Forces

For each problem below show a clear force diagram.

1. A particle with mass $m = 2\,kg$ accelerates under the action of $F_1 = 1\,N$ North and $F_2 = 2\,N$ East

   (a) draw a clear diagram; try to "guess" the approximate direction and magnitude of $\vec{a}$ from the picture

   (b) write the 2nd Law in vector form

   (c) find a_x and a_y

   (d) find a

   (e) find the angle which $\vec{a}$ makes with the x-axis

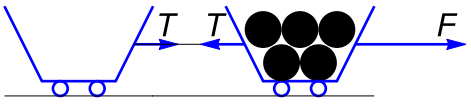
   (f) which force $\vec{F}_3$ should be added so that $\vec{v} = const$?

2. A student with mass $m = 80\,kg$ brings floor scales into an elevator for an experiment. At the instant the elevator starts moving the scales show the "weight" of the student as $660\,N$. Find the direction and magnitude of the acceleration a of the elevator.

3. A locomotive applies a force of $10^4\,N$ to an empty train car (mass $m = 2000\,kg$) which in turn pulls a loaded car with mass $M = 8000\,kg$.

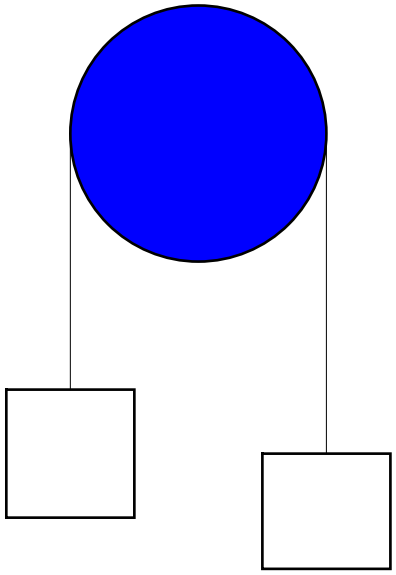
   (a) Find the tension force between the two cars.

   (b) The same, if the order of the cars was switched (i.e. the loaded car would be directly hitched to the locomotive).



4. A block with mass $M = 2\,kg$ rests on a horizontal frictionless table. A lighter block with mass $m = 1\,kg$ is hanging from a string which is attached to the 1st block. Find the acceleration a of the system and the tension T of the string.

5. In the Atwood machine the heavier body on left has mass $M = 1.1\,kg$, while the lighter body on right has mass $m = 1\,kg$. There is no friction and no mass of the pulley. Find acceleration a.



see Lecture Notes

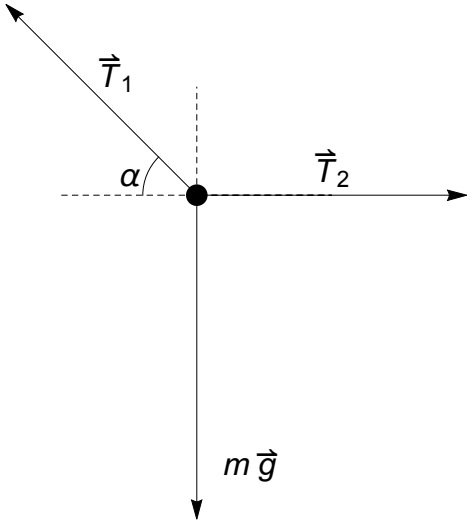
6. consider $M = 2\,kg$ on a 30^o frictionless inclined plane

   (a) find the downhill component of gravity

   (b) find a

   (c) suppose, at some point the speed is $1\,m/s$ downhill. Find the speed $1\,m$ lower

7. Find tensions T_1 and T_2 if $m = 2\,kg$ and $\alpha = 30^o$.



(a) write the condition of equilibrium in vector form

(b) write down the x-component of equilibrium

(c) write down the y-component of equilibrium