Total: 20 points

Homework 2.3

2 **E.32 As we discussed in class, the impulse (change in momentum) is the same for both cases (you come to a complete stop in both cases). The force required to stop you is F = Δp/t (impulse/time). So the shorter the time, the larger the force (and the more pain) to stop you.**

2 **E.33** To avoid accelerating when pushed on with a force, the villain would have to have infinite mass. That's impossible (conservation of momentum).

2 **E.34** Conservation of angular momentum. If there is no outside torque acting on the system, angular momentum is conserved. This can also be concluded from Newton's third law: an object in (rotational) motion will remain in (rotational) motion.

2 **E.36 Conservation of angular momentum. The initial angular momentum is zero (and will remain zero, without an interfering outside torque). So, if your body spins to the right a bit, the chair spins to the left a bit, to maintain the total angular momentum at zero. For the same reason** (conservation of angular momentum); when you stop moving, the chair will also stop moving.

2 **E.41** Sliding friction converts some of the gravitational potential energy into thermal energy. When the pole is slippery most of the gravitational potential energy is converted into kinetic energy (only a small fraction into thermal energy).

2 P. 8

$\vec{p} = m \cdot \vec{v}$

$\vec{p} = 0.0001\,kg \cdot 1\,\frac{m}{s}$

$\vec{p} = 0.0001\,kg\,\frac{m}{s}$

2 P. 9

$\vec{p} = m \cdot \vec{v}$

$\vec{p} = 800\,kg \cdot 3\,\frac{m}{s}$

$\vec{p} = 2400\,kg\,\frac{m}{s}$; forward

2 P. 10

change in momentum: $\Delta\vec{p} = 2400\,kg\,\frac{m}{s}$

$\Delta p = F \cdot t$

$t = \frac{\Delta p}{F}$

$t = \frac{2400\,kg\,\frac{m}{s}}{200\,N}$

$t = 12\,s$

② P.12 again $\Delta p = 2400 kg \frac{m}{s}$

$$\Delta p = F \cdot t$$

$$F = \frac{\Delta p}{t}$$

$$F = \frac{2400 kg \cdot m/s}{0.1 s}$$

$$F = 24{,}000 \ N$$ //

② P.13 initial momentum is zero, so final momentum (after push) is zero

⇒ If your momentum is $450 kg \cdot \frac{m}{s}$ to the left,
your friend's momentum is $450 kg \cdot \frac{m}{s}$ to the right.