2. Chp4 Maths for Finance

27 April 2024 10:49


Maths for Finance On...


Maths for Finance On...

One Shot Revisions

- Live Revision on YouTube
- Coverage – Concepts, All IMP MCQs
- One Video for One Chapter
- Max Coverage in Min. Time
- Free PDF of Revision NOTES

YT Revisions – Phase I

Date	Day	Chapter Name	Category	Marks	Time
25-Apr-24	Thu	One Shot - Blood Relations	A	6	11.30 AM
27-Apr-24	Sat	One Shot - Maths for Finance	A	12	11.30 AM
28-Apr-24	Sun	One Shot - Seating Arrangements	A	4	11.30 AM
30-Apr-24	Tue	One Shot - Statistical Description of Data	A	6	11.30 AM
02-May-24	Thu	One Shot - Direction Test	A	5	11.30 AM
04-May-24	Sat	One Shot - Central Tendency & Dispersion	A	12	11.30 AM
05-May-24	Sun	One Shot - Number Series Coding Decoding	A	5	11.30 AM
07-May-24	Tue	One Shot - Correlation Regression	B	5	11.30 AM
09-May-24	Thu	One Shot - Index Numbers	B	6	11.30 AM

YT Revisions – Phase II

Date	Day	Chapter Name	Category	Marks	Time
21-May-24	Tue	One Shot - Equation	B	4	TBD
23-May-24	Thu	One Shot - Linear Inequalities	B	1	TBD
25-May-24	Sat	One Shot - Ratio, Proportion, Indices, Logarithm	B	6	TBD
26-May-24	Sun	One Shot - Sequence and Series	B	4	TBD
28-May-24	Tue	Theory hai Zaroori	Special		TBD
30-May-24	Thu	Theory hai Zaroori	Special		TBD
01-Jun-24	Sat	OTM Permutations and Combinations	C	5	TBD
02-Jun-24	Sun	OTM Set Relation Functions	C	4	TBD
04-Jun-24	Tue	OTM Probability	C	6	TBD
06-Jun-24	Thu	OTM Theoretical Distribution	C	5	TBD
08-Jun-24	Sat	OTM Limit Continuity	D		TBD
09-Jun-24	Sun	OTM Calculus	D	4	TBD
11-Jun-24	Tue	Formular Marathon Maths	Special		TBD
13-Jun-24	Thu	Formular Marathon Stats	Special		TBD

ab mushkil nahi kuch bhi,
nahi kuch bhi

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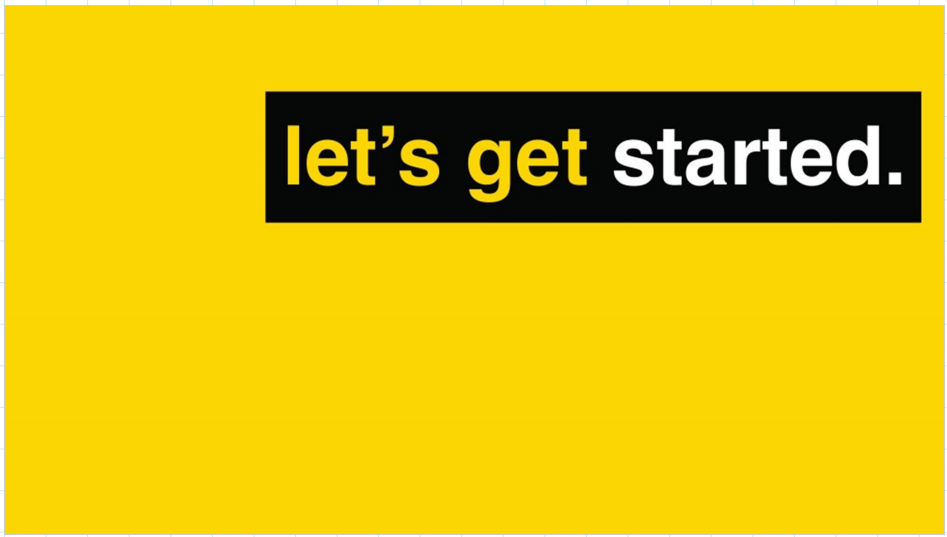


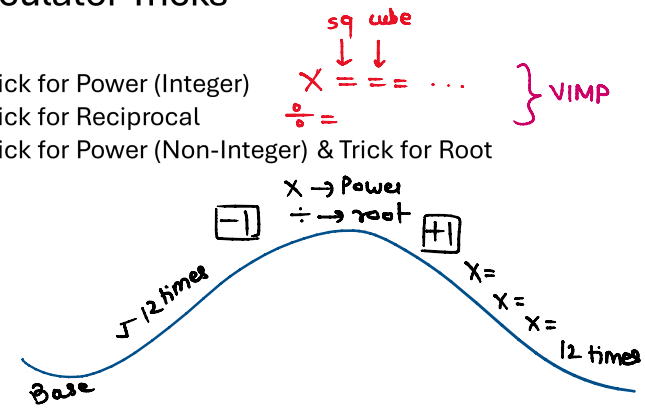
Chapter 4 – Maths for Finance

Past Trends

Attempt	*SI & CI*	*Annuity and Other*	*Total*
May 2018	*3*	*3*	*6*
Nov 2018	*11*	*3*	*14*
Jun 2019	*7*	*3*	*10*
Nov 2019	*10*	*3*	*10*
Nov 2020	*7*	*7*	*14*
Jan 2021	*10*	*4*	*14*
Jul 2021	*6*	*7*	*13*
Dec 2021	*4*	*3*	*7*
Jun 2022	*2*	*8*	*10*
Dec 2022	*8*	*6*	*14*
June 2023	*7*	*7*	*14*

