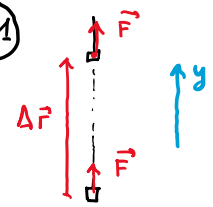
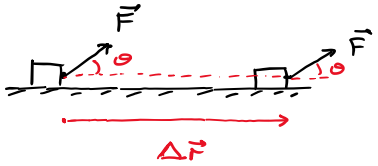
6.1



$\theta = 0$

$$W = \vec{F} \cdot \Delta\vec{r} = F \cdot \Delta r = 2{,}2 \cdot 10^4 N \cdot 7{,}6\ m = 1{,}7 \cdot 10^5\ J$$

6.2

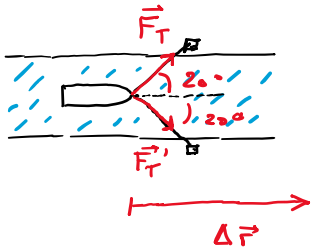


$$W = \vec{F} \cdot \Delta\vec{r} = F \cos\theta\, \Delta r$$

$$\Rightarrow \cos\theta = \frac{W}{F \cdot \Delta r}$$

$$\Rightarrow \theta = \arccos\left(\frac{W}{F \cdot \Delta r}\right) = \arccos\left(\frac{1100}{30 \cdot 50}\right) = 43°$$

6.3



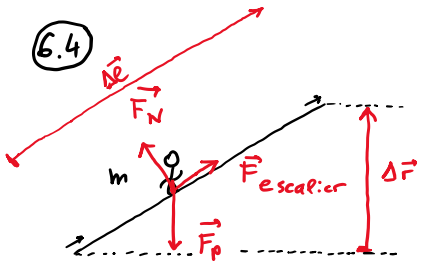
$F_T = F_T' = 5000N$

$\Delta r = 2000\ m$

$$W = \vec{F} \cdot \Delta\vec{r} = (\vec{F_T} + \vec{F_T}') \cdot \Delta\vec{r} = F_T \cos 20\, \Delta r + F_T' \cos 20\, \Delta r$$

$$\Rightarrow W = 2 \cdot 2000 \cdot \cos 20° \cdot 5000 = 1{,}9 \cdot 10^7\ J$$

6.4



(a). $W_{\vec{F_p}} = \vec{F_p} \cdot \Delta\vec{r} = -F_p \cdot \Delta r = -75 \cdot 9{,}81 \cdot 4{,}6 = -3{,}38 \cdot 10^3\ J$

($\theta = 180°$)

(b). La somme des forces sur l'homme est nulle :

$$\Sigma \vec{F}_{ext} = \vec{F_N} + \vec{F_p} + \vec{F}_{escalier} = \vec{0}$$

Comme la vitesse ne varie pas, $W_{\Sigma \vec{F}_{ext}} = 0$

De plus $W_{\vec{F_N}} = \vec{F_N} \cdot \Delta\vec{\ell} = 0$, car $\vec{F_N} \perp \Delta\vec{\ell}$

Donc $W_{\Sigma \vec{F}_{ext}} = \vec{F_p} \cdot \Delta\vec{r} + \vec{F}_{escalier} \cdot \Delta\vec{\ell} = 0$

$$\Rightarrow \vec{F}_{escalier} \cdot \Delta\vec{r} = -\vec{F_p} \cdot \Delta\vec{r} = W_{\vec{F}_{escalier}} = 3{,}38 \cdot 10^3\ J$$