1. TIME VALUE OF MONEY (ACADEMIC INTEREST)

NO. OF PROBLEMS IN 41.5E OF CA INTER: CLASSROOM - 18, ASSIGNMENT - 13

NO. OF PROBLEMS IN 42E OF CA INTER: CLASSROOM - 18, ASSIGNMENT - 13

NO. OF PROBLEMS IN 42.5(2nd Version) OF CA INTER: CLASSROOM - 9, ASSIGNMENT - 8

ICAI has dropped this chapter in the new syllabus but without the knowledge of this chapter students cannot understand further chapters properly. Hence we have dropped some problems in this chapter and decided to teach the same to students. No need to prepare this chapter for examination purpose.

MODEL - WISE ANALYSIS OF PREVIOUS EXAMINATIONS

No.	Model Name	M-09 TO N-09	M-10	N-10 TO M-12	N-12	M-13 TO M-15	N-15	M-16	N-16	M-17	N-17	M-18 (O)	M-18 (N)	N-18 (O)	N-18 (N)
1.	Simple Interest	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2.	Compound Interest	-	2	-	5	-	-	-	-	-	-	-	-	-	-
3.	Future Value of Single Amount	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4.	Present Value of Single Amount	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.	Future Value of Annuity immediate	-	-	-	-	-	-	5	-	-	5	-	-	-	-
6.	Present Value of Annuity Immediate	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.	Present Value of Perpetuity	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.	Present Value of Growing Perpetuity	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SIGNIFICANCE OF EACH PROBLEM COVERED IN THIS MATERIAL

Problem No. in this Material	Problem No. in NEW SM	Problem No. in OLD SM	Problem No. in OLD PM	RTP	MTP	Previous Exams	Remarks
CR 1	-	ILL-2	-	-	-		
CR 2	-	-	3	-	-	-	
CR 3	-	-	-		-	-	
CR 4			-	-	-	-	
CR 5	-	-	-	N16	N16	-	
CR 6		ILL-15		-	-	-	
CR 7	-	-	-	-	-	-	
CR 8	-	-		-	-	-	
CR 9	-	-	-	-		-	
ASG 1	-	-	6	-	-	-	
ASG 2			-	-	-	-	
ASG 3			-	-	-	-	
ASG 4	-	-	-	-		-	
ASG 5	-	ILL-6			-	-	
ASG 6	-	ILL-16			-	-	
ASG 7	-	ILL-19	-	-	-	-	
ASG 8	-	ILL-20	-	-	-	-	

TIME VALUE OF MONEY:

a) The basic concept in Finance is Time Value of Money which means that "One rupee today is not equal to one rupee tomorrow, other things being equal".

b) Time Value of Money means "worth of a rupee received today is different from the worth of a rupee to be received in future".

c) The preference for money now, as compared to future money, is known as Time Preference of Money

d) When individuals or business institutions borrow money from others for certain time period, they pay some extra money other than the borrowed amount which is known as interest. Thus money can also be rented in the same way as objects. It means money has some time value.

e) The money being borrowed by an individual is called 'Principal'.

f) The additional sum of money paid for using money is called 'Interest'. Such interest is usually calculated as a percentage and the interest paid for use of Rs.100 is called "Rate Percent". If this rate percent is calculated for a year, it is called Rate percent per annum.

g) The sum of Principal and Interest is called "Amount".

PROBLEMS FOR CLASSROOM DISCUSSION

MODEL 2: CONCEPT OF COMPOUND INTEREST

COMPOUND INTEREST:

a) It is another method of calculation of interest. Practically everybody will be familiar with this method of calculation of interest.

b) In this method the interest earned by an investment is reinvested so that it also earns interest i.e. interest is again converted into principal and hence one can earn interest on interest.

c) **E.g.:** Suppose that Rs.100 is invested at the rate of 6% compounded annually. At the end of first year the value of investment is the original principal (Rs.100) plus interest on such principal i.e. Rs.106. Now, Rs.106 becomes principal for the second year.

$A = p(1 + r)^n$ $\quad$ $C.I = P[(1 + r)^n - 1]$

Where C.I. = Compound Interest.
A = Amount (principal + Interest)
r = Rate of interest (expressed in decimal form)
n = Number of years
P = Principal sum of money

This formula assumes that interest is compounded annually.

MODEL 3: CALCULATION OF FUTURE VALUE OF A SINGLE AMOUNT

FUTURE VALUE:

a) This is also known as terminal value. The accrued amount (FV_n) on a principal (P) after n payment periods at i (in decimal) rate of interest per payment period is given by:

$$FV_n = P_0(1+i)^n$$ Where, $i = \frac{\text{Annual rate of interest}}{\text{Number of payment periods per year}} = \frac{r}{k}$

$(1+i)^n$ is known as future value factor or compound value factor.

So $FV_n = P_0(FVIF_{i,n})$, when computing is done k times a year at an annual interest rate r.

(or)

$FV_n = P_0(FVIF_{i,n})$, Where, $FVIF_{(i, n)}$ is the future value interest factor at i% for n periods equal $(1+i)^n$.

Computation of FV_n shall be quite simple if we make use of either the calculator or the future value table showing values of $(1+i)^n$.

Note:_____

PROBLEM 1: 2,000 is invested at annual rate of interest of 10%. What is the amount after 2 years if the compounding is done?

a) Annually? b) Semi-annually?

(A) (OLD SM) (ANS.: AMOUNT AFTER 2 YEARS ANNUALLY RS.2,420, SEMI ANNUALLY RS.2,431)

(SOLVE PROBLEM NO.1 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

PROBLEM 2: A company offers a Fixed deposit scheme whereby Rs.10,000 matures to Rs.12,625 after 2 years, on a half-yearly compounding basis. If the company wishes to amend the scheme by compounding interest every quarter, what will be the revised maturity value?

