Announcements

1. Thanks
2. Course evaluations
3. Presentations

   Today at 4 PM and Tuesday 12/10/02 at 9 AM (need to finish before 11 AM)
4. Final exam

   Bring:

   Up to 4 equation sheets (8 ½ x 11 inches)

   Calculator

   Clear head

   Dates: Thursday 12/12/02 at 9 AM or Saturday 12/14/02 at 2 PM
5. Some parting words about waves
6. Review and study advice

Facts about waves

$$\frac{\partial^2 y}{\partial t^2} = v^2 \frac{\partial^2 y}{\partial x^2} \qquad y(x,t) \text{ describes wave as a function of } x \text{ and } t.$$

Traveling waves

Pulse – $y(x,t) = y_0 e^{-(x-vt)^2}$

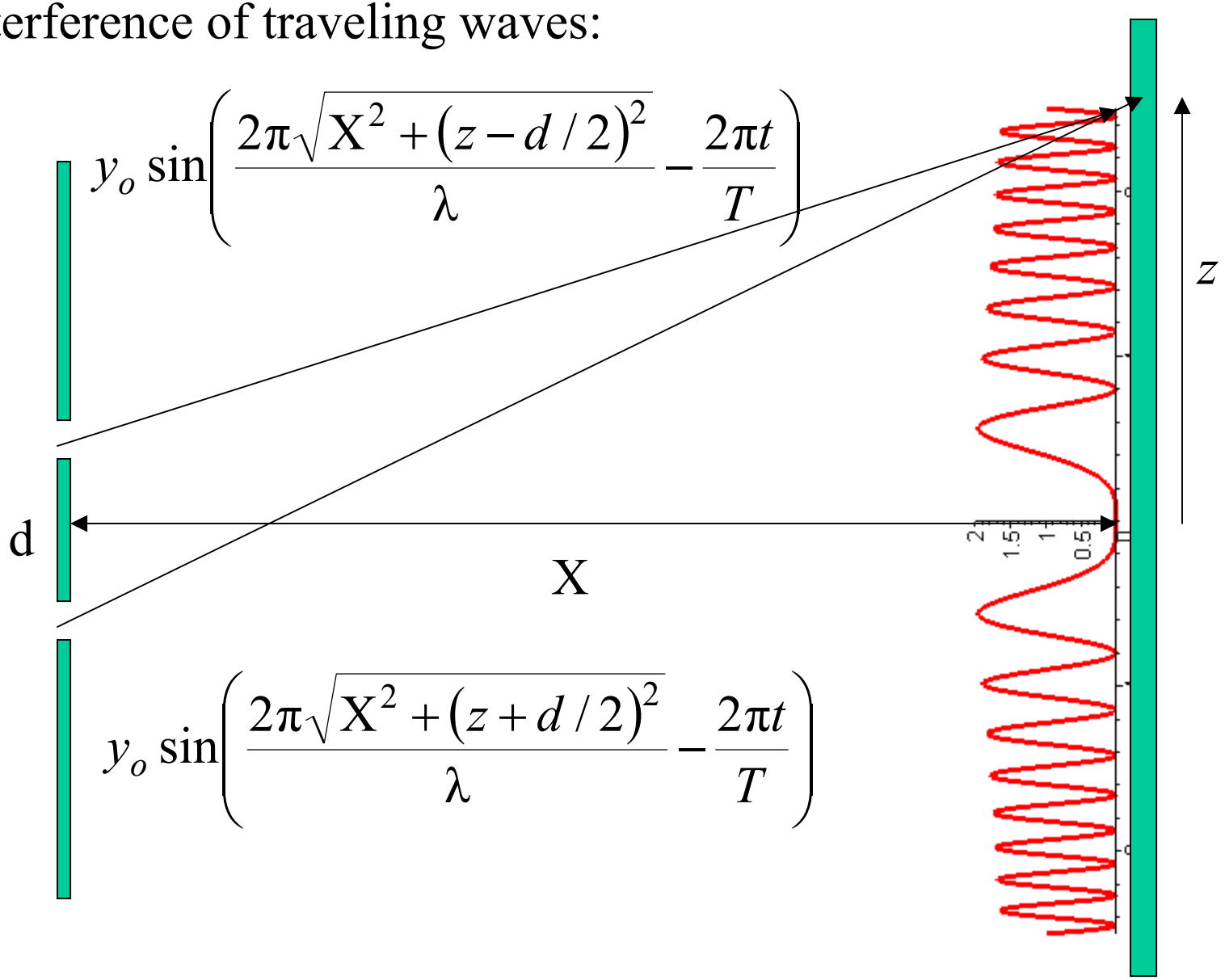
Periodic wave – $y(x,t) = y_0 \sin\left(2\pi\left(\frac{x}{\lambda} - \frac{t}{T}\right) + \varphi\right) \qquad \frac{\lambda}{T} = v$

Standing periodic wave –

$$y_{right}(x,t) + y_{left}(x,t) = 2y_0 \sin\left(\frac{2\pi x}{\lambda}\right)\cos\left(\frac{2\pi t}{T}\right)$$

