PH 354: hw 3, problem 12

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For a Blackbody, $I(\omega) = \frac{\hbar}{4\pi^2 c^2} \frac{\omega^3}{\exp\left(\frac{\hbar\omega}{k_B T}\right) - 1}$

Taking $x = \frac{\hbar\omega}{k_B T}$

$$W = \int_0^\infty I(\omega) d\omega = \int_0^\infty \frac{\hbar}{4\pi^2 c^2} \frac{\left(\frac{k_B T}{\hbar}\right)^3 x^3}{\exp(x) - 1} \left(\frac{k_B T}{\hbar}\right) dx$$

$$\implies W = \frac{k_B^4 T^4}{4\pi^2 c^2 \hbar^3} \int_0^\infty \frac{x^3}{\exp(x) - 1} dx$$