Marathon 1

CA Nishant Kumar

NISH10

Schedule

Date (Day)	Topic
12-06-2023 (Monday)	Time Value of Money
13-06-2023 (Tuesday)	Logical Reasoning
14-06-2023 (Wednesday)	Measures of Central Tendency and Dispersion
15-06-2023 (Thursday)	Ratio, Proportion, Indices, Logarithms; Linear Inequalities
16-06-2023 (Friday)	Equations; Statistical Description of Data
17-06-2023 (Saturday)	Sequence and Series
18-06-2023 (Sunday)	Sets, Relations, and Functions
19-06-2023 (Monday)	Correlation and Regression
20-06-2023 (Tuesday)	Index Numbers
21-06-2023 (Wednesday)	Permutations and Combinations
22-06-2023 (Thursday)	Probability
23-06-2023 (Friday)	Theoretical Distributions

Highlights

Conceptual Revision

Question Based Revision

Last Day Preparation Tips

Questions to Revise on the day before ExamQuizzes

Chapter 4 – Time Value of Money

Interest

Simple Interest

Compound Interest
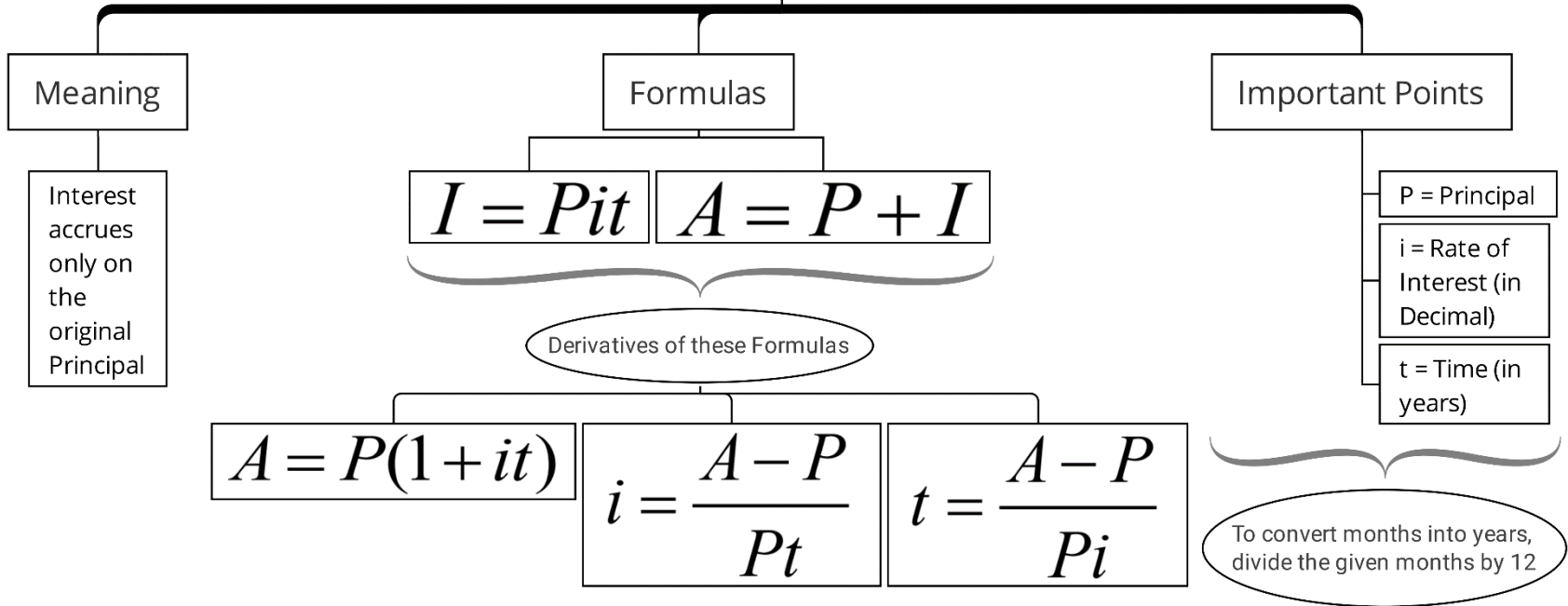
Questions on Simple Interest

Question 1 – ICAI SM

Sania deposited ₹50,000 in a bank for two years with the interest rate of 5.5% p.a. What will be the final value of investment?