Waves in two-dimensions

Interference of traveling waves:



Doppler effect:

For sound waves:

Summary:

$$f_O = f_S \frac{v \pm v_O}{v \mp v_S}$$

toward

away

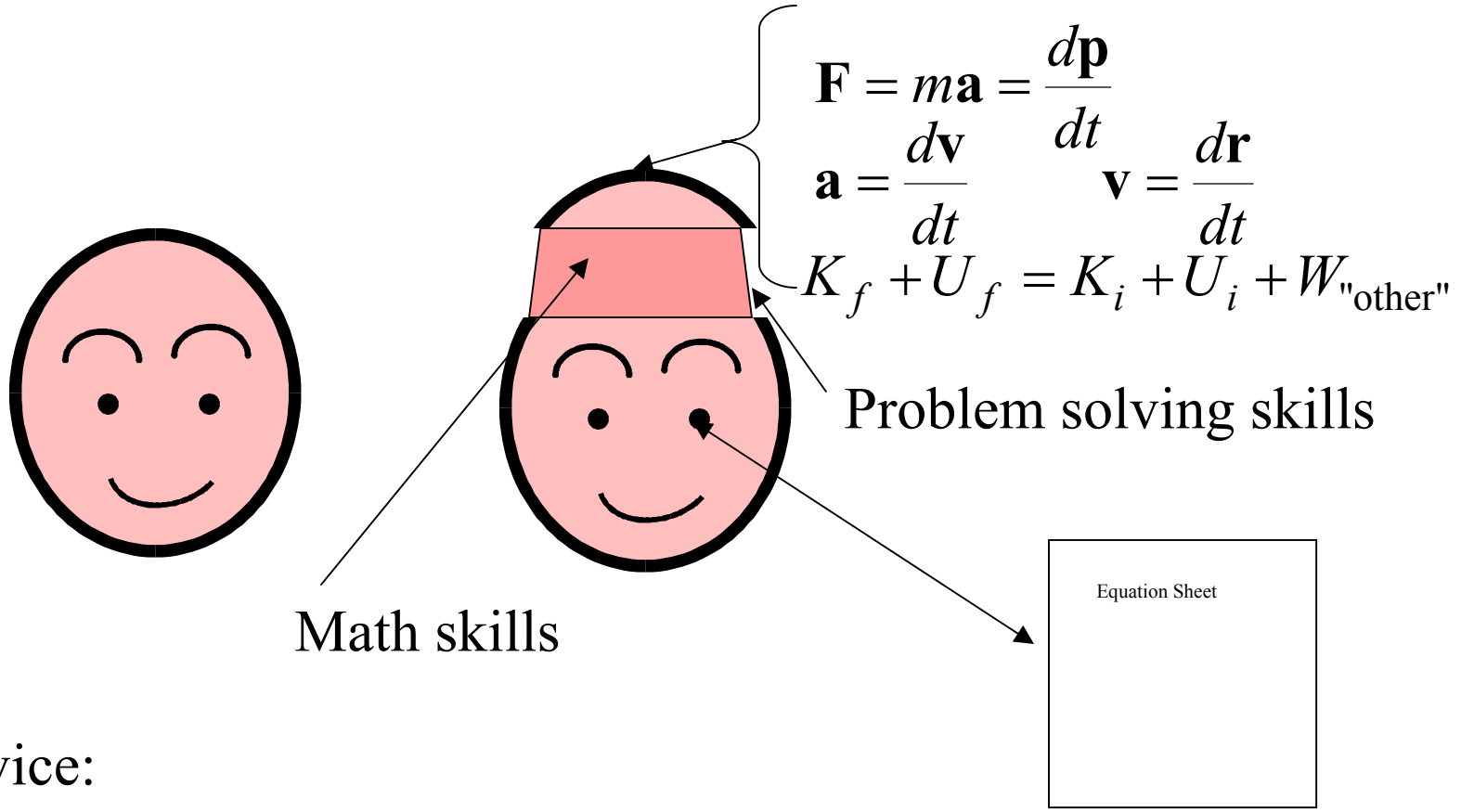
For light waves:

$$f_O = f_S \sqrt{\frac{v + v_O}{v - v_O}}$$

observer velocity relative to source

Advice on how to prepare for final exam

1. Decide that reviewing physics material is a useful exercise.
   - Physics concepts often need time for your mind to "digest". Material that we covered in the beginning of the course should now make more sense.
   - You will be able to see more of the interconnections between many of the topics we covered.
2. Review lecture notes, re-read text, rework homework and online quiz problems, review previous exams.
3. Work lots of problems; make sure equation sheet has the right information.
4. Keep track of your questions and get them answered.



