Quiz **9**   **Differential Equations**

Name: _____

                                                             Friday April 8
Time Begun: _____   Ron Buckmire
Time Ended: _____

Topic : Laplace Transforms

The idea behind this quiz is to provide you with an opportunity to illustrate your ability to use Laplace Transforms.

Reality Check:

EXPECTED SCORE : _____/**10**   ACTUAL SCORE : _____/**10**

Instructions:

0. Please look for a hint on the course website at `http://faculty.oxy.edu/ron/math/341/` in the News section.

1. Once you open the quiz, you have **30 minutes** to complete it, please record your start time and end time at the top of this sheet.

2. You may use the book or any of your class notes. **You must work alone.**

3. If you use your own paper, please staple it to the quiz before coming to class. If you don't have a stapler, buy one.

4. After completing the quiz, sign the pledge below stating on your honor that you have adhered to these rules.

5. Your solutions must have enough details such that an impartial observer can read your work and determine HOW you came up with your solution.

6. Relax and enjoy...

7. **This quiz is due on Monday April 11**, in class. NO LATE QUIZZES WILL BE AC-CEPTED.

Pledge: I, _____, pledge my honor as a human being and Occidental student, that I have followed all the rules above to the letter and in spirit.

1. We're interested in finding the function $f(t)$ whose Laplace Transform is

$$F(s) = A(s) - B(s) = \frac{1}{s^2} - \frac{e^{-s}}{s(1 - e^{-s})}, \quad s > 0$$

(a) *2 points.* Compute $\mathcal{L}^{-1}\left[\dfrac{1}{s^2}\right] = a(t)$

(b) *2 points.* If one considers $\dfrac{1}{1 - e^{-s}}$ as the sum of a geometric series with first term $a = 1$ and ratio $r = e^{-s}$ then show that $\dfrac{e^{-s}}{s(1 - e^{-s})}$ can be written as $\displaystyle\sum_{k=1}^{\infty} \frac{e^{-ks}}{s} = \frac{e^{-s}}{s} + \frac{e^{-2s}}{s} + \frac{e^{-3s}}{s} + \ldots$

(c) *3 points.* Recall that $\mathcal{L}^{-1}\left[e^{-as}F(s)\right] = f(t - a)\mathcal{H}(t - a)$. Compute $\mathcal{L}^{-1}\left[\dfrac{e^{-s}}{s(1 - e^{-s})}\right] = b(t)$

(d) *3 points.* Give a sketch of $a(t)$, $b(t)$ and $f(t) = a(t) - b(t)$ below for $t > 0$.