

## Spring, 1999 – Final Exam Answers

1. (a)  $y(x) = \frac{1}{4}x^2 - \frac{1}{3}x + \frac{1}{2} + \frac{1}{3x^2}$

(b)  $y(x) = \frac{1}{1 - 2x - \frac{1}{2}x^2}$

2.  $y(x) = c_1x^2 + c_2x^2 \ln x + \frac{1}{2}x^2 \ln^2 x$

3.  $y(x) = c_1e^x + c_2xe^x + 3 + \frac{1}{2}x^2e^x + \cos x$

4.  $\lambda = 1 + n^2\pi^2$ ,  $y(x) = Ce^{-x} \sin n\pi x$  where  $n = \pm 1, \pm 2, \dots$

5. (a)  $\frac{4}{(s+3)^2 + 16} + \frac{s}{(s+4)^3} + \frac{4}{(s+4)^2} + \frac{4}{s+4}$

(b)  $e^{-2t} - 2te^{-2t} + 3e^{-3t} \cos 4t + e^{-3t} \sin 4t$

6.  $Y(s) = \frac{5 + e^{-4s}(3e^4 \cos 4 - 8)}{s^2 + 2}$ ,  $X(s) = sY(s) + \frac{8e^{-4s}}{s}$

7. (a)  $X''(x) - KX(x) = 0$ ,  $X(0) = 0 = X(8)$ ;  $T''(t) - 3KT(t) = 0$

(b)  $v(x) = 3e^x + 27 + \frac{43 - 3e^8}{8}x$

8. (a)  $f(x) = 2 + \sum_{k=1}^{\infty} \frac{8}{(2k-1)\pi} (-1)^{k+1} \cos nx$