(a) ₹55,800   (b) ₹5,500   (c) ₹55,500   (d) ₹5,800

Question 2 – ICAI SM

The sum required to earn a monthly interest of ₹1,200 at 18% p.a. SI is:

 (a) ₹50,000 (b) ₹60,000 (c) ₹80,000 (d) None

Question 3

₹8,000 becomes ₹10,000 in 1 year 8 months at simple interest. The amount that will become ₹6,875 in 2 years 7 months at the same rate of interest is:

(a) ₹4,850   (b) ₹5,000   (c) ₹4,955   (d) ₹5,275

Question 4 – ICAI SM

$P = ₹8,500$, $A = ₹10,200$, $R = 12½\%$ SI, t will be:

(a) 1 year 7 months   (b) 2 years   (c) 1½ year   (d) None

Question 5 – MTP December, 2021

A 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

Question 6 – MTP November, 2019

A person deposited a sum of ₹10,000 in a bank. After 2 years, he withdrew ₹4,000 and at the end of 5 years, he received an amount of ₹7,900; then the rate of simple interest is:

(a) 6%   (b) 5%   (c) 10%   (d) None

Question 7 – May, 2018; MTP June, 2021

A person borrows ₹5,000 for 2 years at 4% p.a. simple interest. He immediately lends to another person at 6¼% p.a. for 2 years. Find his gain in the transaction per year.

 (a) ₹112.50   (b) ₹125   (c) ₹225   (d) ₹167.50

Question 8 – June, 2011; MTP June, 2021

If a simple interest on a sum of money at 6% p.a. for 7 years is equal to twice of simple interest on another sum for 9 years at 5% p.a., the ratio will be:

  (a) 2 : 15   (b) 7 : 15   (c) 15 : 7   (d) 1 : 7

Question 9 – MTP June, 2021

A sum of money amounts to ₹20,800 in 5 years and ₹22,720 in 7 years. Find the principal and rate of interest.

 (a) ₹5,000; 6%   (b) ₹16,000; 6%   (c) ₹80,000; 8%   (d) ₹10,000; 10%

Question 10 – MTP June, 2021

Two equal sums were lent out at 7% and 5% simple interest respectively. The interest earned on the two loans adds upto ₹960 for four years. Find the sum lent out.

(a) ₹4,000   (b) ₹3,000   (c) ₹5,000   (d) ₹6,000

Question 11 – MTP November, 2019

A trust fund has invested ₹30,000 in two different types of bonds which pays 5% and 7% interest respectively. Determine how much amount is invested in each type of bond if trust obtains an annual total interest of ₹1,600.

(a) ₹5,000   (b) ₹6,000   (c) ₹7,000   (d) ₹8,000

Question 12 – December, 2022

A farmer borrowed ₹3,600 at the rate of 15% simple interest per annum. At the end of 4 years, he cleared this account by paying ₹4,000 and a cow. The cost of the cow is:

(a) ₹1,000   (b) ₹1,200   (c) ₹1,550   (d) ₹1,760

Question 13 – July, 2021

A certain sum amounts to ₹15,748 in 3 years at simple interest at $r\%$ p.a. The same sum amounts to ₹16,510 at $(r+2)\%$ p.a. simple interest in the same time. What is the value of r?

(a) 10% (b) 8% (c) 12% (d) 6%

Question 14 – December, 2021

An amount is lent at R% simple interest for R years and the simple interest amount was one-fourth of the principal amount. Then R is _____.

(a) 5 (b) 6 (c) 5½ (d) 6½

Compound Interest

Meaning

Interest is calculated not only on the original Principal, but also on the interest accrued on it.

Formulas

$$A = P \left(1 + \frac{i}{NOCPPY}\right)^{t \times NOCPPY}$$

$$CI = P \left[\left(1 + \frac{i}{NOCPPY}\right)^{t \times NOCPPY} - 1\right]$$

Important Points

NOCPPY = No. of Conversion Periods Per Year	
Compounded Annually	NOCPPY = 1
Compounded Semi-Annually	NOCPPY = 2
Compounded Quarterly	NOCPPY = 4
Compounded Monthly	NOCPPY = 12

$n = t \times NOCPPY$

Questions on Compound Interest

Question 15 – July, 2021

A sum of ₹x amounts to ₹27,900 in 3 years and to ₹41,850 in 6 years at a certain rate percent per annum, when the interest is compounded yearly. The value of x is:

(a) 16,080 (b) 18,600 (c) 18,060 (d) 16,800

Question 16 – ICAI SM

Mr. X borrowed ₹5,120 at 12½% p.a. C.I. At the end of 3 years, the money was repaid along with the interest accrued. The amount of interest paid by him is:

(a) ₹2,100   (b) ₹2,170   (c) ₹2,000   (d) None

Question 17 – ICAI SM

If A = ₹1,000; n = 2 years; R = 6% p.a. compound interest payable half-yearly, then Principal (P) is:

(a) ₹888.50   (b) ₹885   (c) ₹800   (d) None

Question 18 – ICAI SM

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) ₹2,290.84

Question 19 – ICAI SM

On what sum will the compound interest at 5% p.a. for two years compounded annually be ₹1,640?

