Question 1

Linearity

=> For an equation to be linear, none of the dependant terms are multiplied with one another or involved in any other functions such as sin, cos etc.

Advection

=> Advection is essentially a transport equation describing the bulk motion of a material. The most common form of the advection equation is:

$$u_t + cu_x = 0$$

Diffusion

=> The diffusion describes the random movement of particles (governed

by Brownian motion) from a region of high concentration to a region of low concentration. It is usually described by the equation

$$u_t = C u_{xx}$$

Now,

$$u_t - a(t) u_x - \epsilon u_{xx} = 0$$

$a(t) u_x$: advection term

$-\epsilon u_{xx}$: diffusion term