(A) (OLD PM) (ANS.: REVISED MATURITY VALUE RS.12,670)

Note:_____

PROBLEM 3: A nationalized bank issues "Re-investment certificates" for a period of 3 years. If Rs.5,000 are invested in these certificates, their maturity value becomes Rs. 6,725. Assuming that the interest is compounded every year, what is the rate of interest? *(B) (ANS.: RATE OF INTEREST: 10%)*

Note:_____

MODEL 4: CALCULATION OF PRESENT VALUE OF A SINGLE AMOUNT

PRESENT VALUE:

a) It is the current value of a "Future Amount". It can also be defined as the amount to be invested today (Present Value) at a given rate over specified period to equal the "Future Amount".

b) Since finding present value is simply the reverse of finding Future Value (FV), the formula for Future Value (FV) can be readily transformed into a Present Value formula. Therefore the Present Value (P_0), becomes:

$$P_0 = \frac{FV_n}{(1+i)^n} \text{ or } P_0 = FV_n (1+i)^{-n}$$

Where,

FV_n = Future value n years hence

i = Rate of interest per annum

n = Number of years for which discounting is done.

c) Computation of PV_n shall be quite simple if we make use of either the calculator or the Present value table showing values of $(1+i)^{-n}$

Note:

a) The process of computing the present value of future cash flows is called "Discounting".

b) The interest rate used to discount the future cash flow is known as "Discount rate".

c) The expression $1/(1+i)^n$ is called "Discounting factor".

PROBLEM 4: The cost of a new mobile phone is Rs.10,000. If the interest rate is 5 percent, how much would you have to set aside now to provide this sum in five years?

(B) (ANS.: AMOUNT SET A SIDE RS. 7,840) (SOLVE PROBLEM NO.2 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

MODEL 5: CALCULATION OF AMOUNT OF ANNUITY / FV OF ANNUITY IMMEDIATE

ANNUITY:

a) An annuity is a stream of regular periodic payments made or received for a specified period of time. In an ordinary annuity, payments or receipts occur at the end of each period. The interval is generally year, but it may be half year, quarter or month.

b) In fact, annuity means an installment. L.I.C Premium, Deposits into a recurring account, loan installments of homes or automobiles are examples of Annuities.

NOTE:

a) The size of each payment of an annuity is called **"Periodic payment".**

b) Time interval between 2 successive payment dates of an Annuity is called" Payment Period" or **"Payment Interval".**

c) Total time period is called **"Term of Annuity".**

d) An annuity which is payable forever is called **"Perpetuity".**

e) Present value of an annuity is equal to sum of present values of all installments.

f) The total worth of all payments at the conclusion of annuity is called Amount of Annuity.

g) The accumulated sum of series of periodic deposits invested for replacement of an asset or for liquidation of a loan is called "Sinking Fund".

FV OF AN ANNUITY: Future value or Amount of Annuity is the sum of future values of each individual payment at the end of each Year.

$$FVA_n = R(FVIFA_{i,n})$$

$$FVAn = R\frac{(1+i)^n - 1}{i}$$

Where,

FVA_n = Future value annuity,

R = Constant Periodic flow,

$FVIFA_{(i,n)}$ = Future value interest factor of an annuity at i % for n period.

(or)

Computation of future value of an annuity (FVAn) shall be quite simple if we make use of either the calculator or the future value annuity table $FVIFA_{(i,n)}$.

Note:

a) It is assumed that each periodic payment is made at the end of each year/ period.

b) Future value/ Amount of Annuity is the sum of future values of each individual payment.

c) Please note that the last payment is made at the end of n^{th} year. So, it will not yield any interest.

Note:_____

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PROBLEM 5: Mr. X wish to get her daughter admitted into a medical college after 15 years from now. He will be required total Rs. 25,00,000 to get admission into the college. For this he has identified a fund, which pays interest @ 9% p.a. In this regard he wanted to know the amount to be invested in each of the following situations:

i) If he decides to make annual payment into the fund at the end of each year;

ii) If he decides to invest a lump sum in the fund as on today.

iii) If he decides to make annual payment into the fund at the beginning of each year.

(FVIF/ CVF (15, 0.09) = 3.642, FVIFA/ CVFA (15, 0.09) = 29.361, PVIF/ PVF(15, 0.09) = 0.275 and PVIFA/ PVFA (15, 0.09) = 8.061).

(A) (RTP N16, MTP1 N16) (ANS.: (I) RS. 85,146.96 P.A.; (II). RS. 6,86,436.02; (III). RS.78,117.68 P.A.)

(SOLVE PROBLEM NO.3 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

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MODEL 6: PRESENT VALUE OF ORDINARY ANNUITY/ANNUITY IMMEDIATE

PRESENT VALUE OF AN ORDINARY ANNUITY:

a) It is sum of the present values of Cash flows occur at the end of each period. It represents the amount that must be invested now to purchase the payments due in future.

b) Unless otherwise specified, we assume that each payment is made at the end of each payment period, that is called an "Ordinary Annuity". We also assume that interest is computed at the end of each payment period.

$$PVA_n = R(PVIFA_{i,n})$$

Where,

PVA_n = Present value annuity,

R = Constant Periodic flow

$PVIF_{i,n}$ = Present value interest factor of an annuity at i % for n period.

c) Computation of PV n shall be quite simple if we make use of either the calculator or the Present value annuity table ($PVIFA_{i,n}$).

PROBLEM 6: Find out the Present Value of a 4 year annuity of Rs.20,000 discounted at 10%.