(a) ₹2,200   (b) ₹1,487.53   (c) ₹16,000   (d) None

Question 20 – ICAI SM

What annual rate of interest compounded annually doubles an investment in 7 years? Given that $2^{\frac{1}{7}} = 1.104090$.

  (a) 11.41%   (b) 10%   (c) 10.41%   (d) None

Question 21 – ICAI SM

The population of a town increases every year by 2% of the population at the beginning of that year. The number of years by which the total increase of population be 40% is:

(a) 7 years   (b) 10 years   (c) 17 years (approx.)   (d) None

Question 22 – ICAI SM

The annual birth and death rates per 1,000 are 39.4 and 19.4 respectively. The number of years in 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

Question 23 – ICAI SM

$A = ₹5,200$, $R = 5\%$ p.a., $T = 6$ years, P will be

(a) ₹2,000   (b) ₹3,880   (c) ₹3,000   (d) None

Question 24 – MTP December, 2020

A man borrows ₹4,000 from a bank at 10% compound interest. At the end of every year ₹1,500 as part of repayment of loan and interest. How much is still owed to the bank after three such instalments [Given: $(1.1)^3 = 1.331$]

(a) ₹359   (b) ₹820   (c) ₹724   (d) ₹720

Question 25 – December, 2022

A trust fund has invested ₹27,000 money in two schemes 'A' and 'B' offering compound interest at the rate of 8% and 9% per annum respectively. It the total amount of interest accrued through these two schemes together in two years was ₹4,818.30, what was the amount invested in scheme 'A'?

(a) ₹12,000 (b) ₹12,500 (c) ₹13,000 (d) ₹12,500

Question 26 – December, 2022

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) 18 years

Compound Interest

Applications

Depreciation

Important Points
- Principal = Cost of Machine
- Amount = Scrap Value
- Rate of Depreciation has to be written in negative

Effective Rate of Interest

Meaning

Ignoring the compounding of Annually/ Semi-Annually/ Quarterly/ Monthly, etc., what is the actual rate of interest which will fetch you the effective interest in a year

Formula

$$E = \left(1 + \frac{i}{NOCPPY}\right)^{t \times NOCPPY} - 1$$

Difference between CI and SI

Formula

$$CI - SI = P\left[\left\{(1+i)^t - 1\right\} - it\right]$$

Questions Based on Depreciation

Question 27 – MTP December, 2020

A Machine was purchased for ₹10,000. Its rate of depreciation is 10% in the first year and 5% per annum afterwards. Find the depreciated value of Machine after 7 years of purchase. $\left\{Given:(0.95)^6 = 0.7351\right\}$

(a) ₹6,606   (b) ₹6,616   (c) ₹6,660   (d) ₹6,661

Question 28 – December, 2022

A machine worth ₹4,90,740 is depreciated at 15% on its opening value each year. When its value would reduce to ₹2,00,750?

(a) 5 years 5 months (b) 5 years 6 months (c) 5 years 7 months (d) 5 years 8 months

Question 29 – ICAI SM

A machine worth ₹4,90,740 is depreciated at 15% of its opening value each year. When its value would reduce by 90%?

(a) 11 years 6 months

(b) 11 years 7 months

(c) 11 years 8 months

(d) 14 years 2 months

Questions Based on Difference Between Compound Interest and Simple Interest

Question 30 – June, 2006; MTP June, 2021

The difference between the simple and compound interest on a certain sum for 3 years at 5% p.a. is ₹228.75. The compound interest on the sum for 2 years at 5% p.a. is:

 (a) ₹3,175   (b) ₹3,075   (c) ₹3,275   (d) ₹2,975

Question 31 – MTP December, 2020

The difference between simple interest and compound interest on a sum of ₹6,00,000 for two years is ₹6,000. What is the annual rate of interest?

