GE 403
Engineering Economy

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Multiple Compounding Periods

Ex.1 Ali wishes to make a single deposit p at t=0 into a fund paying 15% per year compounded quarterly such that $ 1000 payments are received at t=1,2,3 and 4 (periods are 3 month intervals), and a single payment of $7500 is received at t=12. What single deposit is required?

Solution

r = 15% per year compounded quarterly
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Let ***r*** denote the nominal annual interest rate for money and ***m*** denote the number of compounding periods in a year

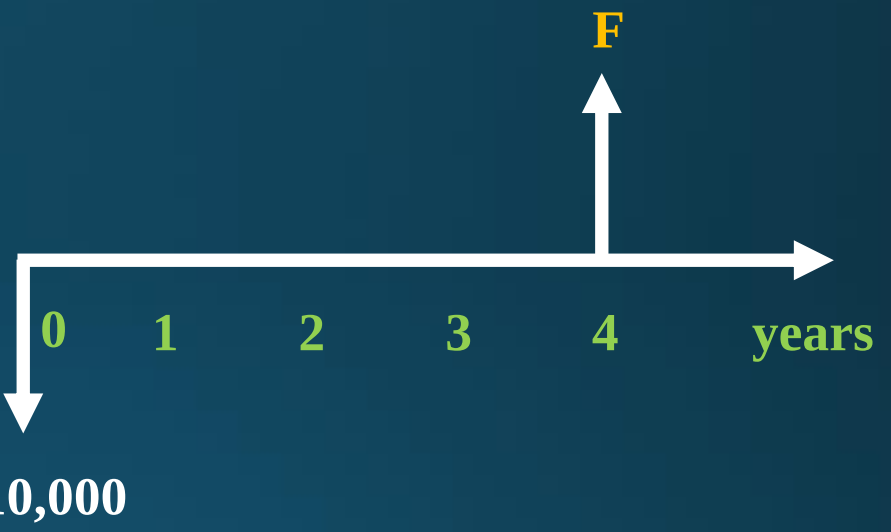
$$i = {}^{r}/_{m} \quad \Longrightarrow \quad i = {}^{0.15}/_{4} \times 100 = 3.75\% \text{ per quarter}$$

$$\boldsymbol{P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right] + F(1+i)^n}$$

$$\boldsymbol{P = 1000\left[\frac{(1+0.0375)^4 - 1}{0.0375(1+0.0375)^4}\right] + 7500(1+0.0375)^{-12} = \$8473.12}$$

Ex.2 If $10,000 is invested in a fund that pays interest at a rate of 16% per year compounded monthly, after 4 years how much will be in the fund?

Solution



First Solution

Effective annual interest rate

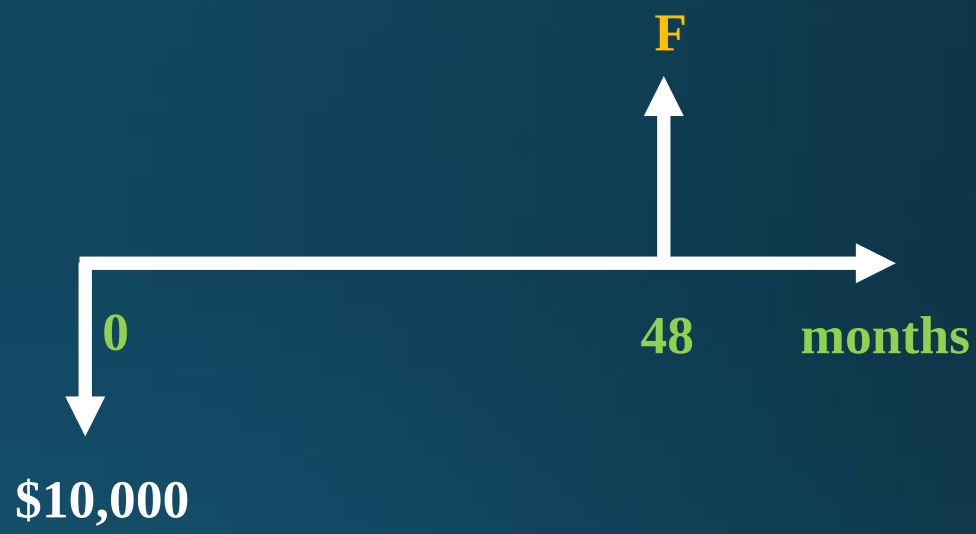
$$I_{eff} = [(1 + {}^{r}/_{m})^{m} - 1] \times 100$$