(B) (OLD SM) (ANS.: PRESENT VALUE OF 4Y ANNUITY RS.63,400)
(SOLVE PROBLEM NO.4 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

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PROBLEM 7: A doctor is planning to buy an X-Ray machine for his hospital. He has two options. He can either purchase it by making a cash payment of Rs.5 lakhs or Rs.6,15,000 are to be paid in six equal annual installments. Which option do you suggest to the doctor assuming the rate of return is 12 percent? Present value of annuity of Re.1 at 12 percent rate of discount for six years is 4.111.

(A) (OLD PM) [ANS.: OPT (1)-CASH PAYMENT RS.5,00,000, OPT-(2)- PRESENT VALUE OF ANNUTIY RS.4,21,378, OPT (2) IS BETTER] (SOLVE PROBLEM NO.5 & 6 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

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MODEL 7: PRESENT VALUE OF PERPETUITY

PERPETUITY:

a) Perpetuity is a stream of cash flows for an infinite period.

b) Fixed coupon payments on permanently invested (irredeemable) sums of money are prime examples of perpetuities.

$$PVA\infty = \frac{R}{(1+i)^1} + \frac{R}{(1+i)^2} + \frac{R}{(1+i)^3} + ... + \frac{R}{(1+i)^\infty} = \sum_{n=1}^{\infty} \frac{R}{(1+i)^n} = \frac{R}{i}$$

Where,

R= the payment or receipt each period

i = the interest rate per payment or receipt period

c) If a deposit of Rs.1,000 is made in a savings bank account at 4½% for an indefinite period then the yearly interest of Rs.50 is a perpetuity of interest income so long as the initial deposit of Rs.1,000 is kept unchanged. In order to find out the PV of perpetuity, the present value of each of the infinite number of cash flows should be added. But it is difficult or rather impossible to find out the PV of perpetuity. However, mathematically it can be easily calculated by using following formula:

PV_p = Annual Cash flow/r

Where, PV_p is the present value of perpetuity and r is the rate of interest.

PROBLEM 8: Find out the present value of an investment which is expected to give a return of Rs.2,500 p.a. indefinitely and the rate of interest is 12% p.a.

(B) (ANS.: PRESENT VALUE OF AN INVESTMENT RS.20,833)

(SOLVE PROBLEM NO.7 OF ASSIGNMENT PROBLEMS AS REWORK)

Note:_____

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MODEL 8: PRESENT VALUE OF GROWING PERPETUITY

GROWING PERPETUITY:

a) A stream of cash flows that grows at a constant rate forever is known as growing perpetuity

$$PVA = \frac{R}{(1+i)^1} + \frac{R(1+g)}{(1+i)^2} + \frac{R(1+g)^2}{(1+i)^3} + \ldots\ldots + \frac{R(1+g)^\infty}{(1+i)^\infty} = \sum_{n=1}^{\infty} \frac{R(1+g)^{n-1}}{(1+i)^n} = \frac{R}{i-g}$$

Where,

R = cash flow at the end of first period

i = the interest rate per payment or receipt period

b) A growing perpetuity may be defined as an infinite series of periodic cash flows which grow at a constant rate per period. In such a case present value of perpetuity is calculated as follows:

PV	=	Cash flow / (r - g)
Where cash flow	=	The cash flow at the end of the first period,
r	=	rate of interest,
And, g	=	growth rate in perpetuity amount

c) However, it may be noted that above formula can be used only if the rate of interest is more than the rate of growth i.e. r > g.

PROBLEM 9: A person is going to retire shortly and he wants to maintain his present standard of living he should get a regular income of Rs.50,000 p.a. How much he has to invest now so as to earn interest perpetually. Please note that inflation is growing at the rate of 8%. Investors expected rate of return is 10%. *(A) (ANS.: 5,00,000) (SOLVE PROBLEM NO.8 OF ASSIGNMENT PROBLEMS AS REWORK)*

Note:_____

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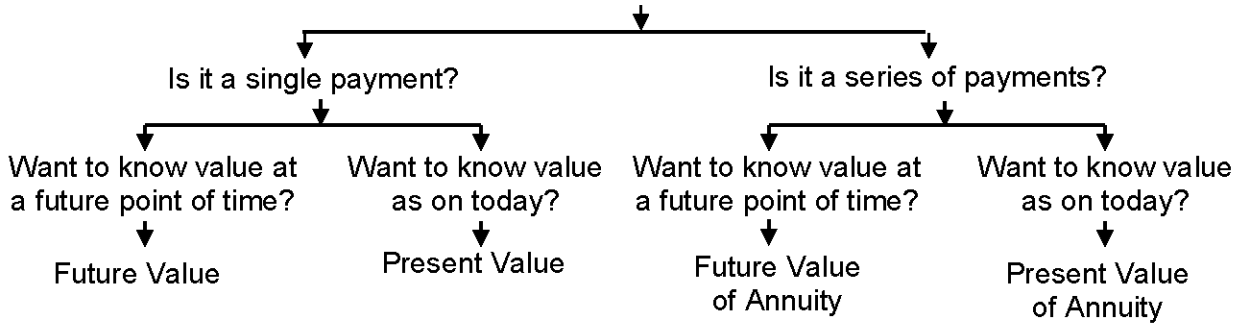
How to identify the nature of problem?



ASSIGNMENT PROBLEMS

MODEL 3: CALCULATION OF FUTURE VALUE OF A SINGLE AMOUNT

PROBLEM 1: X is invested Rs.2,40,000 at annual rate of interest of 10 percent. What is the amount after 3 years if the compounding is done?