Calculator Tricks

- Trick for Power (Integer)
- Trick for Reciprocal
- Trick for Power (Non-Integer) & Trick for Root



CA FOUNDATION QUANTITATIVE APTITUDE | MATHS FOR FINANCE

PP

(2) Evaluate $(1.63)^{12}$

a. 573.38 b. 122790.4

c. 351.76 d. None

CA FOUNDATION QUANTITATIVE APTITUDE | MATHS FOR FINANCE

PP

(5) Find the value of x if $x = \frac{500}{(1.02)^5}$

a. 362 b. 552.04

c. 452.8 d. None

PP

(6) Evaluate $(1.02)^{4.8}$

a. 1.048 b. 1.099

c. 1.153 d. None

$(1.02)^{4.8}$

1.02 √ 12 times −1 ×4.8 +1 X= X= X=.. 12 times

PP

(7) Calculate $\sqrt[5]{7}$

a. 1.475 b. 2.64

c. 16807 d. None

$\sqrt[5]{7} = 7^{1/5}$

7 √ 12 times −1 ÷5 +1 X= X= 12 times

Simple Interest

- Formula of SI: $$SI = \frac{P.r.t}{100}$$

  where,
  P = principal value, r = rate of interest per annum, t = time in years

- Formula of Amount as per SI

$$A = P + SI$$

$$A = P + \frac{P.r.t}{100} = P(1 + \frac{rt}{100})$$

- Special Points: Interest p.a. is constant, No Interest on earned interest, difference between amount of any two consecutive years is equal to interest of one year

ICAI SM

(8) *Simple interest on ₹ 3500 for 3 years at 12% per annum is*

a. ₹ 1200 *b.* ₹ 1260

c. ₹ 2260 *d.* ₹ 2000

P = ? SI

ICAI SM

(9) *The sum required to earn a monthly interest of Rs 1200 at 18% per annum Simple Interest is*

a. ₹ 50,000 *b.* ₹ 60,000

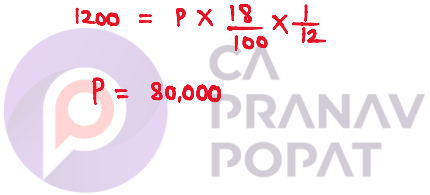
c. ₹ 80,000 *d.* none of these

t = 1 month = 1/12 years

$SI = P \times \frac{r}{100} \times t$

$1200 = P \times \frac{18}{100} \times \frac{1}{12}$

$P = 80{,}000$



MTP Nov 18

(10) *What principal will amount to ₹ 370 in 6 years at 8% p.a. at simple interest*

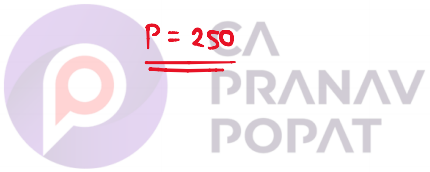
a. ₹ 210 *b.* ₹ 250

c. ₹ 310 *d.* ₹ 310

$A = P\left(1 + \frac{rt}{100}\right)$

$370 = P\left(1 + \frac{8}{100} \times 6\right)$

$P = 250$

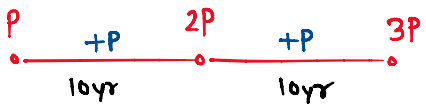


MTP May 19

(11) *A certain money doubles itself in 10 years when deposited on simple interest. It would triple itself in*

a. 30 years b. 20 years ✓

c. 25 years d. 15 years



CA PRANAV POPAT

ICAI SM

(12) *A sum of money amounts to ₹6,200 in 2 years and ₹7,400 in 3 years. The principal and rate of interest are*

✓ a. 3800, ~~3.57%~~ 31.57% b. 3000, 20%

c. 3500, 15% d. None

$A_2 = 6200$
$A_3 = 7400$
SI p.a. = 1200

6200 − 1200 − 1200 = 3800

3800 × 31.57%
= 1199.66
≈ 1200

CA PRANAV POPAT

P

MTP May 20

(13) *A sum of ₹ 46,875 was lent out at simple interest and at the end of 1 year 8months the total amount was ₹ 50,000. Find the rate of interest percent per annum.*

a. 5% A b. 6%

✓ c. 4% d. 8%

t r = ?

