In preparation for Test 2, you should be able to:

- Understand and be able to show whether motion is oscillatory and exhibits simple harmonic motion–and be able to extract oscillation frequencies.

- Understand the conditions characteristic of non-linear motion; phase plots, Poincare sections, etc.

- Know what is meant by ‘attractor,’ 'limit cycles,' 'stable,' 'self-limiting,' etc.

- Be familiar with mappings of the form $x_{n+1} = f(\alpha, x_n)$, logistic mapping, bifurcation, etc.

- Be able to identify the characteristics of chaotic motion: sensitivity to initial conditions, Luapunov exponents, etc.

- Be comfortable working with gravitational potential: $g = -\nabla \Phi$ and $d\Phi = -G \frac{dM}{r}$. Be able to compute the gravitational potential for various mass distributions.

- Be able to use ‘Gauss’ law for gravitation’ to determine the gravitational potential for various mass arrangements.

- Understand the concept of field lines and equipotential surfaces.

- Appreciate the basic ideas behind tides and their causes.

- Understand how Euler’s equation arises from seeking the stationary value of an integral.

- Be able to implement Euler’s equation to solve problems involving minima and maxima–including cases when auxiliary conditions (constraints) are imposed.

- Understand how Hamilton’s principle is a special case extension of Euler’s equation and how it relates to Newton’s second law, i.e., the principle of least action.

- Know how/why the Lagrangian was introduced to analyse mechanical systems.

- Be able to select appropriate generalised coordinates and apply the Lagrangian approach to extract (and solve for) equations of motion.

- Be able to write down equations describing constraints on a system and be able to use the Lagrangian multiplier approach to obtain equations of motion.