

Homework 2

Due February 10

Part 1: Consider the initial value problems:

$$(1) \begin{cases} y'' + 4y = \sin 2t \\ y(0) = 1, \quad y'(0) = 2. \end{cases}, \quad (2) \begin{cases} z'' + 4z = 3t - 2 \\ z(\pi) = 1 - \pi/4, \quad z'(\pi) = 2. \end{cases}$$

- (5 points) Solve the initial problem (1) by using the method of undetermined coefficients, and the initial value problem (2) by variation of parameters.
- (5 points) Plot in Maple the graph of the function:

$$f(t) = \begin{cases} y(t), & 0 \leq t \leq \pi \\ z(t), & \pi \leq t \leq 2\pi. \end{cases}$$

where y and z are the solutions to the above IVPs. Give a physical interpretation for the function f . (*Hint:* Think of the equation for a harmonic oscillator.)

Part 2:

- (2 points) Mensa is an international society whose membership is limited to persons having IQs above the general population's 98th percentile. It is well known that the average IQ for the general population is 100, the standard deviation is 16, and the distribution, itself, is normal. What, then, is the *lowest* IQ that will qualify a person to belong to Mensa?
- (3 points) A cohort of hemophiliacs is followed to elicit information on the distribution of time to onset of AIDS following ser-conversion (referred to as *latency time*). All patients who seroconvert become symptomatic within 10 years, according to the following distribution:

Latency time (years)	Number of patients
0	2
1	6
2	9
3	33
4	49
5	66
6	52
7	37
8	18
9	11
10	4.

Assuming an underlying normal distribution, compute 95 % confidence intervals for the mean and variance of the latency times. Still assuming normality, estimate the probability p that a patients's latency time will be at least 8 years.