12m + 8m = 20m

$\frac{20m}{12}$

$3125 = 46875 \times \frac{r}{100} \times \frac{20}{12}$

r = 4%

CA PRANAV POPAT

PYQ June 22

(14) *In how much time a sum of amount doubles at simple interest at 12.5% rate?*

a. *7 years* ✓b. *8 years*

c. *9 years* d. *10 years*

$r = 12.5\%$

$A = 2P$

$2P = P\left(1 + \frac{12.5}{100} \times t\right)$

$1 = \frac{12.5}{100} \times t$

$t = 8$ years

CA PRANAV POPAT

MTP Oct 21

(16) *1A sum of money gets doubled in 5 years at X% simple interest. If the interest was Y%, the sum of money would have become ten-fold in thirty years. What is Y – X (in %)*

✓a. *10* b. *5*

c. *8* d. *none of these*

rate = X% $A = 2P$ $P\left(1 + \frac{X}{100} \times 5\right) = 2P$

$1 + \frac{5X}{100} = 2$, $X = 20\%$

rate = Y% $A = 10P$ $P\left(1 + \frac{Y}{100} \times 30\right) = 10P$

$1 + \frac{30Y}{100} = 10$, $Y = 30\%$

CA PRANAV POPAT

MTP Nov 18

(20) *The simple interest of P % for P years will be ₹ P on a sum of :*

a. *₹ p / 100*

✓b. $₹ \frac{100}{p}$

c. $₹ \left(\frac{p}{100} + 1\right)$

d. $₹ \left(\frac{100}{p} - 1\right)$

$r = P\%$, $t = P$ years, $SI = ₹ P$

Principal = ?

$SI = \text{Principal} \times \frac{\text{rate}}{100} \times \text{time}$

$P = \text{Principal} \times \frac{P}{100} \times P$

$\text{Principal} = \frac{100 \times P}{P^2} = \frac{100}{P}$

CA PRANAV POPAT

$t = ?$

MTP March 22

(21) *How much time would the simple interest on a certain sum be 0.125 times the principal at 10% per annum*

✓a. $1\frac{1}{4}$ *years* $\frac{5}{4} = 1.25$ b. $1\frac{3}{4}$ *years*

c. $2\frac{1}{4}$ *years* d. $2\frac{3}{4}$ *years*

$SI = 0.125\,P$

$SI = 0.125P$

$P \times \frac{10}{100} \times t = 0.125P$

$t = \frac{0.125 \times 100}{10} = 1.25$ years

CA PRANAV POPAT

PYQ June 19

(17) *In simple interest if the principal is ₹ 2,000 and the rate and time are the roots of the equation $x^2 - 11x + 30 = 0$ then simple interest is*

a. ₹ 500 *b.* ₹ 600 ✓

c. ₹ 700 *d.* ₹ 800

$x^2 - 11x + 30 = 0$

$x^2 - 6x - 5x + 30 = 0$

$x = 6, \; x = 5$

$\frac{2000 \times 6 \times 5}{100} = ₹600$

CA PRANAV POPAT

Compound Interest

- **Approach:** Interest is calculated on accumulated balance, Interest on previously earned interest is also taken, Interest keeps increasing every subsequent period
- **Convsersion Period:** Period for which interest is computed, interest and time period is adjusted according to conversion period
- **Formula of Amount as per CI:**

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

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

where,

P = Initial Principal, i = adjusted interest rate, n = no. of periods

- **Trick to find Amount as per CI**

$P + i\% + i\% + \ldots n \text{ times}$

Suitable when value of n is small ✓

Compound Interest

- **Formula of CI (Direct)**

$$CI = A - P$$
$$CI = P(1+i)^n - P$$
$$CI = P[(1+i)^n - 1]$$

CI = P [(1+i)^n - 1]

where,
P = initial principal, i = adjusted interest rate, n = no. of periods

- **Formula of Effective Rate**

$$E = [(1+i)^n - 1]$$

- **Formula for Scrap Value under WDV Dep**

$$A = P(1-i)^n$$

where, P = Historical Cost of Asset, A = Scrap Value/ Residual value of asset, n = no. of periods, i = Depreciation %

CA FOUNDATION QUANTITATIVE APTITUDE | MATHS FOR FINANCE

P r = 10% ICAI SM

(24) ₹2000 is invested at annual rate of interest of 10%. What is the amount after two years if compounding is done (a) Annually (b) Semi-annually (c) Quarterly (d) Monthly

t = 2 yrs

a. 2420, 2605, 2436.8, 2440.58
b. 2200, 2605, 2183.7, 2366.48
c. ✓ 2420, 2431, 2436.8, 2440.58
d. 2420, 2431, 2436.8, 2496.68

	a	b	c	d
i	10%	5%	2.5%	10/12 %
n	2	4	8	24

a) $A = 2000(1.1)^2 = 2420$ 2000 + 10% + 10%

b) $A = 2000(1.05)^4 = 2431$ 2000 + 5% + 5% + 5% + 5%

c) $A = 2000(1.025)^8 = 2436.8$

d) $A = 2000\left(1 + \frac{10\%}{12}\right)^{24} = 2440.78$

} calculator not suitable

CA PRANAV POPAT

CA FOUNDATION QUANTITATIVE APTITUDE | MATHS FOR FINANCE

PYQ Nov. 18

(25) A man deposited ₹ 8,000 in a bank for 3 years at 5% per annum compound interest, after 3 years he will get

a. ₹ 8,800
✓ b. ₹ 9,261
c. ₹ 9,200
d. ₹ 9,000

compounding → silent → annually

$8000(1.05)^3 = 9261$

CA PRANAV POPAT

PYQ Nov. 18

(27) If ₹ 10,000 is invested at 8% per year compounded quarterly, then the value of the investment after 2 years is:
(Given $(1+0.02)^8 = 1.171659$)

a. ₹ 11,716.59 b. ₹ 10,716.59
c. ₹ 117.1659 d. None of these

$i = \frac{8}{4} = 2\%$ $n = 2 \times 4 = 8$

$A = (1.02)^8 \times 10,000 =$

PYQ Nov. 20

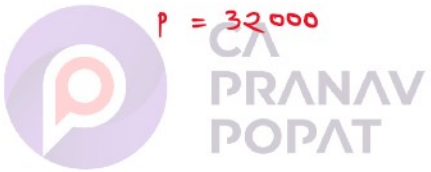
(29) On what sum will the compound interest at 5% per annum for 2 years compounded annually be ₹ 3,280.

