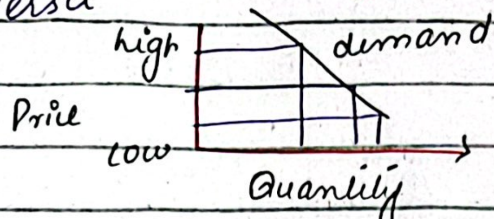
Law of demand

Price ↑ than Quantity of demand ↓ & vice versa



factors influencing demands

income of people, prices of related goods tastes of consumer.

Unit # 03:-

Interest Formula's & their Application

① Interest rate rental value of money. When you save or invest money, the bank or institution adds extra money to your account overtime, this extra amount is called interest.

② Compound Amount:-

Year end	Interest	Compound Amount
0		100
1	15	115
2	17.25	132.25
3	19.84	152.09
4	22.81	174.90
5	26.24	201.14

formula to find future worth

① future amount ← $F = P(1+i)^n$ → interest rate

principal amount invested at time 0

period of deposit.

③ Present worth:

End of year (n)	Present worth	Compound amount after n years.
0	86	100
1	~~78~~ 86.96	100
2	~~65~~ 75.61	"
3	~~57~~ 65.75	"
4	~~49~~ 57.18	"
5	~~43~~ 49.72	"
6	~~37~~ 43.29	"
7	~~32~~ 37.59	"
8	32.69	"
9	28.43	"
10	24.72	"

Formula for present worth:

② $$P = \frac{F}{(1+i)^n}$$

④ Interest Formulas:-

Interest Rate

- Simple IR — interest calculated on basis of "initial deposit".
- Compound IR — calculated on total amount so far.

P principal amount

n No. of interest periods.

i interest rate

F future amount

A equal amount deposited at end of every interest period.

G uniform amount which will be added / subtracted period after period to / from the amount of deposit A1 at end of period 1.

(5) Single Payment Compound Amount :-

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

Future

$(F/P, i, n)$ = single payment compound amount factor.

Eg 3.1 :-

$P = 20{,}000$, $i = 18\% = 0.18$

$n = 10$

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

$$F = 20{,}000(1+0.18)^{10} = 20{,}000(F/P, 18\%, 10)$$

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

$$F = \text{Rs } 104676.7$$

present

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

Eg 3.2 :-

$F = 100000 \quad n = 10 \quad i = 15\% = 0.15$

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

$$P = \frac{100000}{(1+0.15)^{10}} = F(P/F, 15\%, 10)$$

$$P = \frac{100000}{4.0455} = Rs\ 24718.4$$

(6) Equal Payment Series Compound Amount :-

objective to find future worth, at The end of each period.

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

Eg 3.3

$A = 10,000$

$n = 25$

$i = 20\% = 0.2$

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

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

$$F = 10,000 \frac{(95.39) - 1}{0.2}$$

$$F = 10,000 \frac{94.39}{0.2}$$

$$F = (10,000)(471.981)$$

$F =$ Rs 4719810.

(7) Equal Payment Series Sinking Fund:-

Objective is to find equivalent amount A.

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

E.g 3.4

$F = 500,000$

$n = 15$ $i = 18\% = 0.18$

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

$$A = 500,000 \frac{0.18}{(1.18)^{15} - 1}$$

$$A = 500,000 (0.016402)$$

$A =$ Rs 8201.

Eg (1)

$n = 6$

$i = 15\% = 0.15$

$F = ?$ $P = 100,000$

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

$F = 100,000(1+0.15)^6$

$F = 100,000 \times 2.3130$

$F = 231306/-$

Eg (2)

$i = 18\% = 0.18$

$n = 15$

$F = 200,000$

$P = ?$

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

$$P = \frac{200,000}{(1+0.18)^{15}}$$

$P = 16703.20/-$

Eg (3)

$A = 10,000$

$i = 15\% = 0.15$

$n = 60$ $F = ?$

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

$$F = 10,000 \frac{(1+0.15)^{30} - 1}{0.15}$$

$$F = \cancel{2912199} \quad 4347451.4/-$$

Eg (4)

$i = 18\% = 0.18$

$F = 1500,000$

$n = 10 \qquad A = ??$

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

$$A = 1500,000 \left(\frac{0.18}{(1+0.18)^{10} - 1} \right)$$

$$A = 1500,000 \; (0.042514)$$

$$A = 63771.96/$$

⑧ Equal Payment Series Present Worth Amount:

objective is to find the present worth of an equivalent payment.

