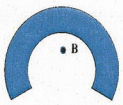
Total: 30 points

Homework 2.1

E.4



E.5 The wheel has rotational inertia, as measured by its rotational mass, making it hard to start and stop spinning.

E.6 To open the door you need to apply a torque to the door. To apply a torque, the force needs to be perpendicular to the lever arm (the door width), and not parallel to it.

E.7 (see answer to E.6). A force exerted at the hinges produces no torque about them. In this case there is no lever arm.

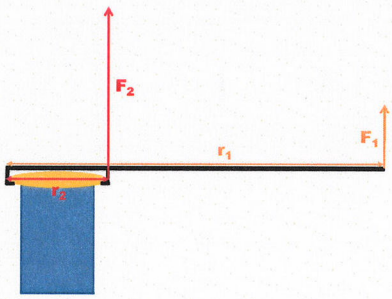
E.8 When your arm is at your side, the weight produces no torque, since the force (weight) is parallel to your arm (the lever arm. When your arm is in front of you, the weight produces a large torque (weight x length of your arm), that your shoulder muscles need to counteract.

E.9 The farther the water is from the water wheel's pivot, the more torque its weight produces on the wheel.

E.11 Your force far from the hinges produces a large torque. To oppose this torque, the nut must exert a huge force near the hinges.

E.12 Mechanical advantage, torque balance. The torque you are producing with your hand (long lever arm, smaller force), is balanced by the torque coming from the wire. Thus, the closer the wire is to the hinge (short lever arm), the larger the force acting on the wire.

E.16 Mechanical advantage, torque balance. (As we did in class).



$r_1F_1 = r_2F_2$

Thus, the force acting on the lid: $F_2 = \frac{r_1}{r_2}F_1$

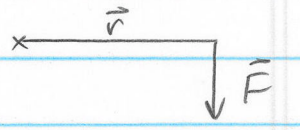
E.17 By pushing far from the pivot (making lever arm longer), you exert more torque on the lid.

P.1 $\vec{\tau} = \vec{r} \times \vec{F}$

$\vec{\tau} = 0.175\,m \times 700\,N$

$\vec{\tau} = 122.5\,Nm$ //

(2)



P.3 $\tau = I \cdot \alpha$

if you bring the disk up to speed in 2s rather than 6s, you need 3x the acceleration, and thus 3x the torque

(2)

P.4 $\tau = I \cdot \alpha$

If I triples, (three times rotational mass), it will take three times longer to speed up the saw

(2)

P.5 $\vec{\tau} = \vec{r} \times \vec{F}$

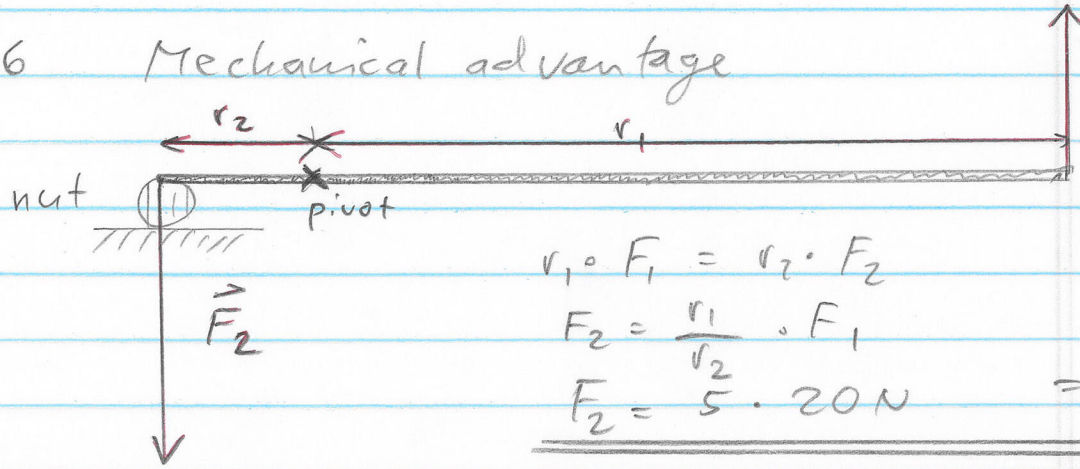
$\vec{\tau} = 0.125\,m \times 100\,N$

$\vec{\tau} = 12.5\,Nm$

(2)

The blade will slow down

P.6 Mechanical advantage



(2)

$r_1 \cdot F_1 = r_2 \cdot F_2$

$F_2 = \frac{r_1}{r_2} \cdot F_1$

$F_2 = \frac{5}{1} \cdot 20\,N = 100N$ //