(a) 8%   (b) 10%   (c) 6%   (d) 12%

Question 32 – July, 2021

What is the difference (in ₹) between the simple interest and the compound interest on a sum of ₹8,000 for $2\frac{2}{5}$ years at the rate of 10% p.a., when the interest is compounded yearly?

(a) 136.12   (b) 129.50   (c) 151.75   (d) 147.20

Questions Based on Effective Rate of Interest

Question 33 – ICAI SM

Which is a better investment 3% per year compounded monthly or 3.2% per year simple interest? Given that $(1 + 0.0025)^{12} = 1.0304$.

(a) Compound Interest   (b) Simple Interest   (c) Don't Know   (d) None
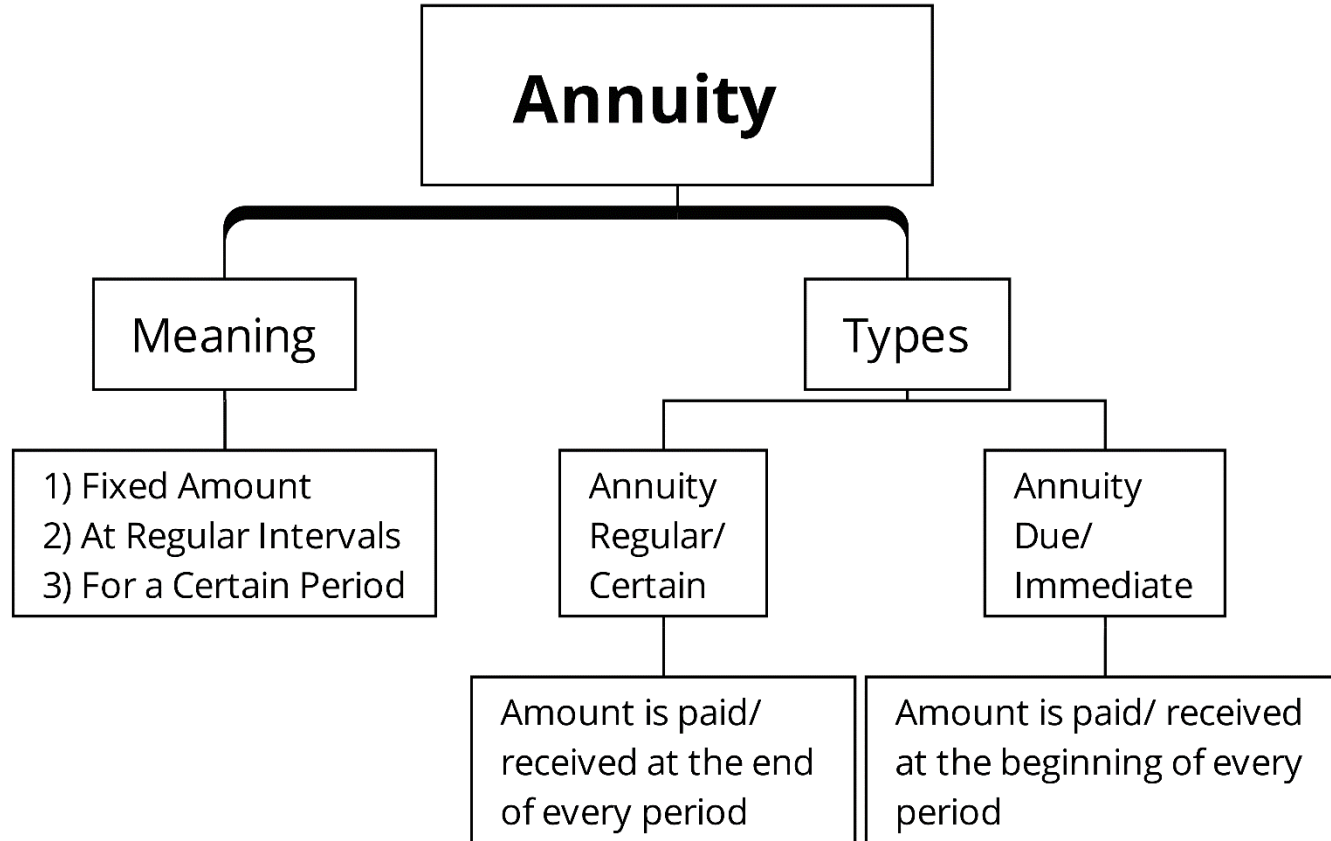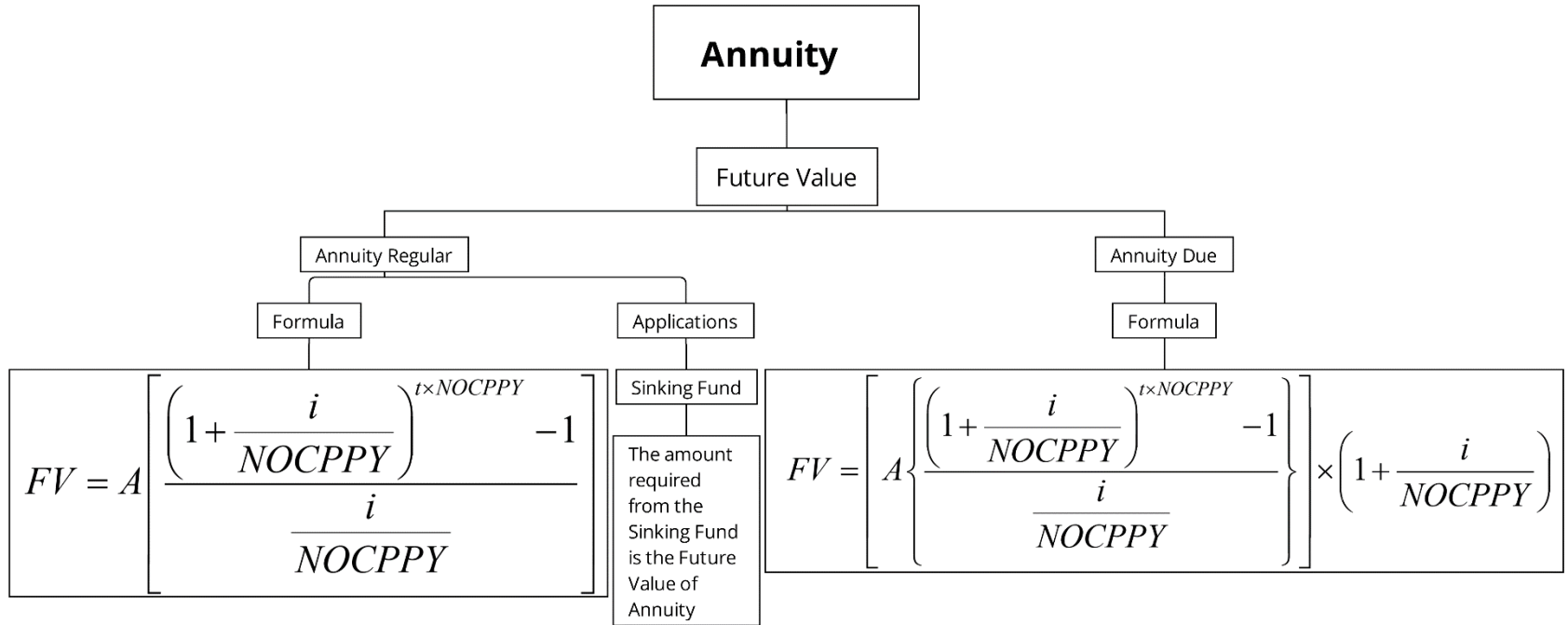
Questions Based on Future Value of Annuity

