

**Answer keys to Final Exam, Math 250, Fall 2004**

Multiple Choices:

Problem	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Answer	b	c	d	d	d	d	c	b	c	b

Partial Credit problems:

**Problem 11.**  $y(t) = t^{-4}(e^{-1} - e^{-t})$

**Problem 12.** (a).  $\frac{2(1 - e^{-2s})}{s^2} - \frac{4e^{-2s}}{s} + \frac{e^{2-2s}}{s-1}$

(b).  $t - \sin t + \frac{1}{2}u_2(t)(e^{t-2} - e^{-t+2}) + e^{-t} \cos t$  or equivalently  
 $t - \sin t + u_2(t) \sinh(t-2) + e^{-t} \cos t.$

**Problem 13.** (a).  $y(t) = C_1 e^{3t} \begin{pmatrix} 1 \\ 1 \end{pmatrix} + C_2 e^{-5t} \begin{pmatrix} 1 \\ -3 \end{pmatrix}.$

(b). saddle point, unstable.

**Problem 14.**  $y(t) = u_2(t) \left( -\frac{8}{15} + \frac{1}{5}e^{5(t-2)} + \frac{1}{3}e^{-3(t-2)} \right).$

**Problem 15.** (a).  $ct^{-2}.$

(b).  $y_2 = t^{-4}.$

**Problem 16.** (a).  $x_1'' - 3x_1 = 0, x_1(0) = 1, x_1'(0) = 5.$

(b). The system is:

$$\begin{cases} x_1' = x_2 \\ x_2' = -4x_1 + 4x_2 + e^t \end{cases}, \quad \begin{cases} x_1(0) = 1 \\ x_2(0) = 0 \end{cases}.$$