# CI - Differential Equations

|  |  |
| --- | --- |
| **What is separation of variables?** |  |
| **How is an exact first order differential equation solved?** | 1. Use the product rule in reverse. 2. Integrate both sides.     *May require some manipulation to get it into the form required.* |
| **How is the integrating factor used to solve 1st order linear differential equations?** | 1. Get the differential equation into the following form:      1. Find the integrating factor:      1. Multiply the equation in (1) by the integrating factor. 2. Use the product rule in reverse. 3. Integrate both sides.   **Example:**    *Nonlinear may be dy/dx = x2 + y2.* |
| **What is the general solution for a 2nd order differential equation made up of? Define both parts** | * General Solution = Complementary Function + Particular Integral. * GS = CF + PI * Complementary function - solution when 2nd order differential equations = 0. * Particular integral - particular solution for what it equals. |
| **What are the 3 possible complementary functions?** | Also shown below: |
| **What is a homogeneous differential equation?** | When it equals **ZERO**. |
| **What possible particular integrals can you have? How do these depend on the complementary function?** | *You need to ensure you don’t have the same constants on either side of the complementary function. Eg,*    *Or…* |
| **When does a body undergo SHM?** | *This is a requirement and gives the following solution:* |
| **How can you derive the standard results for SHM?** | *You can have 2 different values for x, it depends on when the clock starts ticking.* |
| **What is the form of a differential equation under damping? How does it link to the different types of damping?** | *Something in this form with k in front of dx/dt. The larger k is, the stronger resistance to motion.*  If the discriminant of the auxiliary equals is…   * > 0, heavy damping * = 0, critical damping   + Here, the amplitude reduces as fast as possible. * < 0, light damping. |