# 6.055J/2.038J (Spring 2010)

# Homework 6

*Submit your answers and explanations online by **10pm on Wednesday, 14 Apr 2010**.*

***Open universe:*** *Collaboration, notes, and other sources of information are **encouraged.** However, avoid looking up answers to the problem, or to subproblems, until you solve the problem or have tried hard. This policy helps you learn the most from the problems.*

*Homework is graded with a light touch: P (made a decent effort), D (made an indecent effort), or F (did not make an effort).*

**Problem 1 Guessing an integral using easy cases**

Use easy cases to choose the correct value of the integral

$$\int_{-\infty}^{\infty} e^{-\alpha x^2}\,dx. \qquad (1)$$

☐ $\sqrt{\pi\alpha}$

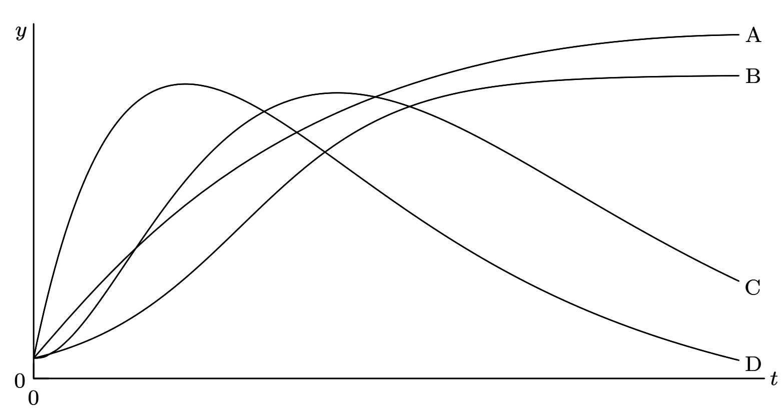
☐ $\sqrt{\pi/\alpha}$

**Problem 2 Differential-equation solution**

Which sketch shows a solution of the differential equation

$$\frac{dy}{dt} = Ay(M-y),$$

where $A$ and $M$ are positive constants?




☐ Curve A

☐ Curve B

☐ Curve C

☐ Curve D

Comments on page 1

Here is the next homework on NB in case you would like to collaborate using NB. Have fun!

**Problem 6 Debugging**

Use special (i.e. easy) cases of $n$ to decide which of these two C functions correctly computes the sum of the first $n$ odd numbers:

☐ Program A:

```
int sum_of_odds (int n) {
  int i, total = 0;
  for (i=1; i<=2*n+1; i+=2)
    total += i;
  return total;
}
```

☐ Program B:

```
int sum_of_odds (int n) {
  int i, total = 0;
  for (i=1; i<=2*n-1; i+=2)
    total += i;
  return total;
}
```

**Problem 7 Damped, driven spring**

A damped, driven spring–mass system (e.g., in 18.03, 2.003, 2.004, 6.003, and maybe also 8.01) is described by the differential equation

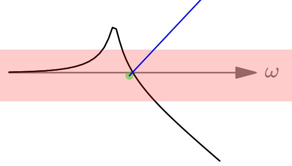
$$m\frac{d^2x}{dt^2} + b\frac{dx}{dt} + kx = F_0 e^{i\omega t}, \tag{3}$$

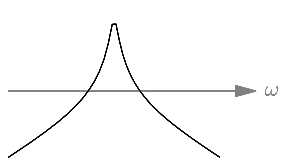
where $m$ is the mass of the object, $b$ is the damping constant, $k$ is the spring constant, $x$ is the displacement of the mass, $\omega$ is the (angular) frequency of the driving force, and $F_0$ is the amplitude of the driving force. The solution has the form

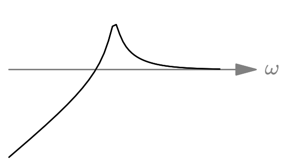
$$x = x_0 e^{i\omega t}, \tag{4}$$

where $x_0$ is the (possibly complex) amplitude.

Which graph, on log–log axes, correctly shows the transfer function $F_0/x_0$? Don't solve the differential equation – use an approximation method to guess the answer!

☐ Curve A 


☐ Curve B 


☐ Curve C 




**How did you forget 8.03!?**

I know! "And maybe also 8.01", psh.

**F/x is the y axis, what is the x-axis?**

omega or frequency

omega (oscillation frequency)

**I have not clue. I can't wait to read the answer on this one though**