Solutions to Attendance Quiz # 1 for Dr. Z.'s Calc4 for Sept. 5, 2013

1. Verify that $y(t) = e^t + t$ is a solution of the initial value differential equation

$$y'' - y' = 0 \quad , \quad y(0) = 1 \quad , \quad y'(0) = 2 \quad .$$

Sol. to 1: $y(t) = e^t + t$. So $y'(t) = e^t + 1$, and $y''(t) = e^t$. So

$$y''(t) - y'(t) = e^t - (e^t + 1) = -1 \quad .$$

So this is **NOT** a solution. Once the proposed solution failed to be a solution it is not necessary to check the initial conditions. (you only check them if it passed the diff.eq. test!).

Comment: This was an (unintentional) trick question. A fairer wording would have been "Check whether ..." instead of "Verify". However it still makes sense. I am glad that more than %70 of the students got it right.

2. For each of of the following diff.eq. state whether there are linear or non-linear, and find the order.

a. $y^{(5)}(t) + 6ty''(t) + (\cos t^2)\, y(t) = 7 \quad ,$

Sol. to 2a: The highest order that shows up is fifth. So this is a **fifth order** diff. eq. (most people got this right). It is **linear** since all the derivatives, and the function itself, are by themselves, and none of them is raised to a power. About half of the people got confused and said that it is non-linear. Note that the **coefficients**, $6t$, and $\cos t^2$ are complicated functions of t but they do not change the fact that the diff.eq. is linear.

b. $y^{(100)}(t) + y''(t)y'(t) + y(t) = 6 \quad .$

Sol. to 2b: The highest order that shows up is 100, so the order is 100. Since $y''(t)$ and $y'(t)$ gets mutiplied by each other, it is **non-linear**.

(About %85 of the people got it right).