A signal of 0.1 kW is transmitted in a cable. The attenuation of cable is -5 dB per km and cable length is 20 km. The power received at receiver is 10^{-x} W. The value of x is

_____.

[Gain in $dB = 10\log_{10}\left(\frac{P_o}{P_i}\right)$]

Given, power of transmitted signal, $P_i = 0.1 \text{ kW} = 0.1 \times 10^3 \text{W} = 10^2 \text{ W}$

Rate of attenuation, $R = -5 \text{ dB/km}$

Length of cable, $l = 20 \text{ km}$

Power received at receiver, $P_x = 10^{-x} \text{ W}$

Total loss, $\beta = R \times l = -5 \times 20 = -100 \text{ dB}$

$\because$ Gain $(\beta) = 10\log_{10}\frac{P_0}{P_i}$

$\therefore \beta = -100 = -10\log_{10}\frac{P_0}{P_i}$

$\Rightarrow -10 = \log_{10}\frac{P_0}{P_i} \Rightarrow 10^{-10} = \frac{P_0}{P_i}$

$\Rightarrow P_0 = 10^{-10}P_i = 10^{-10} \times 10^2 = 10^{-8} \Rightarrow P_0 = 10^{-8}V$

Hence, x = 8