$$I_{eff} = [(1 + {}^{0.16}/_{12})^{12} - 1] \times 100 = 17.227\% \text{ per year compounded annually}$$

$$F = P(1 + i)^{n} = 10{,}000(1 + 0.1723)^{4} = \$18{,}884.77$$

Ex.2 If $10,000 is invested in a fund that pays interest at a rate of 16% per year compounded monthly, after 4 years how much will be in the fund?

Solution



Second Solution

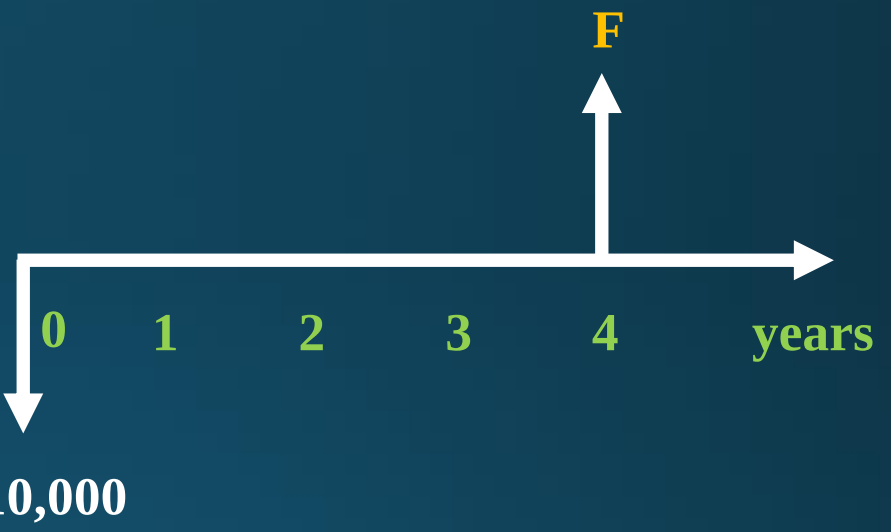
Monthly interest rate

$i = {}^{r}/_{m} \Longrightarrow {}^{0.16}/_{12} \times 100 = 1.333\%$ per month

$F = P(1+i)^{n} = 10{,}000(1+0.01333)^{48} = \$18{,}884.77$

Ex.3 If \$10,000 is invested in a fund that pays interest at a rate of 1% per month, after 4 years how much will be in the fund?

Solution



First Solution

Effective annual interest rate

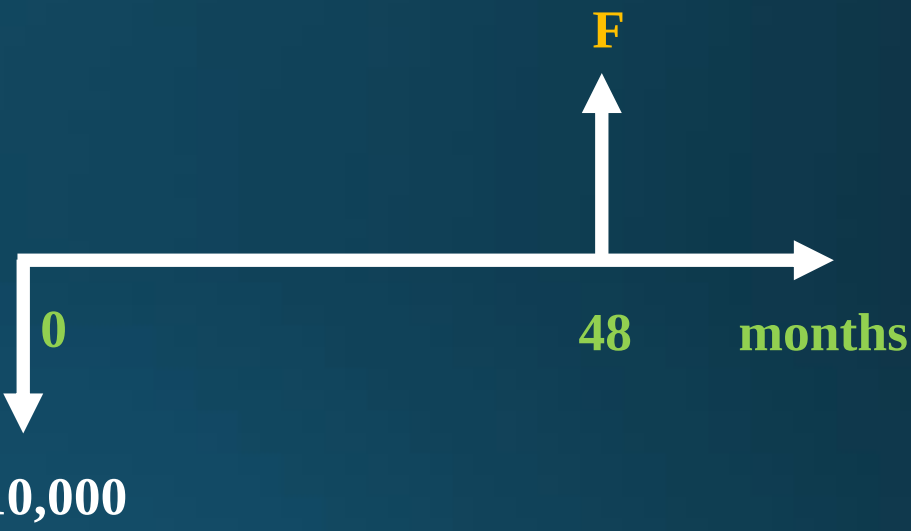
$$I_{eff} = [(1 + {}^{r}/_{m})^{m} - 1] \times 100$$

