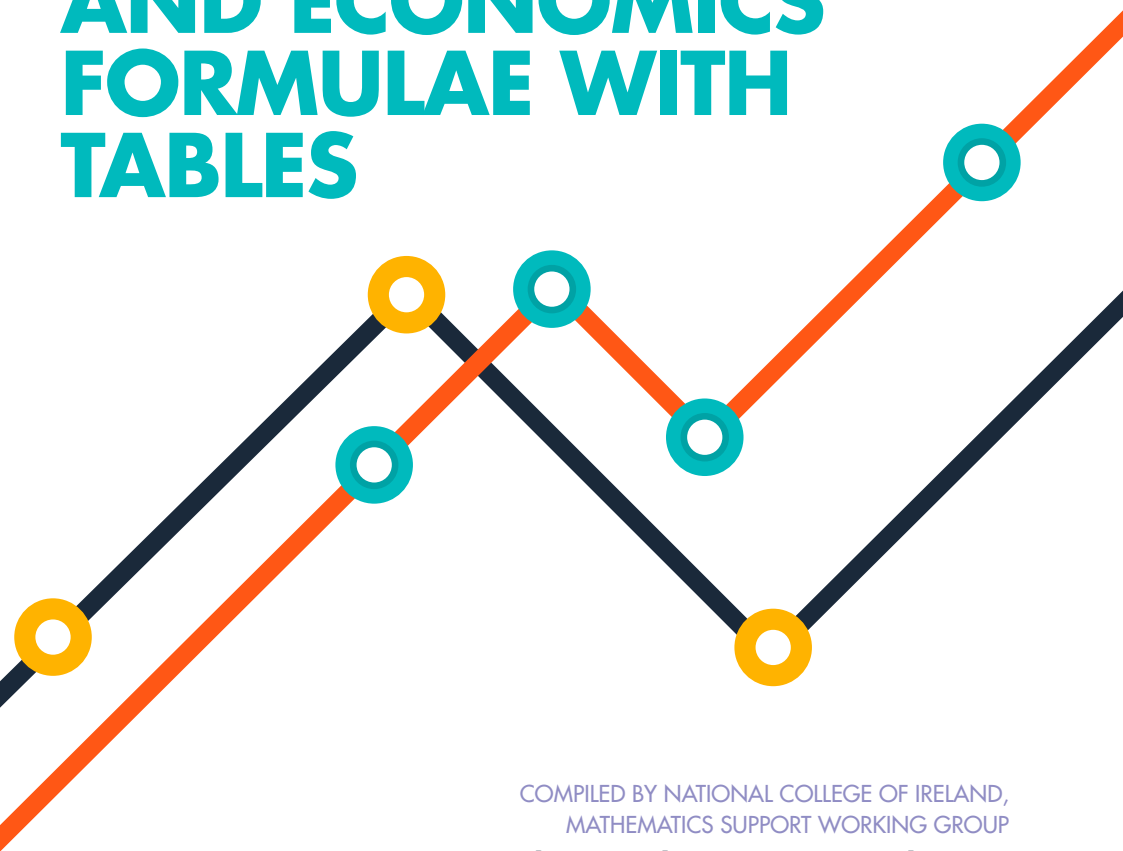




National
College *of*
Ireland

FINANCIAL MATHEMATICS AND ECONOMICS FORMULAE WITH TABLES



COMPILED BY NATIONAL COLLEGE OF IRELAND,
MATHEMATICS SUPPORT WORKING GROUP

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FINANCIAL MATHEMATICS SYMBOLS

Symbol	Meaning
i, r, k	Interest Rate
t	Number of Years
n	Number of Compounding Periods
PV	Principal Value of an Investment
PV	Present Value
FV	Future Value of an Investment
CF	Cash Flow
CF_n	Cash Flow at period n
A_0	Initial Investment into a Fund
A_n	Future Value of a Fund after n periods
F	Regular Investment Value

Symbol	Meaning
NPV	Net Present Value
$N_1, N_2...N_3$	Net Present Value
$I_1, I_2...I_3$	An Interest Rate associated with a NPV
IRR	Internal Rate of Return
V_e	Value of Equity
V_d	Value of Debt
K_e	Cost of Equity
K_d	Cost of Debt
D_0	Dividend at time 0
g	Growth Rate
k	Discount Rate

