > 0$	$\sqrt{\frac{\pi}{2}} \frac{e^{-a\lvert\omega\rvert}}{a}$
$\begin{cases} 1 & \text{for } \lvert x\rvert < a \\ 0 & \text{otherwise} \end{cases}$	$\sqrt{\frac{2}{\pi}} \frac{\sin(\omega a)}{\omega}$
$\sqrt{\frac{2}{\pi}} \frac{\sin(ax)}{x}$	$\begin{cases} 1 & \text{for } \lvert\omega\rvert < a \\ 0 & \text{otherwise} \end{cases}$

List of Laplace Transforms.

$f(t)$	$F(s)$
$\cos(\omega t)$	$\frac{s}{s^2 + \omega^2}$
$\sin(\omega t)$	$\frac{\omega}{s^2 + \omega^2}$
$\cosh(\omega t)$	$\frac{s}{s^2 - \omega^2}$
$\sinh(\omega t)$	$\frac{\omega}{s^2 - \omega^2}$
t^n	$\frac{n!}{s^{n+1}}$
e^{at}	$\frac{1}{s - a}$
$f(t-a)u(t-a)$	$e^{-sa}F(s)$
$\delta(t-a)$	e^{-sa}

Trigonometric identities.

- $\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$
- $\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$
- $\sin\alpha\cos\beta = \frac{1}{2}\big(\sin(\alpha - \beta) + \sin(\alpha + \beta)\big)$
- $\cos(2\alpha) = 2\cos^2(\alpha) - 1 = 1 - 2\sin^2(\alpha)$
- $2\sin\alpha\cos\beta = \sin(\alpha + \beta) + \sin(\alpha - \beta)$
- $2\cos\alpha\sin\beta = \sin(\alpha + \beta) - \sin(\alpha - \beta)$
- $2\cos\alpha\cos\beta = \cos(\alpha - \beta) + \cos(\alpha + \beta)$
- $2\sin\alpha\sin\beta = \cos(\alpha - \beta) - \cos(\alpha + \beta)$

Integrals.

- $\int x^n \cos ax \, dx = \frac{1}{a}x^n \sin ax - \frac{n}{a}\int x^{n-1} \sin ax \, dx$
- $\int x^n \sin ax \, dx = -\frac{1}{a}x^n \cos ax + \frac{n}{a}\int x^{n-1} \cos ax \, dx$

Order conditions for Runge-Kutta methods

p	Conditions	p	Conditions
1	$\sum_{i=1}^{s} b_i = 1$	4	$\sum_{i=1}^{s} b_i {c_i}^3 = \frac{1}{4}$
2	$\sum_{i=1}^{s} b_i c_i = \frac{1}{2}$		$\sum_{i=1}^{s}\sum_{j=1}^{s} b_i c_i a_{ij} c_j = \frac{1}{8}$
3	$\sum_{i=1}^{s} b_i {c_i}^2 = \frac{1}{3}$		$\sum_{i=1}^{s}\sum_{j=1}^{s} b_i a_{ij} {c_j}^2 = \frac{1}{12}$
	$\sum_{i=1}^{s}\sum_{j=1}^{s} b_i a_{ij} c_j = \frac{1}{6}$		$\sum_{i=1}^{s}\sum_{j=1}^{s}\sum_{k=1}^{s} b_i a_{ij} a_{jk} c_k = \frac{1}{24}$