Clicker Test – just for those who are having trouble. Press a letter (A?) and see if your screen name appears.

Press another and see if a 1 appears next to it.

You can do this twice

Chapter 4 of Tipler & Mosca, sections 4 - 6
Various Forces

0. Newton's Laws (reminder):

a.) **2nd:** $\vec{F}_{\text{net}} = m\vec{a}$ **(in inertial frame)**

1st is special case. $\vec{F}_{\text{net}} = 0$ **so velocity does not change.**

b.) **3rd:** $\vec{F}_{AB} = -\vec{F}_{BA}$ **(two objects. "action – reaction" – or not)**

4. Force due to gravity: Weight

a.) $\vec{F}_g = m\vec{g}$ **magnitude of this is weight**

(*g* varies slightly with location on the surface. Decreases with altitude. So weight depends on where you are!!)
g = 9.8 m/s^2 = 32 ft/s^2

b.) **Apparent weight (perceived weight) requires a balancing force.)**

c.) **Free fall – Gravity still accelerates you, you just don't feel it. Examples Will return to this at end of lecture**

5. Solids, springs and strings.

a.) Surface of solid

i) **Normal force** (is perpendicular)

ii) **Friction force** (is tangential)

b.) Examples – inclines.
demo

c.) **Springs.** Hooke's law: $F_x = -kx$
the sign means a "restoring force"
x=0 at "equilibrium point"
actual springs and things that deform.
Elastic Limit
demo

d.) **Strings** (ropes, cables, etc.). Exert **Tension** (pull, don't push)

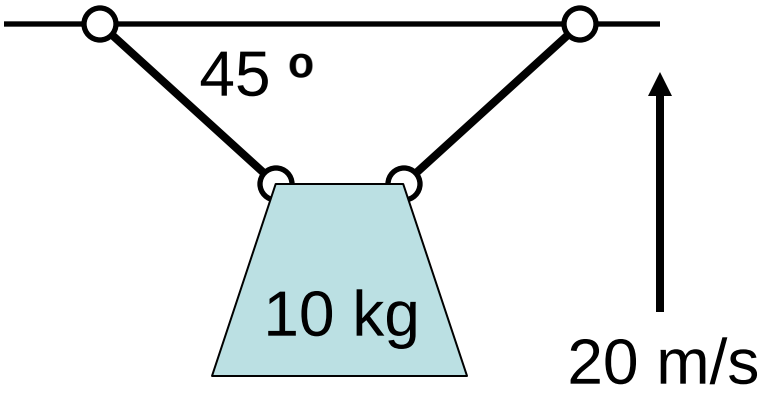
i) Usually Assume k very large – ignore stretch

ii) Usually ignore mass of string

iii) Will see more later.

iv) Clicker question

The 10 kg weight is tied to the ceiling of an elevator going up at 20 m/s. The ropes make 45 deg angles with the ceiling. The tension in each rope is



A. 98 N
B. 49 N
C. 69 N
D. 139 N

6. Free Body Diagrams

a.) Isolate the thing in question. (the "body")

b.) Draw the thing with all the force vectors on it. Point them carefully. Label them

c.) The "body" is drawn all by itself, to avoid confusing 3rd law force pairs. Now you can compute the Net Force.

d.) Sometimes you know components of the Net Force which you can use to determine the individual forces.

e.) Demo. Examples.