FINANCIAL MATHEMATICS FORMULAE

Financial Mathematics – Theory of interest

Simple Interest	$FV = PV(1 + ni)$
Discrete Compound Interest	$FV = PV \left(1 + \frac{i}{n} \right)^{nt}$ <p>alternatively in the annual case</p> $FV = PV(1 + i)^n$
Continuous Compounding	$FV = PVe^{it}$
Present Value	$PV = \frac{FV}{\left(1 + \frac{i}{n} \right)^{nt}}$ <p>alternatively in the annual case</p> $PV = \frac{FV}{(1 + i)^t}$
Net Present Value	$\sum_{t=0}^n \left(\frac{CF_t}{(1 + i)^t} \right)$
Internal Rate of Return	$IRR = \frac{N_1 I_2 - N_2 I_1}{N_1 - N_2}$ <p>alternatively</p> $IRR = r_a + \left[\left(\frac{NPV_a}{NPV_a - NPV_b} \right) (r_b - r_a) \right]$

FINANCIAL MATHEMATICS FORMULAE

Effective interest rate (APR) given a nominal annual rate of interest <i>i</i> .	$APR = \left[1 + \frac{i}{n} \right]^n - 1$
Depreciation value given book value B and depreciation rate <i>i</i> .	$D = B(1 - i)^n$
Mortgages, Sinking Funds, and Annuities	$A_n = A_0(1 + i)^n + \frac{F(1 + i)^n - F}{i}$
Weighted Average Cost of Capital (WACC)	$WACC = \left[\frac{V_e}{V_e + V_d} \right] K_e + \left[\frac{V_d}{V_e + V_d} \right] K_d(1 - t)$
Dividend Discount Model for Constant Growth	$P_0 = \sum_{i=1}^{\infty} \left(\frac{D_0(1 + g)^i}{(1 + k)^i} \right)$ <p>alternatively</p> $P_0 = \frac{D_0(1 + g)}{(1 + k)} + \frac{D_0(1 + g)^2}{(1 + k)^2} + \frac{D_0(1 + g)^3}{(1 + k)^3} + \dots$

FINANCIAL MATHEMATICS FORMULAE

Financial Mathematics Formulae: Index Number Symbols

Symbol	Meaning	Symbol	Meaning
p_0	Price at base time point	q_0	Quantity at base time point
p_n	Price at some other time point	q_n	Quantity at some other time point
I_p	Price Relative Index	I_Q	Quantity Relative Index
v_0	Value of Commodity at base time point	v_n	Value of Commodity at current time point

Financial Mathematics Formulae: Index Numbers

Price Relative Index	$I_p = \frac{p_n}{p_0} \times 100$
Quantity Relative	$I_Q = \frac{q_n}{q_0} \times 100$
Real Value Index for a time series: $x_1, x_2 \dots x_n$	$RVI = \frac{x_n}{x_0} \times \frac{I_0}{I_n} \times 100$
$RVI = \frac{\text{current value}}{\text{base value}} \times \frac{\text{base indicator}}{\text{current indicator}} \times 100$	

FINANCIAL MATHEMATICS FORMULAE

Weighted Average of Relatives	$I_{AR} = \frac{\sum wI}{\sum w} \times 100$
Weighted Aggregate Index	$I_{AG} = \frac{\sum wv_n}{\sum wv_0} \times 100$
Laspeyres Price Index	$L_p = \frac{\sum q_0 p_n}{\sum q_0 p_0} \times 100$
Laspeyres Quantity Index	$L_q = \frac{\sum p_0 q_n}{\sum p_0 q_0} \times 100$
Paasche Price Index	$P_p = \frac{\sum q_n p_n}{\sum q_n p_0} \times 100$
Paasche Quantity Index	$P_q = \frac{\sum p_n q_n}{\sum p_n q_0} \times 100$

