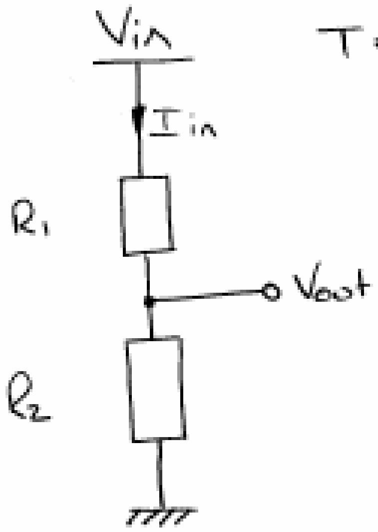
① TO CALCULATE RESISTOR VALUES FOR A VOLTAGE DIVIDER, WHERE THE IMPEDANCE LOOKING BACK INTO THE DIVIDER IS DETERMINISTIC AND INDEPENDENT OF THE DIVIDER VALUE:

②



$T = R_1 // R_2$.

$V = IR$	
$\frac{V}{I} = R$	$\frac{V}{R} = I$

FIND; R_1 & R_2
for given; V_{in}, V_{out} & T

③ $$I_{in} = \frac{V_{in}}{R_1 + R_2}$$

④ $$V_{out} = I_{in} . R_2$$

⑤

$$V_{out} = \frac{V_{in}}{R_1 + R_2} . R_2.$$

$$V_{out} = \frac{V_{in} . R_2}{R_1 + R_2}.$$

$$\frac{V_{out}}{V_{in}} = \frac{R_2}{R_1 + R_2}.$$

$$\frac{V_{in}}{V_{out}} = \frac{R_1 + R_2}{R_2} = \frac{R_1}{R_2} + \frac{R_2}{R_2}$$

$$\boxed{\frac{V_{in}}{V_{out}} = \frac{R_1}{R_2} + 1}$$

⑥

$$\boxed{R_1 // R_2 = \frac{R_1 . R_2}{R_1 + R_2}.}$$

$$T = \frac{R_1 . R_2}{R_1 + R_2}$$

$$\frac{1}{T} = \frac{R_1 + R_2}{R_1 . R_2}.$$

$$= \frac{R_1}{R_1 . R_2} + \frac{R_2}{R_1 . R_2}.$$

$$= \frac{1}{R_2} + \frac{1}{R_1}$$

$$\frac{1}{T} - \frac{1}{R_1} = \frac{1}{R_2}.$$

$$R_2 = \frac{1}{\frac{1}{T} - \frac{1}{R_1}}$$

$\therefore$

$$\boxed{R_2 = \frac{R_1 . T}{R_1 - T}} \Leftarrow \underline{\underline{A}}$$

⑦

$$\frac{V_{in}}{V_{out}} = \frac{R_1}{R_2} + 1$$

$$\frac{V_{in}}{V_{out}} - 1 = \frac{R_1}{R_2}$$

$$\left(\frac{V_{in}}{V_{out}} - 1\right) R_2 = R_1$$

$$R_2 = \frac{R_1 . T}{R_1 - T}$$

$$\left(\frac{V_{in}}{V_{out}} - 1\right)\left(\frac{R_1 . T}{R_1 - T}\right) = R_1$$

$$\frac{V_{in} . R_1 . T}{V_{out}(R_1 - T)} - \frac{R_1 . T}{R_1 - T} = R_1$$

$$\frac{V_{in} . R_1 . T}{V_{out} . R_1 - V_{out} T} - \frac{R_1 . T}{R_1 - T} = R_1$$

$$\frac{V_{in} . T}{V_{out} . R_1 - V_{out} . T} - \frac{T}{R_1 - T} = 1$$

$$\frac{(R_1 - T) V_{in} . T - (V_{out} . R_1 - V_{out} . T) T}{(R_1 - T)(V_{out} . R_1 - V_{out} . T)} = 1$$

$$\frac{A}{B} = 1$$

$$A = V_{in} . T . R_1 - V_{in} . T^2 \cancel{- V_{out} . T . R_1 + V_{out} . T^2}$$

$$B = V_{out} . R_1^2 \cancel{- V_{out} . T . R_1} - V_{out} . T . R_1 \cancel{+ V_{out} . T^2}$$

$$= V_{out} . R_1^2 - \cancel{2} V_{out} . T . R_1 + V_{out} . \cancel{T^2}$$

⑧

$$\frac{-V_{in} . T^2 + V_{in} . T . R_1}{V_{out} . R_1^2 - V_{out} . T . R_1} = 1$$

$$\frac{T(-V_{in} . T + V_{in} . R_1)}{R_1(V_{out} . R_1 - V_{out} . T)} = 1$$

$$\frac{-V_{in} . T + V_{in} . R_1}{V_{out} . R_1 - V_{out} . T} = \frac{R_1}{T}$$

$$\frac{V_{in}(-T + R_1)}{V_{out}(-T + R_1)} = \frac{R_1}{T}$$

$$\frac{V_{in}}{V_{out}} = \frac{R_1}{T}$$

$$\boxed{\frac{V_{in} T}{V_{out}} = R_1} \leftarrow \underline{\underline{B}}$$

$$R_1 = \frac{V_{in} T}{V_{out}}$$

$$R_2 = \frac{R_1 . T}{R_1 - T}$$