Name: _____

VIP ID: _____

- Write your name and your VIP ID in the space provided above.

- The test has five (5) pages, including this one and the table of Laplace transforms at the end.

- 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.

- No books, notes or calculators may be used on this test.

Page	Max	Points
2	60	
3	20	
4	20	
Total	100	

Problem 1 (60 pts—10 pts each). Find the Laplace transform of the following functions:

(a) $f(x) = 3x^2 - 4x + 7$

$$F(s) = \boxed{}$$
$$(s > \quad)$$

(b) $f(x) = x^3 - x^{3/2}$

$$F(s) = \boxed{}$$
$$(s > \quad)$$

(c) $f(x) = 2e^{3x} - 8e^{-7x} + \cos(\pi x)$

$$F(s) = \boxed{}$$
$$(s > \quad)$$

(d) $f(x) = 3x^2 \sin(5x)$

$$F(s) = \boxed{}$$
$$(s > \quad)$$

(e) $f(x) = 6xe^{-x} \sin x$

$$F(s) = \boxed{}$$
$$(s > \quad)$$

(f) $f(x) = \sin x \cos x$

$$F(s) = \boxed{}$$
$$(s > \quad)$$

Problem 2 (20 pts—10 pts each). Find the inverse Laplace transform of the following functions in the given domains.
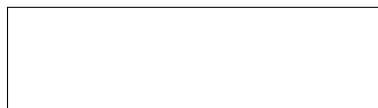
(a) $F(s) = \dfrac{2s - 3}{s^2 - 2s - 15}, \ (s > 5)$

$$f(x) = \boxed{}$$

(b) $F(s) = \dfrac{s - 3}{(s - 3)^2 + 16}, \ (s > 3)$

$$f(x) = \boxed{}$$

Problem 3 (20 pts). Use techniques based on the Laplace transform to solve the initial value problem $y'' + 3y' + 2y = x$ that satisfies $y(0) = 0, y'(0) = 2$.

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

You may use this as scratch paper. Do not detach from the rest of the test