MACRO ECONOMICS SYMBOLS

Symbol	Meaning
<i>GDP</i>	Gross Domestic Product
<i>GNP</i>	Gross National Product
<i>GNI</i>	Gross National Income
<i>P</i>	Price
<i>P_t</i>	Price at time <i>t</i>
<i>Q</i>	Quantity
<i>Q_t</i>	Quantity at time <i>t</i>
<i>M</i>	Imports
<i>M_t</i>	Imports at time <i>t</i>
<i>X</i>	Exports
<i>X_t</i>	Exports at time <i>t</i>
<i>NX</i>	Net Exports

Symbol	Meaning
<i>MPC</i>	Marginal Propensity to Consume
<i>MPM</i>	Marginal Propensity to Import
<i>MPT</i>	Marginal Propensity to Tax
<i>RR</i>	Reserve Requirement Ratio
<i>C</i>	Consumption
<i>I</i>	Investment
<i>G</i>	Government Spending
<i>M</i>	Money Supply
<i>V</i>	Velocity
<i>Y</i>	Real GDP
<i>Y_d</i>	Disposable Income

MACRO ECONOMICS FORMULAE

Percentage change of a variable

$$\% \Delta = \left(\frac{X_t - X_{t-1}}{X_{t-1}} \right) \times 100$$

where

$$\begin{cases} X_t & : \text{value of } X \text{ at current time period} \\ X_{t-1} & : \text{value of } X \text{ in previous time period} \end{cases}$$

Macro Economics – Inflation

Inflation Rate

$$\pi = \left(\frac{PI_t - PI_{t-1}}{PI_{t-1}} \right) \times 100$$

$$\text{Inflation Rate} = \left(\frac{\text{Price Index}_{\text{in year 2}} - \text{Price Index}_{\text{in year 1}}}{\text{Price Index}_{\text{in year 1}}} \right) \times 100$$

Real Interest Rate

$$\text{Real Interest Rate} = \text{Nominal Interest Rate} - \text{Inflation Rate}$$

Macro Economics – Unemployment

$$\text{Labour Force Participation Rate} = \left(\frac{\text{Labour Force}}{\text{Population}_{\text{age 16 or older}}} \right) \times 100$$

$$\text{Unemployment Rate} = \left(\frac{\text{Number of People Unemployed}}{\text{Labour Force}} \right) \times 100$$

$$\text{Employment Rate} = \left(\frac{\text{Number of People Employed}}{\text{Labour Force}} \right) \times 100$$

MACRO ECONOMICS FORMULAE

Macro Economics - Gross Domestic Product

Gross Domestic Product	$GDP = C + I + G + X - M$
$GDP = \text{Consumption} + \text{Investment} + \text{Government Spending} + \text{Exports} - \text{Imports}$	
Gross Domestic Product	$GDP = (P)(Q)$
$GDP = \text{Price} \times \text{Quantity (for all goods and services produced)}$	
Real Gross Domestic Product	$\text{Real GDP} = \frac{GDP}{\text{Price Index}} \times 100$
Gross Domestic Product per Capita	$GDP_{\text{per capita}} = \frac{GDP}{\text{Population}_{\text{size}}}$
$GDP_{\text{per capita}} = \frac{\text{Gross Domestic Product}}{\text{Size of Population}}$	
Gross Domestic Product growth rate	$GDP_{\text{growth rate}} = \left(\frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} \right) \times 100$
$GDP_{\text{growth rate}} = \left(\frac{GDP_{\text{in year 2}} - GDP_{\text{in year 1}}}{GDP_{\text{in year 1}}} \right) \times 100$	

MACRO ECONOMICS FORMULAE

Real Gross Domestic Product growth rate	$Real\ GDP_{growth\ rate} = \left(\frac{Real\ GDP_t - Real\ GDP_{t-1}}{Real\ GDP_{t-1}} \right) \times 100$
$Real\ GDP_{growth\ rate} = \left(\frac{Real\ GDP_{in\ year\ 2} - Real\ GDP_{in\ year\ 1}}{Real\ GDP_{in\ year\ 1}} \right) \times 100$	

Macro Economics - Gross National Product

Gross National Product	$GNP = GDP \pm NFI$
$Gross\ National\ Product = Gross\ Domestic\ Product \pm Net\ Factor\ Income$	

