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PH2201 – Intermediate Mechanics I
Study Guide 1

Readings

Topic	Book/section	Comments
Mathematics review	Kleppner 1.1-1.10 Morin 1.3	Vectors and derivatives of vectors
Coordinate systems	Kleppner 1.12-1.19 Morin 3.5 Taylor 1.2, 1.7	We will treat only linear motion and motion in a plane in this course We'll use θ for the polar angle (Taylor uses φ)
Newton's laws	Kleppner 2.1-2.6 Taylor 1.4-1.6 Morin 3.1	Study Kleppner examples 2.1, 2.3-2.10
Applying Newton's laws	Kleppner 2.9-2.10 Kleppner 3.1-3.5 Taylor 3.2-3.3 Morin 3.2-3.3	In Kleppner, study examples 3.1-3.3, 3.6

In applying Newton's 2nd law, the basic approach is always in two steps:

- draw a Free-Body- Diagram (FBD) for each part of a system
- apply Newton's 2nd law to each part

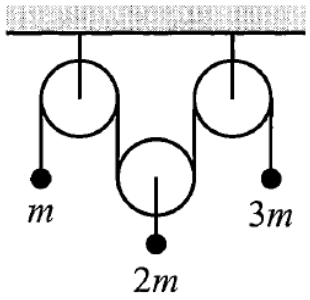
Practice Problems

Note: Here are some problems from Morin (on Reserve) that you can try to solve as a way of helping you to learn the material. The detailed solutions to these problems are given in Morin, and your solutions to these problems are **not to be turned in for grading**. In order to obtain the most benefit from these problems, it is strongly suggested that you give them a good try before looking at the solutions. You will likely find some of these problems to be quite difficult. Getting stuck on these problems is a good thing! It is only by getting stuck, and then finding out why you got stuck, that you really learn the material.

Morin chapter 3: problems 1, 2, 6, 9, 11, 21

Homework Problems

Homework set 1 is **due Thursday Sept. 3:**



1. Kleppner 2.8 (assume $M_1 \neq M_2$)
2. An Atwood's machine is constructed as shown, with masses m, $2m$, and $3m$. Determine the acceleration of each mass. Take the positive y axis pointed upward.
3. A person stands on a scale at the equator. If the earth somehow stopped spinning but kept its same shape, would the reading on the scale increase or decrease. What would be the fractional change (change in reading divided by initial reading)?
4. A bicycle wheel of radius R rolls at constant speed V on a flat surface without slipping. A bug on the ground gets stuck to the rim of the wheel at time $t = 0$. Derive an expression for the velocity and acceleration of the bug, with respect to the ground, in cartesian coordinates. Your answer should be in terms of R, V, and t.
5. A particle moves outward along a spiral. Its trajectory is given by $r = A\theta$, where $A = (1/\pi)$ m/rad is a constant. The angle θ increases in time according to $\theta = \frac{1}{2}\alpha t^2$, where α is a constant. (a) Sketch the motion, indicating the approximate velocity and acceleration at a few points. (b) Show that the radial acceleration is zero when $\theta = 1/\sqrt{2}$ rad. (c) At what angles do the radial and tangential accelerations have equal magnitude?
6. Kleppner 3.10 [Hint: this is not a hard problem, if you consider two FBDs – one for the entire rope, and the other for half the rope]