Question 34 – June, 2022

Ankit invests ₹3,000 at the end of each quarter receiving interest @ 7% per annum for 5 years. What amount will be received at the end of the period?

  (a) ₹71,200.20   (b) ₹71,104.83   (c) ₹73,204.83   (d) None

Question 35 – ICAI SM; MTP May, 2019

₹200 is invested at the end of each month in an account paying interest 6% per year compounded monthly. What is the future value of this annuity after 10th payment? Given that $(1.005)^{10} = 1.0511$.

(a) ₹2,047   (b) ₹2,046   (c) ₹2,044   (d) ₹2,045

Question 36 – MTP November, 2019

At six months' intervals A deposited ₹1,000 in a savings account which credits interest at 10% p.a., compounded semi-annually. The first deposit was made when A's son was 6 months old and last deposit was made when his son was 8 years old. The money remained in the account and was presented to the son on his 10th birthday. How much did he receive? $((1.06)^{16} = 2.1829)$

(a) ₹25,740   (b) ₹23,740   (c) ₹25,860   (d) ₹25,760

0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000				
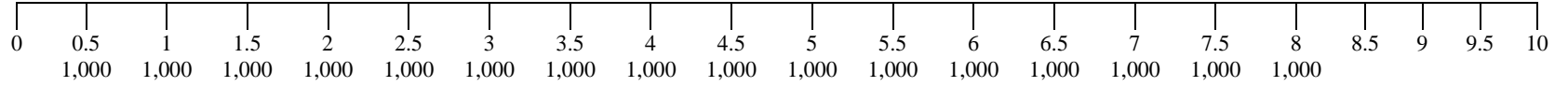
Question 37 – December, 2022

