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Time value of money and cash flow

(1) Single-payment present worth Amount

$$P = \frac{F}{(1+i)^n} = F\,(P/F, i, n)$$

(2) single-payment compound amount

$$F = P(1+i)^n = P(F/P, i, n)$$

(3) equal-payment series compound amount.

$$F = A\,\frac{(1+i)^n - 1}{i} = A\,(F/A, i, n)$$

(4) Equal payment series sinking fund.

$$A = F\,\frac{i}{(1+i)^n - 1} = F(A/F, i, n)$$

(5) equal payment series present worth amount.

$$P = A\,\frac{(1+i)^n - 1}{i(1+i)^n} = A\,(P/A, i, n)$$

(6) equal payment series capital recovery amount.

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

$\left[(1+i)^n - 1\right]$

⑦ Uniform Gradient Series Annual Equivalent Amount

$$A = A_1 + G\,\frac{(1+i)^n - in - 1}{i^2[(1+i)^n - i]}$$

$$A = A_1 + G\,(A/G, i, n)$$

Application

① A person deposits a sum of Rs 20,000 (P) at the interest of 18% (i) compounded annually for n = 10 years. Find the maturity value after 10 years. (F)

$$F = P(1+i)^n$$

$$F = 20{,}000\left(1 + \frac{18}{100}\right)^{10}$$

$$= 20{,}000\,(1 + 0.18)^{10}$$

$$= 20{,}000\,(1.18)^{10}$$

$$= 20{,}000 \times 5.234$$

$$\boxed{F = \text{Rs } 1{,}04{,}1680} \text{ (ans)}$$

(2) A person wishes to have a future sum of Rs 1,00,000 (F) for his son's education after n = 10 years from now. What is the single payment that he should deposit now so that he gets the desired amount after 10 years? 15% is the given rate of interest.

$$P = F \frac{1}{(1+i)^n} = \frac{100000}{\left(1+\frac{15}{100}\right)^{10}}$$

$$= \frac{100000}{(1.15)^{10}}$$

$$= 100000 \times 0.2472$$

$$= \text{Rs } 24720$$

(3) A person who is now 35 years old is planning for his retired life. He plans to invest an equal sum of Rs 10,000 at the end of every year for the next 25 years starting from the end of next year. Rate of int. 20%. Find the maturity value (F) of his account when he is 60 yrs.

✓ A = Rs 10,000 n = 25 i = 20%.

$$F = A \frac{(1+i)^n - 1}{i}$$

$$= 10,000 \times \left(\frac{(1+25/100)^{25} - 1}{(25/100)} \right)$$

$$= 10,000 \times \frac{(1.2)^{25} - 1}{0.2}$$

$$= 10,000 \times 471.981$$

$$= \text{Rs } 4719810 \text{ (ans)}$$

(4) A company has to replace a present facility after (15) (n) years at an outlay of (Rs 5,00,000) (F). It plans to deposit an (A) equal amount at the end of every year for the next 15 years at an interest rate of (18%) compounded annually. Find the equivalent amount that must be deposited at the end of every year for the next 15 years.

$A = ?$ $\quad F = \text{Rs } 5,00,000 \quad (n = 15) \quad i = 18\%$

$$A = F \frac{i}{(1+i)^n - 1} = 500000 \times \frac{0.18}{(1.18)^{15} - 1}$$

$$\frac{(1+i)^n - 1}{i} \qquad \left[\frac{(1.16)^{15} - 1}{\quad}\right]$$

$$= 500000 \times 0.0164$$

$$= \text{Rs } 8200 \quad (\text{ans}).$$

(5) A company wants to set up a reserve which will help the company to have an annual equivalent amount of Rs 10,00,000 (A) for the next 20 years (n) towards its employees welfare measures. The reserve is assumed to grow at the rate of 15% (i) annually. Find the single payment that must be made now as the reserve amount.

$$P = A \frac{(1+i)^n - 1}{i(1+i)^n}$$

$$= 10,00,000 \times \left[\frac{(1.15)^{20} - 1}{0.15 \times (1.15)^{20}}\right]$$

$$= 10,00,000 \times 6.2593$$

$$= \text{Rs } 62,59,300 \quad (\text{ans})$$

(6) A bank gives a loan to a company to purchase an equipment worth Rs 10,00,000 [illegible] amount

purchase an equipment worth Rs 10,00,000 at 18% rate of interest. This amount should be repaid in 15 yearly equal installments. Find the installment amount that the company has to pay to the bank.

$P = 10,00,000 \qquad n = 15 \qquad i = 18\%$

$A = ?$

$$A = \frac{P\, i(1+i)^n}{(1+i)^n - 1} = 10,00,000 \times \frac{0.18 \times (1.18)^{15}}{(1.18)^{15} - 1}$$

$$= 10,05,000 \times 0.1964$$

$$= \text{Rs } 196400 \text{ (ans)}$$

Q7 A person is planning for his retired life. He has 10 more years of service. He would like to deposit 20% of his salary which is 4000 at the end of the first year and thereafter he wishes to deposit an amount with an annual increase of Rs 500 for the next 9 years with an

1) 4000
2) 4500
3) 5000

(10) (500) ... Rs 500 for the next 9 years ... interest rate of 15%. Find the total amount (F) at the end of 10th year.

$A_1 = ₹4000$ $\quad G = ₹500$ $\quad i = 15\%$

$n = 10$ years.

$A = ?$ $\quad F = ?$

$$A = A_1 + G\left[\frac{(1+i)^n - in - 1}{i(1+i)^n - i}\right]$$

$$= 4000 + \left[500 \times \frac{(1.15)^{10} - (0.15\times 10) - 1}{0.15 \times (1.15)^{10} - 0.15}\right]$$

$$= 4000 + 500 \times 3.3832$$

$$= 5691.60$$

$$F = A\,\frac{(1+i)^n - 1}{i} = 5691.60 \times \left[\frac{(1.15)^{10} - 1}{0.15}\right]$$

$$= 5691.60 \times (20.304)$$

$$= Rs\ 1,15,562.25$$

(ans)

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① Cash: It comprises cash on hand & demand deposit with banks.

② Cash equivalents: Short-term, highly liquid investment that are readily convertible into known amounts of cash.

③ Cash flows: These are inflows and outflows of cash and cash equivalents. The flow of cash is said to have taken place when any transaction make changes in the amount of cash & cash equivalents available before it takes place.