(a) $A_v = \dfrac{R_L}{R_L + \frac{1}{g_m}}$

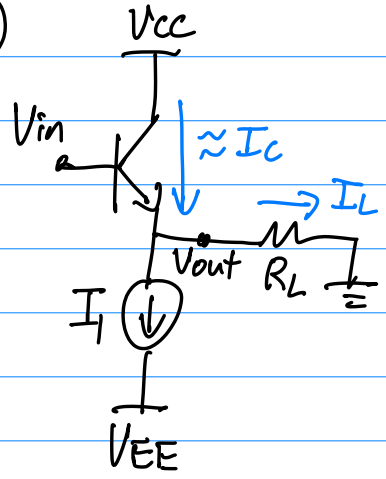
$\frac{1}{g_m} = \frac{R_L}{A_v} - R_L = \frac{8}{0.8} - 8 = 2\ \Omega.$

$g_m = 0.5\ S.$

$\therefore I_C = g_m V_T = 0.5 \times 0.026 = 13\ mA.$

$\therefore I_1 = I_C = 13\ mA.$

(b)



Output power of 0.5 W corresponds to

$I_L^2 R_L = 0.5$

$I_L^2 = \frac{0.5}{8}$

$I_L = 0.25\ A$ (peak).

At this peak,

$I_C = I_L - I_1$

$= 0.25 - 0.013$

$= 0.237\ A.$

$\therefore g_m = \frac{I_C}{V_T} = 9.1\ S.$

$\therefore A_v = \dfrac{R_L}{R_L + \frac{1}{g_m}} = 0.987.$

The voltage gain rose from 0.8 to 0.99
$\Rightarrow$ non-linear response.