How much amount is required to be invested every year so as to accumulate ₹5,00,000 at the end of 12 years if interest is compounded annually at 10% {Where A(12, 0.1) = 21.384284}

(a) ₹23,381.65   (b) ₹24,385.85   (c) ₹26,381.65   (d) ₹28,362.75

Question 38 – ICAI SM

A machine costs ₹5,20,000 with an estimated life of 25 years. A sinking fund is created to replace it by a new model at 25% higher cost after 25 years with a scrap value realization of ₹25,000. What amount should be set aside every year if the sinking fund investments accumulate at 3.5% compound interest p.a.?

(a) ₹16,000   (b) ₹16,500   (c) ₹16,050   (d) ₹16,005

Question 39 – December, 2022

Sinking fund factor is the reciprocal of:

(a) Present value interest factor of a single cash flow
(b) Present value interest factor of an annuity
(c) Future value interest factor of an annuity
(d) Future value interest factor of a single cash flow.

Question 40 – December, 2022

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 $(1 + 0.07)^{12} = 2.25219150$

  (a) ₹5,40,576   (b) ₹3,82,813   (c) ₹6,43,483   (d) ₹3,57,769

Question 41 – ICAI SM

Raja aged 40 wishes his wife Rani to have ₹40 lakhs at his death. If his expectation of life is another 30 years and he starts making equal annual investments commencing now at 3% compound interest p.a. how much should he invest annually?

(a) ₹84,448   (b) ₹84,450   (c) ₹84,449   (d) ₹84,080

Present Value

Annuity Regular

Formula

$$PV = A \left[\frac{\left(1 + \dfrac{i}{NOCPPY}\right)^{t \times NOCPPY} - 1}{\dfrac{i}{NOCPPY} \times \left(1 + \dfrac{i}{NOCPPY}\right)^{t \times NOCPPY}} \right]$$

Annuity Due

Formula

PV of Annuity Due = Initial Receipt/ Payment + PV of Annuity Regular for (n - 1) periods

Questions Based on Present Value

Question 42 – ICAI SM

The present value of ₹10,000 due in 2 years at 5% p.a. compound interest when the interest is paid on half-yearly basis is ₹_____.

(a) ₹9,070   (b) ₹9,069   (c) ₹9,061   (d) None

Questions Based on Present Value of Annuity Regular

Question 43 – MTP June, 2023

Find the present value of an ordinary annuity of 8 quarterly payments of ₹500 each, the rate of interest being 8% p.a. compound quarterly.
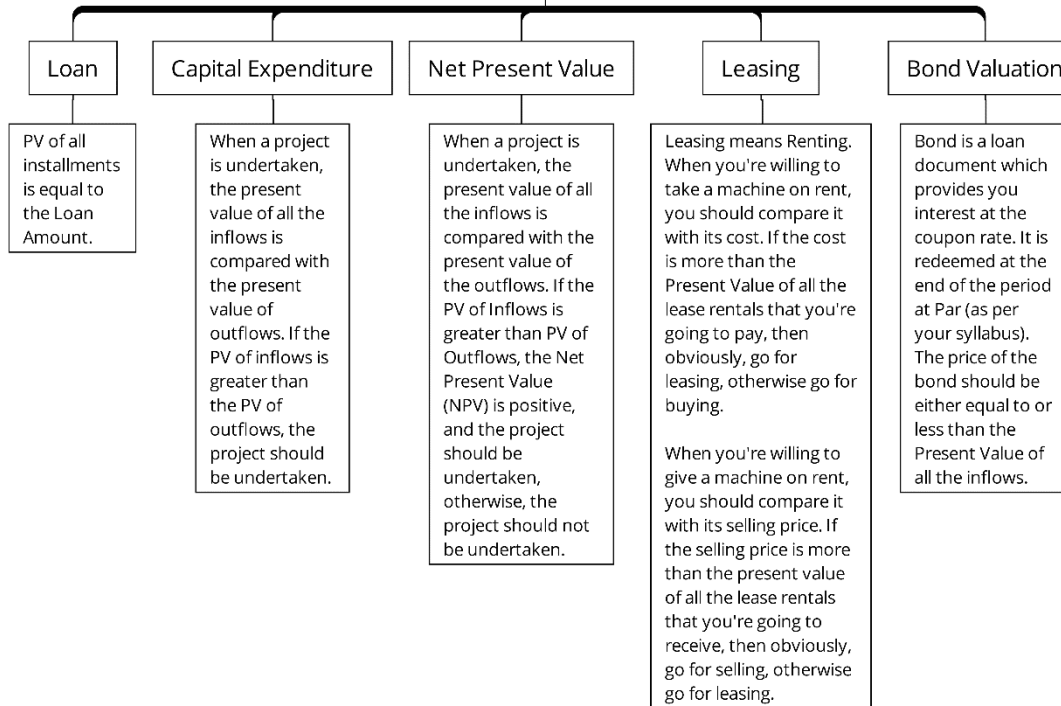
(a) 4275.00　　　　(b) 4725.00　　　　(c) 3662.50　　　　(d) 3266.50

