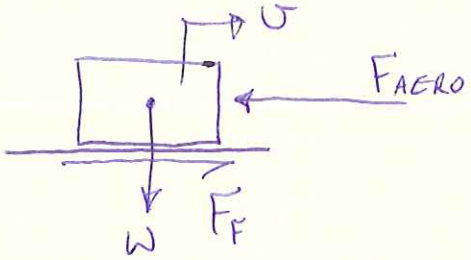
PROB. 13-52

$W = (100\ TON)\left(\frac{2000\ LB}{TON}\right) = 2\times10^5\ LB$, $P = (400\ HP)\left(\frac{550\ ft\cdot LB}{HP\cdot s}\right)$

$P = 2.2\times10^5\ \frac{ft\cdot LB}{s}$, $U = (50\ \frac{MI}{HR})\left(\frac{HR}{3600\ s}\right)\left(\frac{5280\ ft}{MI}\right) = 73.33\ \frac{ft}{s}$

a) FIND FORCE REQUIRED



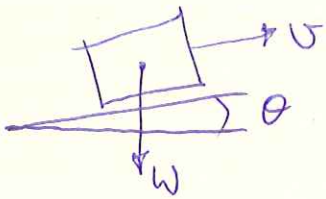

W IS NORMAL TO THE PATH

$P = \vec{F}\cdot\vec{U}$, $F = \frac{P}{U}$

$F = \frac{(2.2\times10^5\ \frac{ft\cdot LB}{s})}{(73.33\ \frac{ft}{s})} = 3000\ LB$

b) FIND ADDITIONAL HP FOR $U = 50\ \frac{MI}{HR}$, 1% GRADE

$\theta = TAN^{-1}\left(\frac{1}{100}\right) = 0.5729°$




$\Delta P = \vec{F}\cdot\vec{U} = WU\sin\theta$

$\Delta P = (2\times10^5\ LB)(73.33\ \frac{ft}{s})\sin 0.5729°$

$\Delta P = (1.466\times10^5\ \frac{ft\cdot LB}{s})\left(\frac{HP\cdot s}{550\ ft\cdot LB}\right) = 266.6\ HP$