$$I_{eff} = [(1 + 0.01)^{12} - 1] \times 100 = 12.683\% \text{ per year compounded annually}$$

$$F = P(1 + i)^{n} = 10{,}000(1 + 0.12683)^{4} = \$16{,}122.55$$

Ex.3 If $10,000 is invested in a fund that pays interest at a rate of 1% per month, after 4 years how much will be in the fund?

Solution



Second Solution

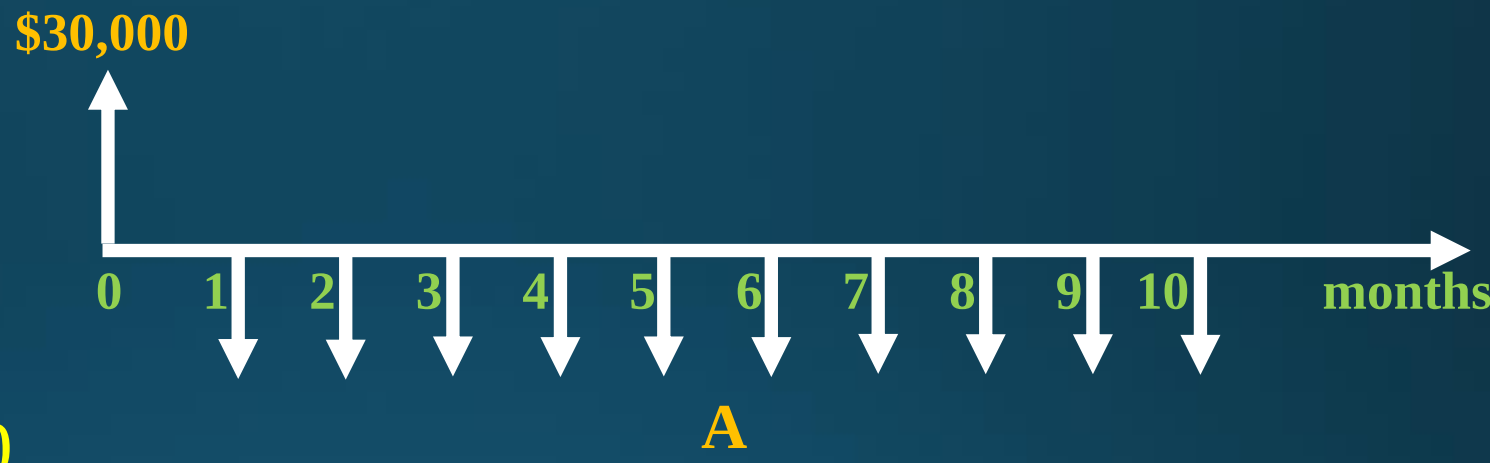
Monthly interest rate

$i = {}^{r}/_{m} \Longrightarrow 1\%$ per month

$F = P(1+i)^{n} = 10{,}000(1+0.01)^{48} = \$16{,}122.26$

Ex.4 Saad borrowed \$30,000 to buy a car; he will pay the loan with 10 equal monthly payments at a rate of 25% per year per quarter. Determine the loan monthly payments.

Solution



$$I_K = [(1 + {}^{r}/_{m})^{{}^{m}/_{k}} - 1] \times 100$$

$$I_{monthly} = \left[(1 + {}^{0.25}/_{4})^{{}^{4}/_{12}} - 1\right] \times 100 = 2\% \text{ per month}$$

$$A = P(A/P\ 2\%, 10) = 30{,}000(0.11133) = \$3339.9$$