Applications of Present Value of Annuity Regular

Loan
PV of all installments is equal to the Loan Amount.

Capital Expenditure
When a project is undertaken, the present value of all the inflows is compared with the present value of outflows. If the PV of inflows is greater than the PV of outflows, the project should be undertaken.

Net Present Value
When a project is undertaken, the present value of all the inflows is compared with the present value of the outflows. If the PV of Inflows is greater than PV of Outflows, the Net Present Value (NPV) is positive, and the project should be undertaken, otherwise, the project should not be undertaken.

Leasing
Leasing means Renting. When you're willing to take a machine on rent, you should compare it with its cost. If the cost is more than the Present Value of all the lease rentals that you're going to pay, then obviously, go for leasing, otherwise go for buying.

When you're willing to give a machine on rent, you should compare it with its selling price. If the selling price is more than the present value of all the lease rentals that you're going to receive, then obviously, go for selling, otherwise go for leasing.

Bond Valuation
Bond is a loan document which provides you interest at the coupon rate. It is redeemed at the end of the period at Par (as per your syllabus). The price of the bond should be either equal to or less than the Present Value of all the inflows.

Questions Based on Applications of Present Value of Annuity Regular

Question 44 – June, 2022

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

(a) ₹15,841.90   (b) ₹13,040.27   (c) ₹14,674.21   (d) ₹14,010.90

Question 45 – ICAI SM

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

Question 46 – MTP December, 2021

A took a loan from B. The loan is to be repaid in annual installments of ₹2,000 each. The first instalment is to be paid three years from today and the last one is to be paid 8 years from today? What is the value of loan today, using a discount rate of eight percent?

(a) ₹9,246   (b) ₹7,927   (c) ₹8,567   (d) None

Question 47 – July, 2021

A loan of ₹1,02,000 is to be paid back in two equal annual instalments. If the rate of interest is 4% p.a., compounded annually, then the total interest charged (in ₹) under this instalment plan is:

(a) 6,160   (b) 8,120   (c) 5,980   (d) 7,560

Question 48 – ICAI SM; MTP June, 2023

Mr. Paul borrows ₹20,000 on condition to repay it with C.I. at 5% p.a. in annual installments of ₹2,000 each. The number of years for the debt to be paid off is:

(a) 10 years   (b) 12 years   (c) 11 years   (d) 14.2 years

Question 49 – ICAI SM

A man purchased a house valued at ₹3,00,000. He paid ₹2,00,000 at the time of purchase and agreed to pay the balance with interest at 12% per annum compounded half yearly in 20 equal half-yearly instalments. If the first instalment is paid after six months from the date of purchase then the amount of each instalment is:

(a) ₹8,718.45   (b) ₹8,769.21   (c) ₹7,893.13   (d) None

Question 50 – ICAI SM; MTP May, 2020

A person bought a house paying ₹20,000 cash down and ₹4,000 at the end of each year for 25 yrs. at 5% p.a. C.I. The cash down price is:

[Given $(1.05)^{25} = 3.386355$]

(a) ₹75,000   (b) ₹76,000   (c) ₹76,375.80   (d) None

Question 51 – MTP December, 2021

Arun purchased a vacuum cleaner by giving ₹1700 as cash down payment, which will be followed by five EMIs of ₹480 each. The vacuum cleaner can also be bought by paying ₹3900 cash. What is the approx. rate of interest p.a. (at simple interest) under this instalment plan?

(a) 18% (b) 19% (c) 22% (d) 20%

Question 52 – MTP June, 2021

A company is considering proposal of purchasing a machine either by making full payment of ₹4,000 or by leasing it for four years at an annual rate of ₹1,250. Which course of action is preferable if the company can borrow money at 14% compounded annually?

