

Mid Semester Exam #2

Math 3350: Higher Mathematics for Engineers and Scientists I

Fall 09 - Section 012

- Time allowed: 1 hour 20 minutes.
 - This is an open book exam.
 - Answer all questions.
 - Show all the necessary work to earn full credit.
 - Answers written on the test paper will not be graded.
 - Please print your name on the first page of your answer scripts.
 - Write your name on all the pages
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(1) (a) Using the method of completing the square show that

$$\mathcal{L}^{-1} \left[\frac{3s + 4}{s^2 + 2s + 2} \right] = e^{-t} (3 \cos t + \sin t).$$

(b) Recall that if $\mathcal{L}[f(t)] = F(s)$, then $\mathcal{L}[tf(t)] = -\frac{dF(s)}{ds}$. Use this result to show that

$$\mathcal{L}[te^{-t}(3 \cos t + \sin t)] = \frac{3s^2 + 8s + 2}{(s^2 + 2s + 2)^2}.$$

(2) Solve for $y(t)$, where $\ddot{y}(t) + 5\dot{y}(t) + 6y(t) = 6 + 2e^{-t}$; $y(0) = \dot{y}(0) = 0$.

(3) Consider

$$\ddot{y}(t) + ay(t) + by(t) = f(t); \quad y(0) = y_0, \quad \dot{y}(0) = v_0,$$

where a , b , y_0 , and v_0 are unknown constants.

For $f(t) = e^{-2t}$, $y(t)$ was recorded as

$$y(t) = 3e^{-2t} + 2e^{-t} + e^{-5t}.$$

- (a) Calculate a , b , y_0 , and v_0 from this data if possible.
 - (b) For $f(t) = \sin t$, what should be the corresponding $y(t)$?
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