Math 252: Formula Sheet for Tests and Final Exam

$$\int \tan x\,dx = \ln|\sec x| + C \qquad \int \cot x\,dx = -\ln|\csc x| + C$$

$$\int \sec x\,dx = \ln|\sec x + \tan x| + C \qquad \int \csc x\,dx = -\ln|\csc x + \cot x| + C$$

$$\int \sec^2 x\,dx = \tan x + C \qquad \int \csc^2 x\,dx = -\cot x + C$$

$$\int \sec x\,\tan x\,dx = \sec x + C \qquad \int \csc x\,\cot x\,dx = -\csc x + C$$

$$\int \frac{dx}{\sqrt{a^2 - x^2}} = \arcsin\left(\frac{x}{a}\right) + C \qquad \int \frac{dx}{a^2 + x^2} = \frac{1}{a}\arctan\left(\frac{x}{a}\right) + C$$

$$\sin^2\theta + \cos^2\theta = 1 \qquad 1 + \tan^2\theta = \sec^2\theta \qquad 1 + \cot^2\theta = \csc^2\theta$$

$$\cos^2\theta = \frac{1 + \cos 2\theta}{2} \qquad \sin^2\theta = \frac{1 - \cos 2\theta}{2} \qquad \sin 2\theta = 2\sin\theta\cos\theta$$

$$\sin(A \pm B) = \sin A\cos B \pm \cos A\sin B$$

$$\cos(A \pm B) = \cos A\cos B \mp \sin A\sin B$$

$$e^{\int P(x)\,dx} \qquad y = vx \qquad u = y^{1-n} \qquad e^{\int \frac{M_y - N_x}{N}\,dx} \qquad e^{\int \frac{N_x - M_y}{M}\,dy}$$

$$y_2 = y_1 \int \frac{e^{-\int P(x)\,dx}}{y_1^2}\,dx$$

$$y = e^{\alpha x}\left(c_1\cos(\beta x) + c_2\sin(\beta x)\right)$$

$$y = x^{\alpha}\left(c_1\cos(\beta\ln x) + c_2\sin(\beta\ln x)\right)$$

$$y_p = u_1y_1 + u_2y_2, \quad u_1 = \int \frac{W_1}{W}\,dx, \quad W_1 = \begin{vmatrix} 0 & y_2 \\ f(x) & y_2' \end{vmatrix}$$

$$mx''(t) + \beta x'(t) + kx(t) = F_e(t)$$

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots, \quad \cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \cdots, \quad e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

$$\mathbf{X}(t) = c_1\mathbf{K}_1e^{\lambda_1 t} + c_2\mathbf{K}_2e^{\lambda_2 t}$$

$$\mathbf{X}(t) = c_1\mathbf{K}e^{\lambda t} + c_2\left(\mathbf{K}t + \mathbf{P}\right)e^{\lambda t}$$

$$\mathbf{X}(t) = c_1\,e^{\alpha t}\left[\mathbf{B}_1\cos(\beta t) - \mathbf{B}_2\sin(\beta t)\right] + c_2\,e^{\alpha t}\left[\mathbf{B}_2\cos(\beta t) + \mathbf{B}_1\sin(\beta t)\right]$$

$$\mathbf{X}_p(t) = \Phi(t)\int \Phi^{-1}(t)\mathbf{F}(t)\,dt$$

Last modified on January 13, 2020 by Patricia Wrean.

Table of Laplace Transforms

$$\mathscr{L}\{f(t)\} = \int_0^\infty e^{-st} f(t)\,dt = F(s)$$

$f(t)$	$\mathscr{L}\{f(t)\} = F(s)$
1	$\frac{1}{s}$
t^n	$\frac{n!}{s^{n+1}}$
$\sin\omega t$	$\frac{\omega}{s^2+\omega^2}$
$e^{at}\sin\omega t$	$\frac{\omega}{(s-a)^2+\omega^2}$
$t\sin\omega t$	$\frac{2\omega s}{(s^2+\omega^2)^2}$
$\frac{\sin\omega t - \omega t\cos\omega t}{2\omega^3}$	$\frac{1}{(s^2+\omega^2)^2}$
$\delta(t)$	1

$f(t)$	$\mathscr{L}\{f(t)\} = F(s)$
e^{at}	$\frac{1}{s-a}$
$\frac{e^{at}t^n}{n!}$	$\frac{1}{(s-a)^{n+1}}$
$\cos\omega t$	$\frac{s}{s^2+\omega^2}$
$e^{at}\cos\omega t$	$\frac{s-a}{(s-a)^2+\omega^2}$
$t\cos\omega t$	$\frac{s^2-\omega^2}{(s^2+\omega^2)^2}$
$\mathcal{U}(t-a)$	$\frac{e^{-as}}{s}$
$\delta(t-a)$	e^{-as}

$$\mathscr{L}\{\alpha f(t) + \beta g(t)\} = \alpha\mathscr{L}\{f(t)\} + \beta\mathscr{L}\{g(t)\}$$

$$\mathscr{L}\{e^{at}f(t)\} = F(s-a) \qquad \mathscr{L}\{t^n f(t)\} = (-1)^n \frac{d^n}{ds^n}F(s)$$

$$\mathscr{L}^{-1}\{e^{-as}F(s)\} = f(t-a)\,\mathcal{U}(t-a) \qquad \mathscr{L}\{f(t)\,\mathcal{U}(t-a)\} = e^{-as}\mathscr{L}\{f(t+a)\}$$

$$\mathscr{L}\{f'(t)\} = sF(s) - f(0) \qquad \mathscr{L}\{f''(t)\} = s^2F(s) - sf(0) - f'(0)$$

$$\mathscr{L}\{f^{(n)}(t)\} = s^nF(s) - s^{n-1}f(0) - \cdots - f^{(n-1)}(0)$$

$$f(t) * g(t) = \int_0^t f(\theta)g(t-\theta)\,d\theta \implies \mathscr{L}\{f(t) * g(t)\} = F(s)G(s)$$

$$\mathscr{L}\left\{\int_0^t f(\theta)\,d\theta\right\} = \frac{F(s)}{s}$$

$$f(t) \text{ has period } T \implies \mathscr{L}\{f(t)\} = \frac{1}{1-e^{-sT}}\int_0^T e^{-st}f(t)\,dt$$