Macro Economics - Gross National Income

Gross National Income	$GNI = GNP + Subsidies - Taxes$
$Gross\ National\ Income = Gross\ National\ Product + Subsidies - Taxes$	

Macro Economics - Net Exports

Net Exports	$NX = X - M$
$Net\ Exports = Exports - Imports$	

MACRO ECONOMICS FORMULAE

Macro Economics – Consumption Functions

Marginal Propensity to Consume	$MPC = \frac{C_t - C_{t-1}}{Yd_t - Yd_{t-1}}$
$MPC = \frac{\Delta \text{Consumer Spending}}{\Delta \text{Disposable Income}}$	
Marginal Propensity to Import	$MPM = \frac{M_t - M_{t-1}}{Yd_t - Yd_{t-1}}$
$MPM = \frac{\Delta \text{Imports}}{\Delta \text{Disposable Income}}$	
Marginal Propensity to Tax	$MPT = \frac{T_t - T_{t-1}}{Yd_t - Yd_{t-1}}$
$MPT = \frac{\Delta \text{Taxes}}{\Delta \text{Disposable Income}}$	
Consumption Function	$c = a + MPC \times Yd$

MACRO ECONOMICS FORMULAE

Macro Economics – Fiscal Multipliers

Simple Fiscal Multiplier	$\frac{1}{(1 - MPC)}$
Fiscal Multiplier	$\frac{1}{(1 - MPC + MPM + MPT)}$

Macro Economics – Money Multipliers

Simple Money Multiplier	$\frac{1}{RR}$
Velocity Theory of Money	$M \times V = P \times Y$

Present Value Discount Rate Table [Interest Rate: 1.0% - 7.5%]

n	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%	7.0%	7.5%
1	0.9901	0.9852	0.9804	0.9756	0.9709	0.9662	0.9615	0.9569	0.9524	0.9479	0.9434	0.9390	0.9346	0.9302
2	0.9803	0.9707	0.9612	0.9518	0.9426	0.9335	0.9246	0.9157	0.9070	0.8985	0.8900	0.8817	0.8734	0.8653
3	0.9706	0.9563	0.9423	0.9286	0.9151	0.9019	0.8890	0.8763	0.8638	0.8516	0.8396	0.8278	0.8163	0.8050
4	0.9610	0.9422	0.9238	0.9060	0.8885	0.8714	0.8548	0.8386	0.8227	0.8072	0.7921	0.7773	0.7629	0.7488
5	0.9515	0.9283	0.9057	0.8839	0.8626	0.8420	0.8219	0.8025	0.7835	0.7651	0.7473	0.7299	0.7130	0.6966
6	0.9420	0.9145	0.8880	0.8623	0.8375	0.8135	0.7903	0.7679	0.7462	0.7252	0.7050	0.6853	0.6663	0.6480
7	0.9327	0.9010	0.8706	0.8413	0.8131	0.7860	0.7599	0.7348	0.7107	0.6874	0.6651	0.6435	0.6227	0.6028
8	0.9235	0.8877	0.8535	0.8207	0.7894	0.7594	0.7307	0.7032	0.6768	0.6516	0.6274	0.6042	0.5820	0.5607
9	0.9143	0.8746	0.8368	0.8007	0.7664	0.7337	0.7026	0.6729	0.6446	0.6176	0.5919	0.5674	0.5439	0.5216
10	0.9053	0.8617	0.8203	0.7812	0.7441	0.7089	0.6756	0.6439	0.6139	0.5854	0.5584	0.5327	0.5083	0.4852
11	0.8963	0.8489	0.8043	0.7621	0.7224	0.6849	0.6496	0.6162	0.5847	0.5549	0.5268	0.5002	0.4751	0.4513
12	0.8874	0.8364	0.7885	0.7436	0.7014	0.6618	0.6246	0.5897	0.5568	0.5260	0.4970	0.4697	0.4440	0.4199
13	0.8787	0.8240	0.7730	0.7254	0.6810	0.6394	0.6006	0.5643	0.5303	0.4986	0.4688	0.4410	0.4150	0.3906
14	0.8700	0.8118	0.7579	0.7077	0.6611	0.6178	0.5775	0.5400	0.5051	0.4726	0.4423	0.4141	0.3878	0.3633
15	0.8613	0.7999	0.7430	0.6905	0.6419	0.5969	0.5553	0.5167	0.4810	0.4479	0.4173	0.3888	0.3624	0.3380
16	0.8528	0.7880	0.7284	0.6736	0.6232	0.5767	0.5339	0.4945	0.4581	0.4246	0.3936	0.3651	0.3387	0.3144
17	0.8444	0.7764	0.7142	0.6572	0.6050	0.5572	0.5134	0.4732	0.4363	0.4024	0.3714	0.3428	0.3166	0.2925
18	0.8360	0.7649	0.7002	0.6412	0.5874	0.5384	0.4936	0.4528	0.4155	0.3815	0.3503	0.3219	0.2959	0.2720
19	0.8277	0.7536	0.6864	0.6255	0.5703	0.5202	0.4746	0.4333	0.3957	0.3616	0.3305	0.3022	0.2765	0.2531
20	0.8195	0.7425	0.6730	0.6103	0.5537	0.5026	0.4564	0.4146	0.3769	0.3427	0.3118	0.2838	0.2584	0.2354