1. Annually
2. Semi-annually

(A) (OLD PM) (ANS.: 1) AMOUNT AFTER 3 YEARS ANNUALLY RS.3,19,440 AND 2) SEMI ANNUALLY RS.3,21,624)

MODEL 4: CALCULATION OF PRESENT VALUE OF A SINGLE AMOUNT

PROBLEM 2: John OLD Smith's great uncle has promised to give him Rs.25,000 at the age 21. John will not reach this ripe old age for four more years. Assuming that he can earn 6%, calculate the amount of money that John OLD Smith will receive as of now?

(A) (ANS.: AMOUNT RECEIVE NOW RS. 19,800)

MODEL 5: CALCULATION OF AMOUNT OF ANNUITY / FV OF ANNUITY IMMEDIATE

PROBLEM 3: A finance company advertises that it will pay a lumpsum of Rs.10,000 at the end of 6 years to investors who deposit annually Rs.1,000. What interest rate is implicit in this offer?

(B) (ANS.: INTEREST RATE IS 20% (APP))

MODEL 6: PRESENT VALUE OF ORDINARY ANNUITY/ANNUITY IMMEDIATE

PROBLEM 4: The ABC company expects to receive Rs.1,00,000 p.a. for a period of 10 years from a new project it has just undertaken. Assuming a 10% rate of interest, how much would be the present value of this annuity? *(A) (ANS.: PRESENT VALUE OF ANNUITY RS. 6,14,500)*

PROBLEM 5: Ramanuj has taken a 20 month car loan of Rs. 6,00,000. The rate of interest is 12 per cent per annum. What will be the amount of monthly loan amortization? *(B) (OLD SM) (ANS.: RS.33,249.1)*

PROBLEM 6: Y bought a TV costing Rs. 13,000 by making a down payment of Rs. 3,000 and Agreeing to make equal annual payment for 4 years. How much would be each payment if the interest on unpaid amount be 14% compounded annually? *(B) (OLD SM)(ANS.: RS.3,431.71)*

MODEL 7: PRESENT VALUE OF PERPETUITY

PROBLEM 7: Ramesh wants to retire and receive Rs. 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) (OLD SM) (ANS.: AMOUNT NEED TO SET A SIDE RS.4,52,775)

MODEL 8: PRESENT VALUE OF GROWING PERPETUITY

PROBLEM 8: Assuming that the discount rate is 7% per annum, how much would you pay to receive Rs. 50, growing at 5%, annually, forever? *(B) (OLD SM) (ANS.: AMOUNT PAY RS.2,500)*

APPENDIX-1 (TIME VALUE OF MONEY – TABLE VALUES)

Table A.1 : Compounded Value of a given Amount *i.e.*, $CVF_{(r, n)}$

Period *n*	*1%*	*2%*	*3%*	*4%*	*5%*	*6%*	*7%*	*8%*	*9%*	*10%*
1	1.010	1.020	1.030	1.040	1.050	1.060	1.070	1.080	1.090	1.100
2	1.020	1.040	1.061	1.082	1.102	1.124	1.145	1.166	1.188	1.210
3	1.030	1.061	1.093	1.125	1.158	1.191	1.225	1.260	1.295	1.331
4	1.041	1.082	1.126	1.170	1.216	1.262	1.311	1.360	1.412	1.464
5	1.051	1.104	1.159	1.217	1.276	1.338	1.403	1.469	1.539	1.611
6	1.062	1.126	1.194	1.265	1.340	1.419	1.501	1.587	1.677	1.772
7	1.072	1.149	1.230	1.316	1.407	1.504	1.606	1.714	1.828	1.949
8	1.083	1.172	1.267	1.369	1.477	1.594	1.718	1.851	1.993	2.144
9	1.094	1.195	1.305	1.423	1.551	1.689	1.838	1.999	2.172	2.358
10	1.105	1.219	1.344	1.480	1.629	1.791	1.967	2.159	2.367	2.594
11	1.116	1.243	1.384	1.539	1.710	1.898	2.105	2.332	2.580	2.853
12	1.127	1.268	1.426	1.601	1.796	2.012	2.252	2.518	2.813	3.138
13	1.138	1.294	1.469	1.665	1.886	2.133	2.410	2.720	3.056	3.452
14	1.149	1.319	1.513	1.732	1.930	2.261	2.579	2.937	3.342	3.797
15	1.161	1.346	1.558	1.801	2.079	2.397	2.759	3.172	3.642	4.177
16	1.173	1.373	1.605	1.873	2.183	2.540	2.952	3.426	3.970	4.595
17	1.184	1.400	1.653	1.948	2.292	2.693	3.159	3.700	4.328	5.054
18	1.196	1.428	1.702	2.026	2.407	2.854	3.380	3.996	4.717	5.560
19	1.208	1.457	1.754	2.107	2.527	3.026	3.617	4.316	5.142	6.116
20	1.220	1.486	1.806	2.191	2.653	3.207	3.870	4.661	5.604	6.728
25	1.282	1.641	2.094	2.666	3.386	4.292	5.427	6.848	8.623	10.835
30	1.348	1.811	2.427	3.243	4.322	5.743	7.612	10.063	13.268	17.449

