Question 1

The equation for the charge in an RLC circuit is:

$$L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{1}{C}q = 0$$

Which of the following is the condition for damped oscillations?

1. Damped oscillations for any R
2. $R < 2\sqrt{\frac{1}{LC}}$
3. $R < 2\sqrt{\frac{L}{C}}$
4. $R > 2\sqrt{\frac{1}{LC}}$
5. $R > 2\sqrt{\frac{L}{C}}$

Question 2

The equation for a driven oscillator is

$$\frac{d^2x}{dt^2} + \omega_0^2 x = \frac{F_0}{m} \cos(\omega t).$$

Consider the candidate solution

$$x(t) = A\cos(\omega t - \delta).$$

Which of the following is/are true?

1. Any A is possible.
2. A must equal F_0/m.
3. A has only one value. This does not depend on ω and is not equal to F_0/m.
4. The value of A depends on ω.

Question 3

The equation for a driven oscillator is

$$\frac{d^2x}{dt^2} + \omega_0^2 x = \frac{F_0}{m} \cos(\omega t).$$

Consider the candidate solution

$$x(t) = A\cos(\omega' t - \delta).$$

Which of the following is true?

1. This provides a solution for any A and ω'.
2. This provides a solution for any A but only some values (more than one is possible) of ω'.
3. This provides a solution only for $\omega' = \omega$.