a. ₹ 32,000 b. ₹ 16,000
c. ₹ 48,000 d. ₹ 64,000

$CI = 3280$

$P[(1.05)^2 - 1] = 3280$

$P = 32000$



PYQ Nov. 20

(31) An amount is lent at a nominal rate of 4.5% per annum compounded quarterly. What would be the gain in rupees over when compounded annually?

a. 0.56 b. 0.45
c. 0.076 d. 0.85

4.5% p.a. comp annually

$E = 4.5\%$

4.5% p.a. comp quarterly

$E = [(1+i)^n - 1]$

$= \left[\left(1 + \frac{4.5\%}{4}\right)^4 - 1\right]$

$= 4.5765\%$

4.5000
4.5765
gain 0.0765%

PYQ Nov. 19

(32) *Scrap value of a machine valued at ₹ 10,00,000, after 10 years within depreciation at 10% p.a.:*

a. ✓	₹ 3,48,678.44	b.	₹ 3,84,679.45
c.	₹ 4,00,000	d.	₹ 3,00,000

$A = P(1-i)^n$

$A = 10{,}00{,}000\,(1-0.1)^{10} = 348678$

CA FOUNDATION QUANTITATIVE APTITUDE | MATHS FOR FINANCE

PYQ Jan. 21

(33) *The population of a town increase by 2% of the population at the beginning of the year. The number of year by which the total increases in population would be 40% is:*

a.	7 years
b.	10 years
c. ✓	17 years
d.	19 years (approx.)

Pop increase 2% CI

$P \longrightarrow 1.4P$

$A = 1.4P$

$P(1.02)^n = 1.4P$

$(1.02)^n = 1.4$

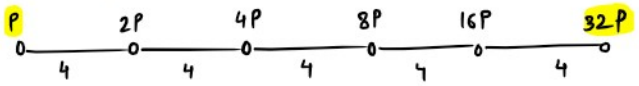
$n = 17$

CA FOUNDATION QUANTITATIVE APTITUDE | MATHS FOR FINANCE

PYQ Dec 22

(34) *A sum of money invested of compound interest double itself in four years. In how many years it become 32 times of itself at the same rate of compound interest?*

a.	12 years	b.	16 years
c. ✓	20 years	d.	24 years



20 years

CI

PYQ Nov. 18

(37) *If compound interest on a sum for 2 years at 4% per annum is ₹ 102, then the simple interest on the same sum for the same period at the same rate will be*

a. ₹ 99 b. ₹ 101

c. ✓ ₹ 100 d. ₹ 95

$CI = P[(1+i)^n - 1]$

$102 = P[(1.04)^2 - 1] \Rightarrow P = 1250$

$SI = 1250 \times 4\% \times 2 = 100$

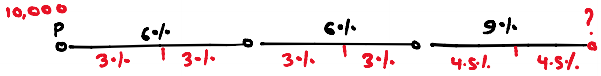
CA PRANAV POPAT

MTP May 20

(42) *The compound interest on half-yearly rests on ₹ 10,000 the rate for the first and second years being 6% and for the third year 9% p.a. is*

a. ₹ 2,200 b. ₹ 2,287

c. ₹ 2,285 d. ✓ ₹ 2290.84

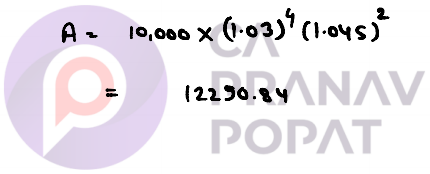


$10,000 + 3\% + 3\% + 3\% + 3\% + 4.5\% + 4.5\%$

$A = 12290 \qquad CI = 2290$

$A = 10,000 \times (1.03)^4 (1.045)^2$

$= 12290.84$



CA PRANAV POPAT

PYQ June 19

(38) *A sum was invested for 3 years as per C.I. and the rate of interest for first year is 9%, 2nd year is 6% and 3rd year is 3% p.a. respectively. Find the sum if the amount in three years is ₹ 550?*

a. ₹ 250 b. ₹ 300

c. ✓ ₹ 462.16 d. ₹ 350

$A = P(1+i_1)(1+i_2)(1+i_3)$

$550 = P(1.09 \times 1.06 \times 1.03)$

$P = 462.16$

CA PRANAV POPAT

ICAI SM

(41) The annual birth rates per 1,000 are 39.4 and 19.4 respectively. The number of years which the population will be doubled assuming there is no immigration or emigration is

a. 35 years b. 30 years
c. 25 years d. none of these

Cal of rate

pop inc rate = $\frac{39.4}{1000} - \frac{19.4}{1000} = \frac{20}{1000}$

$= \frac{2}{100} = 2\%$

$A = 2P$

$P(1.02)^n = 2P \Rightarrow (1.02)^n = 2$

$n = 35$

CA PRANAV POPAT

Single Cashflow vs Annuity

- **Single:** If single amount is deposited initially and interest is compounded on that for a period and in the end we get final value
- Installments: If amount is paid in parts then it is installments
- Annuity: Installment which follows below three conditions are considered as annuity
  i. Constant Amount
  ii. Regularly
  iii. Finite Period of Time
- Annuity Due/ Immediate: If installments starts at the beginning of the period or today
- Annuity Regular: If installments starts at the end of the period
- If que is silent, we take annuity regular