Table A.1 : Compounded Value of a given Amount *i.e.*, $CVF_{(r, n)}$

Period *n*	*11%*	*12%*	*13%*	*14%*	*15%*	*16%*	*17%*	*18%*	*19%*	*20%*
1	1.110	1.120	1.130	1.140	1.150	1.160	1.170	1.180	1.190	1.200
2	1.232	1.254	1.277	1.300	1.322	1.346	1.369	1.392	1.416	1.440
3	1.368	1.405	1.443	1.482	1.521	1.561	1.602	1.643	1.685	1.728
4	1.518	1.574	1.630	1.689	1.749	1.811	1.874	1.939	2.005	2.074
5	1.685	1.762	1.842	1.925	2.011	2.100	2.192	2.288	2.386	2.488
6	1.870	1.974	2.082	2.195	2.313	2.436	2.565	2.700	2.840	2.986
7	2.076	2.211	2.353	2.502	2.660	2.826	3.001	3.185	3.379	3.583
8	2.305	2.476	2.658	2.853	3.059	3.278	3.511	3.759	4.021	4.300
9	2.558	2.773	3.004	3.252	3.518	3.803	4.108	4.435	4.785	5.160
10	2.839	3.106	3.395	3.707	4.046	4.411	4.807	5.234	5.695	6.192
11	3.152	3.479	3.836	4.226	4.652	5.117	5.624	6.176	6.777	7.430
12	3.498	3.896	4.335	4.818	5.350	5.936	6.580	7.288	8.064	8.916
13	3.883	4.363	4.898	5.492	6.153	6.886	7.699	8.599	9.596	10.699
14	4.310	4.887	5.535	6.261	7.076	7.988	9.007	10.147	11.420	12.839
15	4.785	5.474	6.254	7.138	8.137	9.266	10.539	11.974	13.590	15.407
16	5.311	6.130	7.067	8.137	9.358	10.748	12.330	14.129	16.172	18.488
17	5.895	6.866	7.986	9.276	10.761	12.468	14.426	16.672	19.244	22.186
18	6.544	7.690	9.024	10.575	12.375	14.463	16.879	19.673	22.901	26.623
19	7.263	8.613	10.197	12.056	14.232	16.777	19.748	23.214	27.252	31.948
20	8.062	9.646	11.523	13.743	16.367	19.461	23.106	27.393	32.429	38.338
25	13.585	17.000	21.231	26.462	32.919	40.874	50.658	32.669	77.388	95.396
30	22.892	29.960	39.116	50.950	66.212	85.850	111.065	143.371	184.675	237.376

Table A.1 : Compounded Value of a given Amount *i.e.*, $CVF_{(r, n)}$

Period *n*	*21%*	*22%*	*23%*	*24%*	*25%*	*26%*	*27%*	*28%*	*29%*	*30%*
1	1.210	1.220	1.230	1.240	1.250	1.260	1.270	1.280	1.290	1.300
2	1.464	1.488	1.513	1.538	1.562	1.588	1.613	1.638	1.664	1.690
3	1.772	1.816	1.861	1.907	1.953	2.000	2.048	2.097	2.147	2.197
4	2.144	2.215	2.289	2.364	2.441	2.520	2.601	2.684	2.769	2.856
5	2.594	2.703	2.815	2.392	3.052	3.176	3.304	3.436	3.572	3.713
6	3.138	3.297	3.463	3.635	3.815	4.001	4.196	4.398	4.608	4.827
7	3.797	4.023	4.259	4.508	4.768	5.042	5.329	5.629	5.945	6.275
8	4.595	4.908	5.239	5.590	5.960	6.353	6.767	7.206	7.669	8.157
9	5.560	5.987	6.444	6.931	7.451	8.004	8.595	9.223	9.893	10.604
10	6.727	7.305	7.926	8.549	9.313	10.086	10.915	11.806	12.761	13.786
11	8.140	8.912	9.749	10.657	11.642	12.708	13.862	15.112	16.462	17.921
12	9.850	10.872	11.991	13.215	14.552	16.012	17.605	19.343	21.236	23.298
13	11.918	13.264	14.749	16.386	18.190	20.175	22.359	24.759	27.395	30.287
14	14.421	16.182	18.141	20.319	22.737	25.420	28.395	31.961	35.339	39.373
15	17.449	19.742	22.314	25.196	28.422	32.030	36.062	40.565	45.587	51.185
16	21.113	24.084	27.446	31.243	35.527	40.357	45.799	51.923	58.808	66.541
17	25.547	29.384	33.758	38.741	44.409	50.850	58.165	66.461	75.862	86.503
18	30.912	35.848	41.523	48.039	55.511	64.071	73.869	85.071	97.862	112.454
19	37.404	43.735	51.073	59.568	69.389	80.730	93.813	108.890	126.242	146.190
20	45.258	53.357	62.820	73.864	86.736	101.720	119.143	139.380	162.852	190.047
25	117.388	144.207	176.857	216.542	264.698	323.040	393.628	478.905	581.756	705.627
30	304.471	389.748	497.904	634.820	807.793	1025.904	1300.477	1645.504	2078.208	2619.937

Table A.2 : Compound Value of an Annuity *i.e.*, $CVAF_{(r, n)}$

Period *n*	*1%*	*2%*	*3%*	*4%*	*5%*	*6%*	*7%*	*8%*	*9%*	*10%*
1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	2.010	2.020	2.030	2.040	2.050	2.060	2.070	2.080	2.090	2.100
3	3.030	3.060	3.091	3.122	3.152	3.184	3.215	3.246	3.278	3.310
4	4.060	4.122	4.184	4.246	4.310	4.375	4.440	4.506	4.573	4.641
5	5.101	5.204	5.309	5.416	5.526	5.637	5.751	5.867	5.985	6.105
6	6.152	6.308	6.468	6.633	6.802	6.975	7.153	7.336	7.523	7.716
7	7.214	7.434	7.662	7.898	8.142	8.394	8.654	8.923	9.200	9.487
8	8.286	8.583	8.892	9.214	9.549	9.897	10.260	10.637	11.028	11.436
9	9.369	9.755	10.159	10.583	11.027	11.491	11.978	12.448	13.021	13.579
10	10.462	10.950	11.464	12.006	12.578	13.181	13.816	14.487	15.193	15.937
11	11.567	12.169	12.808	13.486	14.207	14.972	15.784	16.645	17.560	18.531
12	12.683	13.412	14.192	15.026	15.917	16.870	17.888	18.977	20.141	21.384
13	13.809	14.680	15.618	16.627	17.713	18.882	20.141	21.495	22.953	24.523
14	14.947	15.974	17.086	18.292	19.599	21.015	22.550	24.215	26.019	27.975
15	16.097	17.293	18.599	20.024	21.579	23.276	25.129	27.152	29.361	31.772
16	17.258	18.639	20.157	21.825	23.657	25.673	27.888	30.324	33.003	35.950
17	18.430	20.012	21.762	23.698	25.840	28.213	30.840	33.750	36.974	40.545
18	19.615	21.412	23.414	25.645	28.132	30.906	33.999	37.450	41.301	45.599
19	20.811	22.841	25.117	27.671	30.539	33.760	37.379	41.446	46.018	51.159
20	22.019	24.297	26.870	29.778	33.066	36.786	40.995	45.762	51.160	57.275
25	28.243	32.030	36.459	41.646	47.727	54.865	63.249	73.106	84.701	98.347
30	34.785	40.568	47.575	56.805	66.439	79.058	94.461	113.283	136.308	164.494

