CALC 203

TEST 2 FORMULA SHEET

- Assume *u* & *v* are the functions of *x*.

***Differentiation*:**

$$\frac{d}{dx}\left[cu^n\right]=cnu^{n-1}\cdot u' \quad \frac{d}{dx}\left[\ln u\right]=\frac{u'}{u} \quad \frac{d}{dx}\left[\log_b u\right]=\frac{u'}{u\ln b} \quad \frac{d}{dx}\left[e^u\right]=e^u\cdot u' \quad \frac{d}{dx}\left[b^u\right]=b^u\cdot\ln b\cdot u'$$

$$\frac{d}{dx}\left[\sin u\right]=\cos u\cdot u' \quad \frac{d}{dx}\left[\cos u\right]=-\sin u\cdot u' \quad \frac{d}{dx}\left[\tan u\right]=\sec^2 u\cdot u' \quad \frac{d}{dx}\left[\cot u\right]=-\csc^2 u\cdot u'$$

$$\frac{d}{dx}\left[\sec u\right]=\sec u\tan u\cdot u' \quad \frac{d}{dx}\left[\csc u\right]=-\csc u\cot u\cdot u' \quad \frac{d}{dx}\left[uv\right]=u'v+uv' \quad \frac{d}{dx}\left[\frac{u}{v}\right]=\frac{u'v-uv'}{v^2}$$

***Integration*:**

$$\int u^n du=\frac{u^{n+1}}{n+1}+C\ (n\neq -1) \quad \int\frac{1}{u}\,du=\ln|u|+C \quad \int e^u du=e^u+C$$

$$\int \sin u\ du=-\cos u+C \quad \int \cos u\ du=\sin u+C \quad \int \tan u\ du=-\ln|\cos u|+C$$

$$\int \cot u\ du=\ln|\sin u|+C \quad \int \sec u\ du=\ln|\sec u+\tan u|+C \quad \int \csc u\ du=\ln|\csc u-\cot u|+C$$

$$\int \sin^2 u\ du=\frac{u}{2}-\frac{\sin 2u}{4}+C \quad \int \cos^2 u\ du=\frac{u}{2}+\frac{\sin 2u}{4}+C \quad \int \tan^2 u\ du=\tan u-u+C$$

$$\int \cot^2 u\ du=-\cot u-u+C \quad \int \sec^2 u\ du=\tan u+C \quad \int \csc^2 u\ du=-\cot u+C$$

Solutions to homogeneous second-order equations, $ay''+by'+cy=0$**.**

The auxiliary equation has the form of $am^2+bm+c=0$

Roots of Auxiliary Equation	Solution to $ay''+by'+cy=0$
Real and Unequal (two real roots m_1 and m_2)	$y=c_1e^{m_1x}+c_2e^{m_2x}$
Real and Equal (double root *m*)	$y=c_1e^{mx}+c_2xe^{mx}$
Non Real (complex roots $A\pm jB$)	$y=e^{Ax}(c_1\cos Bx+c_2\sin Bx)$

Laplace Transform Number	$f(t)$	$\mathcal{L}[f(t)] = F(s)$
1	$y = f(t)$	$F(s) = \int_0^\infty e^{-st} f(t)dt$
2	y'	$s\mathcal{L}[y] - y(0)$
3	y''	$s^2\mathcal{L}[y] - sy(0) - y'(0)$
4	$a\,g(t) + b\,h(t) + \cdots$	$a\mathcal{L}[g(t)] + b\,\mathcal{L}[h(t)] + \cdots$
5	1	$\frac{1}{s}$
6	t	$\frac{1}{s^2}$
7	t^n	$\frac{n!}{s^{n+1}}$
8	$\frac{t^{n-1}}{(n-1)!}$	$\frac{1}{s^n}$
9	e^{at}	$\frac{1}{s-a}$
10	$1 - e^{-at}$	$\frac{a}{s(s+a)}$
11	te^{at}	$\frac{1}{(s-a)^2}$
12	$e^{at}(1+at)$	$\frac{s}{(s-a)^2}$
13	$t^n e^{at}$	$\frac{n!}{(s-a)^{n+1}}$
14	$t^{n-1}e^{-at}$	$\frac{(n-1)!}{(s+a)^n}$
15	$e^{-at} - e^{-bt}$	$\frac{b-a}{(s+a)(s+b)}$
16	$ae^{-at} - be^{-bt}$	$\frac{s(a-b)}{(s+a)(s+b)}$
17	$\sin at$	$\frac{a}{s^2+a^2}$
18	$\cos at$	$\frac{s}{s^2+a^2}$
19	$t\sin at$	$\frac{2as}{(s^2+a^2)^2}$
20	$t\cos at$	$\frac{s^2-a^2}{(s^2+a^2)^2}$
21	$1 - \cos at$	$\frac{a^2}{s(s^2+a^2)}$
22	$at - \sin at$	$\frac{a^3}{s^2(s^2+a^2)}$
23	$e^{-at}\sin bt$	$\frac{b}{(s+a)^2+b^2}$
24	$e^{-at}\cos bt$	$\frac{s+a}{(s+a)^2+b^2}$
25	$\sin at - at\cos at$	$\frac{2a^3}{(s^2+a^2)^2}$
26	$\sin at + at\cos at$	$\frac{2as^2}{(s^2+a^2)^2}$
27	$\cos at - \frac{1}{2}at\sin at$	$\frac{s^3}{(s^2+a^2)^2}$
28	$\frac{b}{a^2}(e^{-at} + at - 1)$	$\frac{b}{s^2(s+a)}$