Future Value

- Future Value of Single Cashflow Formula:

$$FV = CF(1+i)^n$$

where, CF = single cashflow for which FV is to be calculated, i = adjusted interest rate, n = no. of periods

- Future Value of Annuity Regular Formula:

factor

$$FVAR = A_i \times FVAF(n,i)$$

$$FVAR = A_i \times \left\{\frac{[(1+i)^n - 1]}{i}\right\} \qquad \left[\frac{(1+i)^n - 1}{i}\right]$$

*where, **FVAR** = Future Value of Annuity Regular, A_i = Annuity Value (Installment), **FVAF** = Future Value Annuity Factor, **i** = adjusted interest rate, **n** = no. of periods*

Future Value

- Future Value of Annuity Due Formula:

$$FVAD = A_i \times FVAF(n,i) \times (1+i)$$

$$FVAD = A_i \times \left\{ \frac{[(1+i)^n - 1]}{i} \right\} \times (1+i)$$

***where, FVAD**= Future Value of Annuity Due, **A_i** = Annuity Value (Installment), **FVAF** = Future Value Annuity Factor, **i** = adjusted interest rate, **n** = no. of periods*

Present Value

- Present Value of Single Cashflow Formula:

$$PV = \frac{CF}{(1+i)^n}$$

CF × $\frac{1}{(1+i)^n}$

where, CF = Single Cashflow for which PV is to be calculated, i = adjusted interest rate, n = no. of periods

- Compounding & Discounting Factors

Compounding (Adding the interest)	$\times(1+i)^n$
Discounting (Removing the interest)	$\times\frac{1}{(1+i)^n}$

Present Value

- Present Value of Annuity Regular Formula:

$$PVAR = A_i \times PVAF(n,i)$$

$$PVAR = A_i \times \left[\frac{1}{i} \times \left\{ 1 - \frac{1}{(1+i)^n} \right\} \right]$$

***where, PVAR** = Present Value of Annuity Regular, **A_i** = Annuity Value (Installment), **PVAF** = Present Value Annuity Factor, **i** = adjusted interest rate, **n** = no. of periods*

- PVAF Calci Trick $\boxed{1+i}\boxed{\div}\boxed{=}\boxed{=}\ldots n-times\boxed{GT}$
- Present Value of Annuity Due Formula: starting today n = 10

$$PVAD = \left[A_i \times PVAF\{(n-1),i\} \right] + A_i$$

ICAI SM

(46) *You invest ₹ 3000 in a two year investment that pays you 12% per annum. Calculate the future value of the investment.*

a.	*3360*	*b.*	*3900*
c.	*3720*	*d.*	*3763.2* ✓

$FV = CF \times (1+i)^n$

$= 3000 \times (1.12)^2 = 3763.2$

PYQ Nov. 20

(47) *Find the future value of annuity of ₹ 1,000 made annually for 7 years at interest rate of 14% compounded annually. Given that* $1.14^7 = 2.5023$

a. ✓	*10,730.7*	*b.*	*5,365.35*
c.	*8,756*	*d.*	*9,892.34*

$FVAR = A_I \times FVAF(n,i)$

$= 1000 \times \frac{(1.14)^7 - 1}{0.14} = 10730.5$

annuity due *PYQ Dec 22*

(48) *Raju invests ₹ 20,000 every year in a deposit scheme starting from today for next 12 years. Assuming that interest rate on this deposit is 7% per annum compounded annually. What will be the future value of this annuity? Given that* $(1+0.07)^{12} = 2.25219159$.

a.	*₹ 540,526*	*b.* ✓	*₹ 382,813*
c.	*₹ 643,483*	*d.*	*₹ 357,769*

$FVAD = 20{,}000 \times \frac{(1.07)^{12} - 1}{0.07} \times (1.07)$

$= 382813$

PYQ Jun 23

(49) *A company want to replace its existing tool room machine at the end of 10 years, the expected cost of machine would be ₹ 10,00,000. If management of the company creates a sinking fund, how much provision needs to be made out of revenue each year which can earn at the rate of 10% compounded annually?*

a. ₹ 74,625 b. ₹ 72,514
c. ₹ 62,745 d. ₹ 67,245

FVAR after 10yrs = 10,00,000

$$FVAR = A_I \times \frac{(1+i)^n - 1}{i}$$

$$10,00,000 = A_I \times \frac{(1.1)^{10} - 1}{0.1}$$

$$A_I = 62745$$

PYQ Nov. 20

(50) *Find the present value of ₹ 1,00,000 to be required after 5 years if the interest rate be 9% . Given that $1.09^5 = 1.5386$*