Table A.2 : Compound Value of an Annuity *i.e.*, $CVAF_{(r, n)}$

Period n	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	2.110	2.120	2.130	2.140	2.150	2.160	2.170	2.180	2.190	2.200
3	3.342	3.374	3.407	3.440	3.473	3.506	3.539	3.572	3.606	3.640
4	4.710	4.779	4.850	4.921	4.993	5.066	5.141	5.215	5.291	5.368
5	6.228	6.353	6.480	6.610	6.742	6.877	7.014	7.154	7.297	7.442
6	7.913	8.115	8.323	8.536	8.754	8.977	9.207	9.442	9.683	9.930
7	9.783	10.089	10.405	10.730	11.067	11.414	11.772	12.142	12.523	12.916
8	11.589	12.300	12.757	13.233	13.727	14.240	14.773	15.327	15.902	16.499
9	14.164	14.776	15.416	16.085	16.786	17.518	18.285	19.086	19.923	20.799
10	16.722	17.549	18.420	19.337	20.304	21.321	22.393	23.521	24.709	25.959
11	19.561	20.655	21.814	23.004	24.349	25.733	27.200	28.755	30.404	32.150
12	22.713	24.133	25.650	27.271	29.002	30.850	32.824	34.931	37.180	39.580
13	26.212	28.029	29.985	32.089	34.352	36.786	39.404	42.219	45.244	48.497
14	30.095	32.393	34.883	37.581	40.505	43.672	47.103	50.818	54.841	59.196
15	34.405	37.280	40.417	43.842	47.580	51.660	56.110	60.965	66.261	72.035
16	39.190	42.753	46.672	50.980	55.717	60.925	66.649	72.939	79.850	87.442
17	44.501	48.884	53.739	59.118	65.075	71.673	78.979	87.068	96.022	105.931
18	50.396	55.750	61.725	68.394	75.836	84.141	93.406	103.740	115.266	128.117
19	56.939	63.440	70.749	78.969	88.212	98.603	110.285	123.414	138.166	154.740
20	64.203	72.052	80.947	91.025	102.44	115.380	130.033	146.628	165.418	186.688
25	114.413	133.334	155.620	181.871	212.793	249.214	292.105	342.603	402.042	471.981
30	199.021	241.333	293.199	356.787	434.745	530.321	647.439	790.748	966.712	1181.882

Table A.2 : Compound Value of an Annuity *i.e.*, $CVAF_{(r, n)}$

Period n	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%
1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	2.210	2.220	2.230	2.240	2.250	2.260	2.270	2.280	2.290	2.300
3	3.674	3.708	3.743	3.778	3.813	3.843	3.883	3.918	3.954	3.990
4	5.446	5.524	5.604	5.684	5.766	5.848	5.931	6.016	6.101	6.187
5	7.589	7.740	7.893	8.048	8.207	8.368	8.533	8.700	8.870	9.043
6	10.183	10.442	10.708	10.980	11.259	11.544	11.837	12.136	12.442	12.756
7	13.321	13.740	14.171	14.615	15.073	15.546	16.032	16.534	17.051	17.583
8	17.119	17.762	18.430	19.123	19.842	20.588	21.361	22.163	22.995	23.858
9	21.714	22.670	23.669	24.712	25.802	26.940	28.129	29.369	30.664	32.015
10	27.274	28.657	30.113	31.643	33.253	34.945	36.723	38.592	40.556	42.619
11	34.001	35.962	38.039	40.238	42.566	45.030	47.639	50.399	53.318	56.405
12	42.141	44.873	47.787	50.985	54.208	57.738	61.501	65.510	69.780	74.326
13	51.991	55.745	59.778	64.110	68.760	73.750	79.106	84.853	91.016	97.624
14	63.909	69.009	74.528	80.496	86.949	93.925	101.465	109.612	118.411	127.912
15	78.330	85.191	92.669	100.815	109.687	119.346	129.860	141.303	153.750	167.285
16	95.779	104.933	114.983	126.011	138.109	151.375	165.922	181.868	199.337	218.470
17	116.892	129.019	142.428	157.253	173.636	191.733	211.721	233.791	258.145	285.011
18	142.439	158.403	176.187	195.994	218.045	242.583	269.885	300.252	334.006	371.514
19	173.351	194.251	217.710	244.033	273.556	306.654	343.754	385.323	431.868	483.968
20	210.755	237.986	268.783	303.601	342.945	387.384	437.568	494.213	558.110	630.157
25	554.230	650.944	764.596	898.092	1054.791	1238.617	1454.180	1706.803	2002.608	2348.765
30	1445.111	1767.044	2160.459	2640.916	3227.172	3941.953	4812.891	5873.231	7162.785	8729.805

