

Quiz 0

Name: \_\_\_\_\_

ID: \_\_\_\_\_

Prerequisite of PHYS 3305 is PHYS 1304, 1303. Knowledge of mathematics up to MATH 1338 is needed to understand the discussions in the class.

This quiz will help you to check whether you are ready for this course. The result of this quiz will not go into your grade of PHYS 3305.

1. Solve the following equations for variables  $x$ ,  $y$  and  $z$ .

$$3x+3y+4z=0$$

$$x-y+2z=3$$

$$3x+y-4z=16$$

2. (a) When  $y=x^2+\sin 6x$ , What is  $\frac{dy}{dx}$ ? (b) solve this integral:  $U(R)=-\int_{\infty}^R \frac{dr}{r^2}$

3. Solve the equation for  $q$  as a function of  $t$ . Here  $R$  and  $C$  are constants. When  $t=0$ ,  $q=Q_0$ .

$$\frac{q}{C} + \frac{dq}{dt} R = 0$$

4. A bullet of mass  $m$ , speed  $v$ , flies horizontally into a wooden block of mass  $M$ , hanging at one end of a massless string with length  $l$ . The other end of the string is fixed in space. The setup is on the Earth's surface. The block is stationary before the bullet enters it. The bullet enters the block and stops inside the block. We assume that this process happens very quickly and after that the bullet and the wooden block move together. What is the speed of the two objects just after the bullet stops inside the block and what is the maximum displacement in height of the block?

5. A parallel capacitor has two large aluminum disks separated by a small distance  $d$ . The disks have the same radius  $r$ , which is much larger than  $d$ . We ignore the thickness of the disks. There is air between the two disks. Using Gauss's Law to deduce the formula for the capacitance of this device.
6. A capacitor with capacitance  $C$  is initially charged to a charge of  $Q$ . This capacitor is then connected to an inductor of inductance  $L$ . At this moment we start the time  $t$ . What is the maximum current in this circuit? Write the current in the circuit as a function of time.