a. 78,995.98 b. 64,994.15
c. 88,992.43 d. 93,902.12

$$CF \times \frac{1}{(1+i)^n}$$

$$100,000 \times \frac{1}{(1.09)^5} = 64993$$

1.09 X = = = = ÷ = × 100,000

100,000 ÷ 1.09 = = = = =

PYQ Nov. 20

(51) *₹ 2,500 is paid every year for 10 years to pay off a loan. What is the loan amount if interest rate be 14% per annum compounded annually?*

a. ₹ 15,847.90 b. ₹ 13,040.27
c. ₹ 14,674.21 d. ₹ 16,345.11

Total repaym = 2500 × 10 = 25000

Principal Int

PVAR = A_I × PVAF (n,i)

$$= 2500 \times \frac{1}{i}\left[1 - \frac{1}{(1+i)^n}\right]$$

$$= 2500 \times \frac{1}{0.14}\left[1 - \frac{1}{(1.14)^{10}}\right]$$

$$= 2500 \times 5.21611 = 13040$$

(1+i) ÷ = n times GT

1.14 ÷ = = 10 times GT

PYQ June 22

(52) *Anshika took a loan of ₹ 1,00,000 @ 8% for 5 years. What amount will she pay if she wants to pay the whole amount in five equal installments?*

a. ₹ 25,045.63 b. ₹ 26,045.68
c. ₹ 28,045.50 d. None of these

Loan = 100,000 i = 8% n = 5

A_I = ?

PVAR = A_I × PVAF (n,i)

1.08 ÷ = = = = =

GT

$A_1 = ?$

÷ = = = = =

GT

PVAR = A_1 × PVAF(n,i)

100,000 = A_1 × PVAF(5, 8%)

100,000 = A_1 × 3.99271

A_1 = 25045.6

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PYQ Jun 23

(53) *Govinda's mother decides to gift him ₹ 50,000 every year starting from today for the next five years. Govinda deposits this amount in a bank as and when he receives and gets 10% per annum interest rate, compounded annually. What is the present value of this annuity? Given P(4,0.10) = 3.16987.*

due

PVAD

a. ₹ 2,80,493.5 b. ₹ 2,08,493.5

c. ₹ 2,08,943.5 @10% d. ₹ 2,58,493.5

Year	Installm	PV of Installm	
0	50,000	50,000 →	50,000 → same
1	50,000	50,000 ÷ (1.1) =	45454
2	50,000	50,000 ÷ (1.1) = =	41322
3	50,000	50,000 ÷ (1.1) = = =	37566
4	50,000	50,000 ÷ (1.1) = = = =	34151
5	–		208493

discounting

[50,000 × PVAF (4,10%)] + 50,000

(50,000 × 3.1698) + 50,000 = 208493

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MTP May 19

(54) *Y bought Motor Bike Costing 80,000 by making down payment of ₹ 30000 and agreeing to make annual payment for four years. How much would be each payment if the interest on unpaid amount be 14% compounded annually. [Given P (4, 0.14) = 2.91371]*

a. ₹ 17160.25 b. ₹ 17600.25

c. ₹ 15600.25 d. ₹ 16600.25

cost 80,000

down paym 30,000

Loan 50,000

50,000 = A_1 × PVAF (4, 14%)

A_1 = 17160

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MTP Jun 23 Series II

(55) *The amount of an annuity due consisting of 15 annual payments invested at 8% effective is ₹ 10,000. Find the size of each payment.*

a. ₹ 873.86 b. ₹ 108.60
c. ₹ 341.01 d. None of these

FVAD = 10,000

$$10{,}000 = A_I \times \frac{(1.08)^{15}-1}{0.08} \times (1.08)$$

$$A_I = 341.01$$

CA PRANAV POPAT

ICAI SM

(57) *A person invests ₹ 500 at the end of each year with a bank which pays interest at 10% p.a C.I. annually. The amount standing to his credit one year after he has made his yearly investment for the 12th time is. [Given $(1.1)^{12} = 3.1384$]*

a. ₹ 11,761.36 b. ₹ 10,000
c. ₹ 12,000 d. none of these

FVAR at 12th year end $= 500 \times \frac{(1.1)^{12}-1}{0.1} = 10692$

Amt after one year $= 10692 + 10\% = 11761$

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Application of Math for Finance

- Leasing: Here PV of Lease Rentals are compared with cost of asset to make decisions

lessor (owner) lessee (use)

- Capital Expenditure Decisions: Here PV of future benefits are compared with purchase value of asset to decide whether to purchase or not
- Valuation of Bond:
  - *Present value of **interest income** and **maturity value** is compared with the issue price of bond*
  - *Terms*

Bond	*It is a debt security. Type of loan taken by company from public. Like debentures*
Face Value/ Par Value	*Value written on the document of bond. This value is used to calculate Interest Amount*
Issue Price	*Actual payment made to purchase the bond*
Maturity Value	*Amount to be received on redemption or maturity of bond*