Table A.3 : Present Value of a given Amount *i.e.* $PVF_{(r, n)}$

Period *n*	*1%*	*2%*	*3%*	*4%*	*5%*	*6%*	*7%*	*8%*	*9%*	*10%*
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826
3	0.971	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751
4	0.961	0.924	0.889	0.855	0.823	0.792	0.763	0.735	0.708	0.683
5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621
6	0.942	0.888	0.838	0.790	0.746	0.705	0.666	0.630	0.596	0.564
7	0.933	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513
8	0.923	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467
9	0.914	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424
10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386
11	0.896	0.804	0.722	0.650	0.585	0.527	0.475	0.429	0.388	0.350
12	0.887	0.788	0.701	0.625	0.557	0.497	0.444	0.397	0.356	0.319
13	0.879	0.773	0.681	0.601	0.530	0.469	0.415	0.368	0.326	0.290
14	0.870	0.758	0.661	0.577	0.505	0.442	0.388	0.340	0.299	0.263
15	0.861	0.743	0.642	0.555	0.481	0.417	0.362	0.315	0.275	0.239
16	0.853	0.728	0.623	0.534	0.458	0.394	0.339	0.292	0.252	0.218
17	0.844	0.714	0.605	0.513	0.436	0.371	0.317	0.270	0.231	0.198
18	0.836	0.700	0.587	0.494	0.416	0.350	0.296	0.250	0.212	0.180
19	0.828	0.686	0.570	0.475	0.396	0.331	0.276	0.232	0.194	0.164
20	0.820	0.673	0.554	0.456	0.377	0.312	0.258	0.215	0.178	0.149
25	0.780	0.610	0.478	0.375	0.295	0.233	0.184	0.146	0.116	0.092
30	0.742	0.552	0.412	0.308	0.231	0.174	0.131	0.099	0.075	0.057

Table A.3 : Present Value of a given Amount *i.e.* $PVF_{(r, n)}$

Period *n*	*11%*	*12%*	*13%*	*14%*	*15%*	*16%*	*17%*	*18%*	*19%*	*20%*
1	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	0.812	0.797	0.783	0.769	0.756	0.743	0.731	0.718	0.706	0.694
3	0.731	0.712	0.693	0.675	0.658	0.641	0.624	0.609	0.593	0.579
4	0.659	0.636	0.613	0.592	0.572	0.552	0.534	0.516	0.499	0.482
5	0.593	0.567	0.543	0.519	0.497	0.476	0.456	0.437	0.419	0.402
6	0.535	0.507	0.480	0.456	0.432	0.410	0.390	0.370	0.352	0.335
7	0.482	0.452	0.425	0.400	0.376	0.354	0.333	0.314	0.296	0.279
8	0.434	0.404	0.376	0.351	0.327	0.305	0.285	0.266	0.249	0.233
9	0.391	0.361	0.333	0.308	0.284	0.263	0.243	0.226	0.209	0.194
10	0.352	0.322	0.295	0.270	0.247	0.227	0.208	0.191	0.176	0.162
11	0.317	0.287	0.261	0.237	0.215	0.195	0.178	0.162	0.148	0.135
12	0.286	0.257	0.231	0.208	0.187	0.168	0.152	0.137	0.124	0.112
13	0.258	0.229	0.204	0.182	0.163	0.145	0.130	0.116	0.104	0.093
14	0.232	0.205	0.181	0.160	0.141	0.125	0.111	0.099	0.088	0.078
15	0.209	0.183	0.160	0.140	0.123	0.108	0.095	0.084	0.074	0.065
16	0.188	0.163	0.141	0.123	0.107	0.093	0.081	0.071	0.062	0.054
17	0.170	0.146	0.125	0.108	0.093	0.080	0.069	0.060	0.052	0.045
18	0.153	0.130	0.111	0.095	0.081	0.069	0.059	0.051	0.044	0.038
19	0.138	0.116	0.098	0.083	0.070	0.060	0.051	0.043	0.037	0.031
20	0.124	0.104	0.087	0.073	0.061	0.051	0.043	0.037	0.031	0.026
25	0.074	0.059	0.047	0.038	0.030	0.024	0.020	0.016	0.013	0.010
30	0.044	0.033	0.026	0.020	0.015	0.012	0.009	0.007	0.005	0.004

Table A.3 : Present Value of a given Amount *i.e.* $PVF_{(r, n)}$

Period *n*	*21%*	*22%*	*23%*	*24%*	*25%*	*26%*	*27%*	*28%*	*29%*	*30%*
1	0.826	0.820	0.813	0.806	0.800	0.794	0.787	0.781	0.775	0.769
2	0.683	0.672	0.661	0.650	0.640	0.630	0.620	0.610	0.601	0.592
3	0.564	0.551	0.537	0.524	0.512	0.500	0.488	0.477	0.466	0.455
4	0.466	0.451	0.437	0.423	0.410	0.397	0.384	0.373	0.361	0.350
5	0.386	0.370	0.355	0.341	0.328	0.315	0.303	0.291	0.280	0.269
6	0.319	0.303	0.289	0.275	0.262	0.250	0.238	0.227	0.217	0.207
7	0.263	0.249	0.235	0.222	0.210	0.198	0.188	0.178	0.168	0.159
8	0.218	0.204	0.191	0.179	0.168	0.157	0.148	0.139	0.130	0.123
9	0.180	0.167	0.155	0.144	0.134	0.125	0.116	0.108	0.101	0.094
10	0.149	0.137	0.126	0.116	0.107	0.099	0.092	0.085	0.078	0.073
11	0.123	0.112	0.103	0.094	0.086	0.079	0.072	0.066	0.061	0.056
12	0.102	0.092	0.083	0.076	0.069	0.062	0.057	0.052	0.047	0.043
13	0.084	0.075	0.068	0.061	0.055	0.050	0.045	0.040	0.037	0.033
14	0.069	0.062	0.055	0.049	0.044	0.039	0.035	0.032	0.028	0.025
15	0.057	0.051	0.045	0.040	0.035	0.031	0.028	0.025	0.022	0.020
16	0.047	0.042	0.036	0.032	0.028	0.025	0.022	0.019	0.017	0.015
17	0.039	0.034	0.030	0.026	0.023	0.020	0.017	0.015	0.013	0.012
18	0.032	0.028	0.024	0.021	0.018	0.016	0.014	0.012	0.010	0.009
19	0.027	0.023	0.020	0.017	0.014	0.012	0.011	0.009	0.008	0.007
20	0.022	0.019	0.016	0.014	0.012	0.010	0.008	0.007	0.006	0.005
25	0.009	0.007	0.006	0.005	0.004	0.003	0.003	0.002	0.002	0.001
30	0.003	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.000	0.000

