Answer on Question # 83008, Physics / Electromagnetism

Question 1. *A heat pump is used to meet the heating requirements of a house and maintain it at* $20°C$*. On a day when the outdoor air temperature drops to* $-2°C$*, the house is estimated to lose heat at a rate of* $80000\,kJ/h$*. If the heat pump under these conditions has a COP of* 2.5*, determine*
(a) the power consumed by the heat pump and
(b) the rate at which heat is absorbed from th

Proof. $COP = \dfrac{Q_{\text{consumer}}}{W}$, where Q_{consumer} is a heat received by the consumer and W is pump work.

$Q_{\text{consumer}} = 80000\,kJ$ because if we lose $80000\,kJ/h$, then we must replenish $80000\,kJ/h$ to maintain the temperature.

So the power is $P = \Delta W/\Delta t = W = \dfrac{Q_{\text{consumer}}}{COP} = 32000\,kJ/h = 32000000/3600\,J/s \approx 8888.888888889\,W$.

And the rate at which heat is absorbed from the outdoor is $80000\,kJ/h$. □