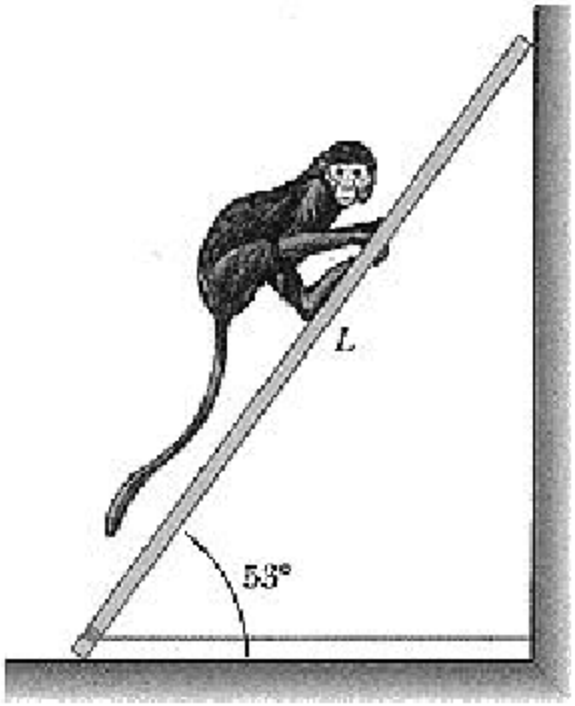
Advice:

1. Keep basic concepts and equations at the top of your head.
2. Practice problem solving and math skills
3. Develop an equation sheet that you can consult.

Problem solving steps

1. Visualize problem – labeling variables
2. Determine which basic physical principle(s) apply
3. Write down the appropriate equations using the variables defined in step 1.
4. Check whether you have the correct amount of information to solve the problem (same number of knowns and unknowns).
5. Solve the equations.
6. Check whether your answer makes sense (units, order of magnitude, etc.).

8.



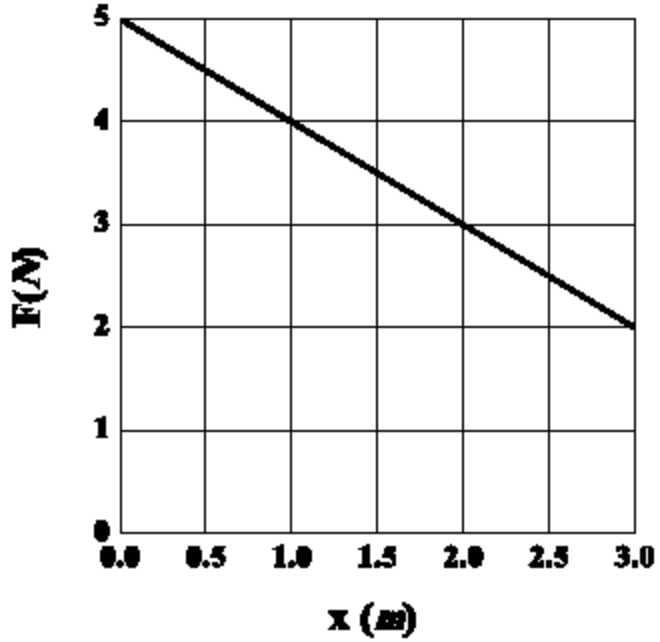
The figure shown on left illustrates a monkey having a mass of $M_M = 20$ kg which is climbing up a ladder which has a uniformly distributed mass of $M_L = 10$ kg and a length of $L = 3$ m. Suppose that both the floor and wall which support the ladder and monkey are frictionless, but that the bottom of the ladder is held by a horizontal rope fastened to the wall as shown. The ladder makes an angle of 53^o with respect to the floor. Find the tension in the rope when the monkey is has climbed a distance $\frac{2}{3}L$ as measured from the bottom.

10. The Mars Odyssey space craft is scheduled to achieve a circular orbit about Mars with a period of $T = 7200$ s (2 hr) some time in January 2002. Estimating the mass of Mars to be 6.4×10^{23} kg and the radius to be 3.4×10^{6} m, determine the height (above Mars' surface) and speed of the space craft in that circular orbit.

11. A large waterproof container, having a total volume $V = 7m^3$, is floating in sea water (density $\rho_{SW} = 1030$ kg/m^3) with $\frac{4}{5}^{ths}$ of the container submerged. What is the weight of the container?

12. Suppose a certain airplane with a total wing area of $A = 10m^2$ is designed so that during normal flying conditions, the air speed above the wing is $v_{above} = 262m/s$, while the air speed below the wing is $v_{below} = 260m/s$. Assuming that the air density is 1.1 kg/m^3, what is the total weight that can be supported by the lift force of the air flowing around the wings?

5.



The figure shows a position dependent force $F(x)$ which is being applied to 5 kg object. If the object had an initial velocity $v_i = 2$ m/s at $x = 0$ m, what is its velocity v_f at $x = 3$ m?

2. Suppose that you are traveling on a staight and level road in your car which has a mass of $m = 2000$ kg, when you see traffic stopped ahead of you. Suppose you immediately step on the brakes in order to come to a complete stop in a distance of 100 m. If your initial speed is 30 m/s and if you assume that your braking achieves a constant deceleration due kinetic friction, estimate the magnitude of the effective kinetic friction coefficent μ_k.

3. Suppose you throw a ball vertically into the air with an initial upward velocity of 15 m/s and catch at the initial height at a time t later. Neglecting the effects of air friction, estimate the magnitude of the t.