Table A.4 : Present Value of a Future Annuity *i.e.*, $PVAF_{(r, n)}$

Period *n*	*1%*	*2%*	*3%*	*4%*	*5%*	*6%*	*7%*	*8%*	*9%*	*10%*
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	1.970	1.942	1.913	1.886	1.859	1.833	1.783	1.783	1.759	1.736
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487
4	3.902	3.808	3.717	3.630	3.546	3.465	3.312	3.312	3.240	3.170
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355
7	6.728	6.472	6.230	6.002	5.789	5.582	5.389	5.206	5.033	4.868
8	7.652	7.326	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103
14	13.004	12.106	11.296	10.563	9.899	9.295	8.746	8.244	7.786	7.367
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.560	8.061	7.606
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.313	7.824
17	15.562	14.292	13.166	12.166	11.274	10.477	9.763	9.122	8.544	8.002
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201
19	17.226	15.679	14.324	13.134	12.085	11.158	10.336	9.604	8.950	8.365
20	18.046	16.352	14.878	13.590	12.462	11.470	10.594	9.818	9.129	8.514
25	22.023	19.524	17.413	15.622	14.094	12.783	11.654	10.675	9.823	9.077
30	25.808	22.397	19.601	17.292	15.373	13.765	12.409	11.258	10.274	9.427

Table A.4 : Present Value of a Future Annuity *i.e.*, $PVAF_{(r, n)}$

Period *n*	*11%*	*12%*	*13%*	*14%*	*15%*	*16%*	*17%*	*18%*	*19%*	*20%*
1	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.850	0.833
2	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.487	4.327
12	6.492	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439
13	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	6.982	6.628	6.303	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675
16	7.379	6.974	6.604	6.265	5.954	5.669	5.405	5.162	4.938	4.730
17	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775
18	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812
19	7.893	7.366	6.938	6.50	6.198	5.877	5.585	5.316	5.070	4.843
20	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870
25	8.422	7.843	7.330	6.873	6.464	6.097	5.766	5.467	5.195	4.948
30	8.694	8.005	7.496	7.003	6.566	6.177	5.829	5.517	5.235	4.979

Table A.4 : Present Value of a Future Annuity *i.e.*, $PVAF_{(r, n)}$

Period *n*	*21%*	*22%*	*23%*	*24%*	*25%*	*26%*	*27%*	*28%*	*29%*	*30%*
1	0.826	0.820	0.813	0.806	0.800	0.794	0.787	0.781	0.775	0.769
2	1.509	1.492	1.474	1.457	1.440	1.424	1.407	1.392	1.376	1.361
3	2.074	2.042	2.011	1.981	1.952	1.923	1.896	1.868	1.842	1.816
4	2.540	2.494	2.448	2.404	2.362	2.320	2.280	2.241	2.203	2.166
5	2.926	2.864	2.803	2.745	2.689	2.635	2.583	2.532	2.483	2.436
6	3.245	3.167	3.092	3.020	2.951	2.885	2.821	2.759	2.700	2.643
7	3.508	3.416	3.327	3.242	3.161	3.083	3.009	2.937	2.868	2.802
8	3.726	3.619	3.518	3.421	3.329	3.241	3.156	3.076	2.999	2.925
9	3.905	3.786	3.673	3.566	3.463	3.366	3.273	3.184	3.100	3.019
10	4.054	3.923	3.799	3.682	3.570	3.465	3.364	3.269	3.178	3.092
11	4.177	4.035	3.902	3.776	3.656	3.544	3.437	3.335	3.239	3.147
12	4.278	4.127	3.985	3.851	3.725	3.606	3.493	3.387	3.286	3.190
13	4.362	4.203	4.053	3.912	3.780	3.656	3.538	3.427	3.322	3.223
14	4.432	4.265	4.108	3.962	3.824	3.695	3.573	3.459	3.351	3.249
15	4.489	4.315	4.153	4.001	3.859	3.726	3.601	3.483	3.373	3.268
16	4.536	4.357	4.189	4.033	3.887	3.751	3.623	3.503	3.390	3.283
17	4.576	4.391	4.219	4.059	3.910	3.771	3.640	3.518	3.403	3.295
18	4.608	4.419	4.243	4.080	3.928	3.786	3.654	3.529	3.413	3.311
19	4.635	4.442	4.263	4.097	3.942	3.799	3.664	3.539	3.421	3.311
20	4.657	4.460	4.279	4.110	3.954	3.808	3.673	3.546	3.427	3.316
25	4.721	4.514	4.323	4.147	3.985	3.834	3.694	3.564	3.442	3.329
30	4.746	4.534	4.339	4.160	3.995	3.842	3.701	3.569	3.447	3.332

THE END