Bond → Benefits
- annuity: every year interest → PV (PVAR)
- single: maturity value at the end → PV (single CF)

issue price — compare — PV of Total benefit

Other Concepts

- Present Value of Perpetuity: $PVP = \frac{A_i}{i}$

Installm.
- constant
- regular
- infinite → perpetual

where, PVP = Present Value of Perpetuity, A_i = Annuity Value (Installment), i = adjusted interest rate

$$PVP = \frac{A_I}{i}$$

- Present Value of Growing Perpetuity

(Instalment), i = adjusted interest rate

PVP = $\frac{A_I}{i}$

- Present Value of Growing Perpetuity

Installm

$$PVGP = \frac{A_i}{i-g}$$

– growing installm
– regular
– infinite

where,
PVGP = Present Value of Growing Perpetuity; A_I = Annuity Value (Installment); i = adjusted interest rate; g = growth rate

g > i PV not possible

PVG = $\frac{A_I}{i-g}$

Other Concepts

- Net Present Value

Formula	*NPV = Present Value of Cash Inflows – Present Value of Cash Outflows*
Decision Base	*If NPV ≥ 0, accept the proposal, If NPV < 0, reject the proposal*

- Real Rate = Nominal Rate – Inflation
- CAGR – Compounded Annual Growth Rate – It is the rate used to show annual growth as per CI

CA FOUNDATION QUANTITATIVE APTITUDE| MATHS FOR FINANCE

MTP Nov 19

(58) *A company is considering proposal of purchasing a machine either by making full payment of ₹ 4000 or by leasing it for four years at an annual rate of ₹ 1250. Which course of action is preferable if the company can borrow money at 14% compounded annually? [P (4,0.14) = 2.9137]*

a. *leasing is not preferable*
b. *leasing is preferable*
c. *cannot determined*
d. *none of these*

purchase
4000

lease
1250 for 4 years @ 14%

PV of lease rent = 1250 × PVAF (4, 14%)
= 3642.14

cheaper option

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PYQ June 19

(59) *A person wants to lease out a machine costing ₹ 5,00,000 for a 10 year period. It has fixed a rental of ₹ 51,272 per annum payable annually starting from the end of first year. Suppose rate of interest is 10% per annum compounded annually on which money can be invested. To whom this agreement is favourable?*

a. Favour of Lessee
b. Favour of Lessor
c. Not for both
d. Can't be determined

cost
500,000

PV of lease rents
51272 × PVAF (10, 10%)
= 315044

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lessor

PYQ June 22

(60) *ABC Ltd. Wants to lease out an asset costing ₹3,60,000 for a five year period. It has a fixed rental of ₹ 1,05,000, per annum payable annually starting from the end of first year. Suppose rate of interest is 14% per annum compounded annually on which money can be invested by the company. Is this agreement favourable to the company.*

a. Yes *b. No*
c. It depends *d. None of these*

cost
360,000

PV of lease rent
105000 × PVAF (5, 14%)
= 360474
(gain)

$\frac{1}{0.14}\left[1-\frac{1}{(1.14)^5}\right]$

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CA FOUNDATION QUANTITATIVE APTITUDE | MATHS FOR FINANCE

MTP May 19 Series II, ICAI SM

(61) *A machine can be purchased for ₹ 50,000. Machine will be contributing ₹ 12,000 per year for the next five years. Assuming borrowing cost is 10% per annum. Determine whether machine should be purchased or not*

a. Should be purchased
b. Should not be purchased
c. Can't say about purchase
d. none of the above

cost 50,000

PV of future benefits
$12000 \times \frac{1}{0.1}\left[1-\frac{1}{(1.1)^5}\right]$
= 45489

CA PRANAV POPAT

MTP Jun 23 – Series I

(62) *A machine with useful life of 7 years costs ₹ 10,000 while another machine with useful life of 5 years costs ₹ 8000. The first machine saves labour expenses of ₹ 1900 annually and the second one saves labour expenses of ₹ 2200 annually. Determine the preferred course of action. Assume cost of borrowing as 10% compounded per annum.*

a. *1st machine should be purchased*
b. *2nd machine should be purchased* ✓
c. *Information is not sufficient*
d. *None of these*

Machine 1

cost 10,000

benefit (PV) 1900 × PVAF(7, 10%) = 9250

Machine 2

cost 8000

benefit (PV) = 2200 × PVAF(5, 10%) = 8340

gain 340

ICAI SM

(63) *An investor intends purchasing a three year ₹1,000 par value bond having nominal interest rate of 10%. At what price the bond may be purchased now if it matures at par and the investor requires a rate of return of 14%?*

a. *₹ 907.125* ✓
b. *₹ 1033.54*
c. *₹ 945.67*
d. *None of these*

face value = 1000 Bond Int rate = 10%

Maturity at par = 1000

Rate of return = discounting rate = 14%

Benefits

(1) 1000 × 10% = 100 p.a. for 3 years (annuity) — PV: 100 × PVAF(3, 14%) = 232.1632

(2) 1000 at 3rd year end (single) — $\frac{1000}{(1.14)^3}$ = 674.97

907.1332

MTP Dec 2022 Series II

(64) *A ₹1000 bond paying annual dividends at 8.5% will be redeemed at par at the end of 10 years. Find the purchase price of this bond if the investor wishes a yield rate of 8%*

a. *₹ 907.135*
b. *₹ 1033.54* ✓
c. *₹ 945.67*
d. *None of these*

FV = 1000 Int rate 8.5% Maturity value = 1000

Benefit

(1) 1000 × 8.5% = 85 p.a. for 10 years — PV: 85 × PVAF(10, 8%) = 570.3569

(2) 1000 at 10th year end — $\frac{1000}{(1.08)^{10}}$ = 463.19

Total PV 1033.54

PYQ June 19

(65) Determine the present value of perpetuity of ₹ 50,000 per month @ rate of interest 12% p.a. is _____

a. ₹ 45,00,000 b. ₹ 50,00,000
c. ₹ 55,00,000 d. ₹ 60,00,000

$i = \frac{12\%}{12} = 1\%$ $A_1 = 50{,}000$

$PVP = \frac{50{,}000}{1\%} = 5{,}000{,}000$

PYQ Nov. 20

(66) A stock pays annually an amount of ₹ 10 from 6th year onwards. What is the present value of the perpetuity, if the rate of return is 20%?