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

Eg 3.5

$A = 1000000$

$n = 20 \qquad i = 15\% = 0.15$

$$F = 10,000 \frac{(1+0.15)^{30} - 1}{0.15}$$

$$F = \cancel{2992999} \quad 4347451.4/-$$

Eg (4)

$i = 18\% = 0.18$

$F = 1500,000$

$n = 10 \qquad A = ??$

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

$$A = 1500,000 \left(\frac{0.18}{(1+0.18)^{10} - 1} \right)$$

$$A = 1500,000 \,(0.042514)$$

$$A = 63771.96/-$$

(8) Equal Payment Series Present Worth Amount:

objective is to find the present worth of an equivalent payment.

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

Eg 3.5

$A = 1000000$

$n = 20 \qquad i = 15\% = 0.15$

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

$$F = 10,00,000 \frac{(1+0.15)^{20} - 1}{(0.15)(1+0.15)^{20}}$$

$$F = 10,00,000 \ (6.2593314)$$

$$F = 6259331/-$$

⑨ Equal Payment Series Capital Recovery Amount.

objective is to find annual equivalent amount which is to be recovered at the end of every interest period for (n) interest periods for a loan (P).

⑧ $$A = P \frac{i(1+i)^n}{(1+i)^n - 1}.$$

E.g 3.6

$P = 10,00,000$

$i = 18\% = 0.18$

$n = 15$ $A = ?$

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

$$A = 10,00,000 \frac{(0.18)(1+0.18)^{15}}{(1+0.18)^{15}-1}$$

$$A = 10,00,000 \times 0.196402$$

$$A = 196402.78/-$$

(10) Uniform Gradient Series Annual Equivalent Amount.

objective is to find A at the end of first year & with equal increment (G) at end of each of following n-1 years with an interest rate i compounded annually.

(9) $$A = A1 + G \frac{(1+i)^n - in - 1}{i(1+i)^n - i}$$

Eg 3.7

$A1 = 4,000$
$G = 500$
$i = 15\%$
$n = 10$

$A = ?$ $F = ?$

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

$$A = 4000 + 500 \frac{(1+0.15)^{10} - (0.15)(10) - 1}{(0.15)(1+0.15)^{10} - 0.15}$$

$$A = 4000 + 1691.597$$

$$A = 6766391$$

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

$$F = 6766391 \left(\frac{(1+0.15)^{10} - 1}{0.15} \right)$$

$$F = 115562.25$$

(11) Effective Interest Rate:-

The actual interest rate on a loan or investment

(10) $$R = (1 + i/C)^c - 1$$

Eg 3.8

$P =$ Rs 5000

$n = 10$ years

$i = 12\% = 0.12$

$F = ?$

Quarterly = 4.

Method 1:-

No. of interest period per year = 4

No. of interest period in 10 year = 10 × 4 = 40.

Revised no. of periods $n = 40$

Interest rate per quarter, $r = 12\% / 4$

$= 3\%$

$F = P(1+r)^n = 5000(1+0.03)^{40}$

$F =$ Rs 16310.19/-

Method 2.

No. of interest periods per year

$C = 4$;

Effective interest rate $R = (1 + i/C)^C - 1$

$= (1 + 12\%/4)^4 - 1$

$= 12.55\%$

$F = P(1+R)^n = 5000(1 + 0.1255)^{10}$

$F = 16,308.91$.

Formula's Of Unit # 03

1- Future Worth:

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

2- Present Worth:

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

3- Single Payment Compound Amount:

future worth

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

present worth

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

4- Equal Payment Series Compound Amount:

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

- Equal Payment Series Sinking Fund:

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

6. Equal Payment Series Present Worth Amount:

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

7- Equal Payment Series Capital Recovery Amount:

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

8. Uniform Gradient Series Annual Equivalent Amount:

$$A = A1 + G \frac{(1+i)^n - in - 1}{i(1+i)^n - i}$$

9. Effective Interest Rate :-

$$R = (1 + i/C)^C - 1.$$