

Name: _____

VIP ID: _____

- Write your name and your VIP ID in the space provided above.
- The test has six (6) pages, including this one.
- Show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.
- Credit for each problem is given at the right of each problem number.
- There is an extra-credit problem on the last page, together with a table of Laplace Transforms. Points obtained in the extra-credit problem will be added to the score of exam #1.

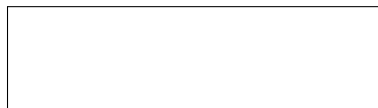
Page	Max	Points
2	40	
3	20	
4	20	
5	20	
Total	100	

$$F(s) = \begin{cases} \frac{1}{s} & (s > 0) \\ 0 & (s < 0) \end{cases}$$

Problem 3 (20 pts). Use the definition of the Laplace transform to find that

$$\mathcal{L}\{5 \cos 2x\} = \frac{5s}{s^2 + 4} \text{ for } s > 0.$$

Problem 4 (20 pts). Use techniques based on the Laplace transform to solve the initial value problem $y'' + y' - 2y = e^x$ that satisfies $y(0) = 0, y'(0) = \frac{4}{3}$. Compute the numerical value of all relevant constants.



$f(x)$	$\mathcal{L}\{f\} = \int_0^\infty e^{-sx} f(x) dx$		
1	$\frac{1}{s} \quad s > 0$	$cf(x) \pm g(x)$	$cF(s) \pm G(s) \quad s > \max(a, b)$
x^n	$\frac{n!}{s^{n+1}} \quad s > 0$	$e^{\alpha x} f(x)$	$F(s - \alpha) \quad s > a + \alpha$
$e^{\alpha x}$	$\frac{1}{s - \alpha} \quad s > \alpha$	$x^n f(x)$	$(-1)^n F^{(n)}(s) \quad s > a$
$\sin \beta x$	$\frac{\beta}{s^2 + \beta^2} \quad s > 0$	$f'(x)$	$sF(s) - f(0)$
$\cos \beta x$	$\frac{s}{s^2 + \beta^2} \quad s > 0$	$f''(x)$	$s^2 F(s) - sf(0) - f'(0)$

Problem 5 (20 pts—extra credit for exam #1). Solve the previous problem using either the method of *variation of parameters*, or *undetermined coefficients*. Do compute the value of all relevant constants.