a. 20.1 b. 19.1
c. 21.1 d. 22.1

$1+i = 1+20\% = 1.2$

5yr end

Y_0 Y_1 Y_2 Y_3 Y_4 Y_5 Y_6 Y_7

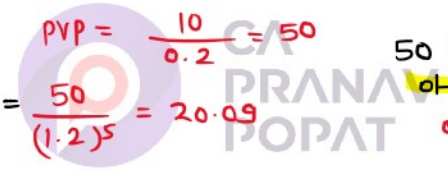
today 50

10 10 10 10 10 ..... ∞

$PVP = \frac{10}{0.2} = 50$

50 is PV as of beginning of 6th year i.e. ending of 5th year

Y_0 value $= \frac{50}{(1.2)^5} = 20.09$



MTP Dec 22 – Series I

(68) Assuming that the discount rate is 7% p.a. How much would you pay to receive ₹ 500. Growing at 5% annually forever?

a. ₹ 2500 b. ₹ 5000
c. ₹ 7500 d. ₹ 25000

$g = 5\%$ $i = 7\%$ $A_1 = 500$

$PVGP = \frac{500}{0.07 - 0.05} = \frac{500}{0.02} = 25000$

$i > g$

MTP Nov 21

(69) *If the cost of capital be 12% per annum, then the Net Present Value (in nearest Rs.) from the given cash flow is given as ₹ in thousands*

Year	0	1	2	3
Operating profit	(100)	60	40	50

21.048 × 1000

a. ₹ 34,048 b. ₹ 34,185
c. ₹ 51,048 d. ✓ ₹ 21,048

i = 12% NPV = ?

Year	Cashflow	PV of cashflow
0 (outflow)	(100)	(100)
1 (inflow)	60	60 ÷ 1.12 =
2	40	40 ÷ 1.12 = =
3	50	50 ÷ 1.12 = = =

PV of cash outflow = 100
PV of cash inflow = 121.048
NPV = 121.048 − 100 = 21.048

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MTP Oct 21

(70) *The nominal rate of growth is 17% and inflation is 9% for the five years. Let P be the Gross Domestic Product (GDP) amount at the present year then the projected real GDP after 6 years is*

a. ✓ 1.587P b. 1.921 P
c. 1.403 P d. 2.51 P

real growth rate = 17 − 9 = 8% real

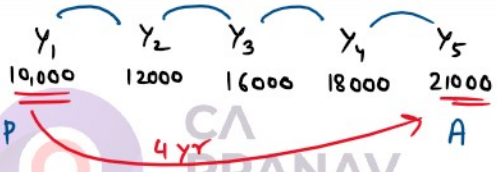
GDP at 6th year end = $P(1.08)^6 = P \times 1.5868$

CA FOUNDATION QUANTITATIVE APTITUDE | MATHS FOR FINANCE

PYQ Jun 23

(71) *Ms. Paul invested ₹ 1,00,000 in a mutual fund scheme in January 2018. After one year in January 2019, she got a dividend amounting to ₹ 10,000 for first year, ₹ 12,000 for second year, ₹ 16,000 for third year, ₹ 18,000 for fourth year and ₹ 21,000 for fifth year in January 2023. What is Compounded Annual Growth Rate (CAGR) of dividend return? Given $1.2038^4 = 2.1$.*

a. ✓ 20.38% b. 18.59%
c. 16.36% d. 15.89%



$21000 = 10,000(1+i)^4$

i = 20.38%

ICAI SM

(74) *Johnson left ₹ 1,00,000 with the direction that it should be divided in such a way that his minor sons Tom, Dick and Harry aged 9, 12 and 15 years should each receive equally after attaining the age 25 years. The rate of interest being 3.5%, how much each son receive after getting 25 years old?*

a. 50,000 b. 51,994
c. 52,000 d. None

	Current age	till 25	Amt received	PV of Amt
T	9	16	x	$x \div (1.035)^{16}$
D	12	13	x	$x \div (1.035)^{13}$
H	15	10	x	$x \div (1.035)^{10}$
				100,000

$x\,(0.5767 + 0.639 + 0.7089) = 100{,}000$

$x = 51947$

ICAI SM

(75) *Appu retires at 60 years receiving a pension of 14,400 a year paid in half-yearly installments for rest of his life after reckoning his life expectation to be 13 years and that interest at 4% p.a. is payable half-yearly. What single sum is equivalent to his pension?*

a. 1,45,000 b. 1,44,900
c. 1,44,800 d. 1,44,700

$A_I = \frac{14400}{2} = 7200 \quad i = \frac{4\%}{2} = 2\% \quad n = 13 \times 2 = 26$

$PVAR = 7200 \times PVAF(26, 2\%)$

$= 7200 \times \frac{1}{0.02}\left[1 - \frac{1}{(1.02)^{26}}\right]$

$= 7200 \times 20.1210$

$= 144871$