(a) Leasing   (b) Purchasing   (c) Don't Know   (d) None

Question 53 – June, 2019 (Similar)

ABC Ltd. wants to lease out an asset costing ₹3,60,000 for a five-year period. It has fixed a 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) No   (b) Yes   (c) Don't Know   (d) None

Question 54 – MTP June, 2023; ICAI SM

A machine with useful life of seven years costs ₹10,000 while another machine with useful life of five years costs ₹8,000. The first machine saves labour expenses of ₹1,900 annually and the second one saves labour expenses of ₹2,200 annually. Determine the preferred course of action. Assume cost of borrowing as 10% compounded per annum.

(a) First Machine   (b) Second Machine   (c) Don't Know   (d) None

Question 55 – July, 2021

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

Year	0	1	2	3
Operating Profit (in thousand ₹)	(100)	60	40	50

(a) ₹34,048   (b) ₹34,185   (c) ₹51,048   (d) ₹21,048

Question 56 – ICAI SM

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) ₹800.125 (c) ₹729.12 (d) None

Question 57 – MTP June, 2023

Find the purchase price of a ₹1,000 bond redeemable at the paying annual dividends at 4% if the yield rate is to be 5% effective.

(a) ₹884.16   (b) ₹984.17   (c) ₹1,084.16   (d) None

Question 58 – ICAI SM

Suppose your mom decides to gift you ₹10,000 every year starting from today for the next five years. You deposit this amount in a bank as and when you receive and get 10% per annum interest rate compounded annually. What is the present value of this annuity?

(a) ₹91,000   (b) ₹79,489   (c) ₹41,698.70   (d) None

Perpetuity

Normal Perpetuity

Growing Perpetuity

$$\frac{A}{i \ / \ NOCPPY}$$

$$\frac{A}{i - g}$$

Questions Based on Perpetuity

Question 59 – ICAI SM

Ramesh wants to retire and receive ₹3,000 a month. He wants to pass this monthly payment to future generations after his death. He can earn an interest of 8% compounded annually. How much will he need to set aside to achieve his perpetuity goal?

(a) ₹4,30,000   (b) ₹4,50,000   (c) ₹4,20,000   (d) None

Question 60 – July, 2021

If a person bought a house by paying ₹45,00,000 down payment and ₹80,000 at the end of each year till the perpetuity. Assuming the rate of interest as 16% the present value of house (in ₹) is given as:

(a) 47,00,000   (b) 45,00,000   (c) 57,80,000   (d) 50,00,000

Question 61 – December, 2020

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

Question 62 – June, 2022

Assuming that the discount rate is 7% per annum, how much would you pay to receive ₹50, growing at 5%, annually, forever?

(a) ₹4,300   (b) ₹2,500   (c) ₹4,200   (d) None

Miscellaneous Topics

Nominal Rate of Interest

Real Rate + Inflation Rate = Nominal Rate

Compound Annual Growth Rate

Consider the first figure as Principal and the last figure as Amount. Then see how many years have lapsed in between. Find the rate of interest using the formula for Amount that you learned in Compound Interest.

Questions Based on Nominal Rate of Return

Question 63 – ICAI SM

Real Rate of Return = 5%; Inflation Rate = 2%. What is the Nominal Rate of Return?

(a) 7%   (b) 9%   (c) 11%   (d) None

Question 64 – July, 2021

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) 1.921P (c) 1.403P (d) 2.51P

Questions Based on Compound Annual Growth Rate (CAGR)

Question 65 – June, 2022

The CAGR of initial value of an investment of ₹15,000 and final value of ₹25,000 in 3 years is:

(a) 19%   (b) 18.56%   (c) 17.56%   (d) 17%

Question 66 – December, 2022

10 years ago, the earning per share (EPS) of ABC Ltd. was ₹5 share its EPS for this year is ₹22. Compute at what rate, EPS of the company grows annually?

(a) 15.97%   (b) 16.77%   (c) 18.64%   (d) 14.79%

Question 67 – July, 2021

Let the operating profit of a manufacturer for five years is given as:

Years	1	2	3	4	5	6
Operating Profit (in lakh ₹)	90	100	106.4	107.14	120.24	157.34

The Compound Annual Growth Rate (CAGR) of Operating Profit for year 6 with respect to year 2 is:

(a) 9% (b) 12% (c) 11% (d) 13%