The HVAC engineer for a company constructing a tall building has requested that $500 K be spent now (during construction) on software and hardware to improve the efficiency of environmental control. This will save $10 K /year in energy cost for ten years and $700 K at the end of the ten years.

Find RoR.

$PW = 0 \Rightarrow -500 + 10(P/A, i, 10) + 700(P/F, i, 10) = 0$

As starting solution,

$-500 + 800(P/F, i, 10) = 0$

$\Rightarrow 800/(1+i)^{10} = 500 \Rightarrow$

$(1+i)^{10} = 8/5 \Rightarrow i \cong (8/5)^{1/10} - 1$

$\cong 4.8\%$

Try it

$PW(0.048) = 500 + \frac{10}{0.048}(1 - 1.048^{-10}) + 700 \times 1.048^{-10}$

$= 15.984 > 0$

Increase i to 5%

$PW(0.05) = 6.957 > 0$

$PW(0.055) = -14.92$

$PW(0.0525) = 1.407$

$PW(0.052) = -1.88$

We conclude that the ROR is in the in interval (5.125%, 5.2%). ROR is found by linear interpolation where x = PW and y = i. Interpolation is done between (x_1,y_1) = (1.407, 5.125) and (x_2, y_2) = (-1.88, 5.2) to find the corresponding y at x = 0.

Recall the interpolation equation

$$y = y_1 + a(x - x_1),$$

where a =(y_2-y_1)/(x_2-x_1).

$$i^* = 5.125 + \frac{(5.2 - 5.125)}{-1.88 - 1.407}(0 - 1.407) = 5.16\%.$$