Present Value Discount Rate Table (cont.) [Interest Rate: 8.0% - 20.0%]

n	8.0%	8.5%	9.0%	10.0%	11.0%	12.0%	13.0%	14.0%	15.0%	16.0%	17.0%	18.0%	19.0%	20.0%
1	0.9259	0.9217	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8547	0.8475	0.8403	0.8333
2	0.8573	0.8495	0.8417	0.8264	0.8116	0.7972	0.7831	0.7695	0.7561	0.7432	0.7305	0.7182	0.7062	0.6944
3	0.7938	0.7829	0.7722	0.7513	0.7312	0.7118	0.6931	0.6750	0.6575	0.6407	0.6244	0.6086	0.5934	0.5787
4	0.7350	0.7216	0.7084	0.6830	0.6587	0.6355	0.6133	0.5921	0.5718	0.5523	0.5337	0.5158	0.4987	0.4823
5	0.6806	0.6650	0.6499	0.6209	0.5935	0.5674	0.5428	0.5194	0.4972	0.4761	0.4561	0.4371	0.4190	0.4019
6	0.6302	0.6129	0.5963	0.5645	0.5346	0.5066	0.4803	0.4556	0.4323	0.4104	0.3898	0.3704	0.3521	0.3349
7	0.5835	0.5649	0.5470	0.5132	0.4817	0.4523	0.4251	0.3996	0.3759	0.3538	0.3332	0.3139	0.2959	0.2791
8	0.5403	0.5207	0.5019	0.4665	0.4339	0.4039	0.3762	0.3506	0.3269	0.3050	0.2848	0.2660	0.2487	0.2326
9	0.5002	0.4799	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843	0.2630	0.2434	0.2255	0.2090	0.1938
10	0.4632	0.4423	0.4224	0.3855	0.3522	0.3220	0.2946	0.2697	0.2472	0.2267	0.2080	0.1911	0.1756	0.1615
11	0.4289	0.4076	0.3875	0.3505	0.3173	0.2875	0.2607	0.2366	0.2149	0.1954	0.1778	0.1619	0.1476	0.1346
12	0.3971	0.3757	0.3555	0.3186	0.2858	0.2567	0.2307	0.2076	0.1869	0.1685	0.1520	0.1372	0.1240	0.1122
13	0.3677	0.3463	0.3262	0.2897	0.2575	0.2292	0.2042	0.1821	0.1625	0.1452	0.1299	0.1163	0.1042	0.0935
14	0.3405	0.3191	0.2992	0.2633	0.2320	0.2046	0.1807	0.1597	0.1413	0.1252	0.1110	0.0985	0.0876	0.0779
15	0.3152	0.2941	0.2745	0.2394	0.2090	0.1827	0.1599	0.1401	0.1229	0.1079	0.0949	0.0835	0.0736	0.0649
16	0.2919	0.2711	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069	0.0930	0.0811	0.0708	0.0618	0.0541
17	0.2703	0.2499	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929	0.0802	0.0693	0.0600	0.0520	0.0451
18	0.2502	0.2303	0.2120	0.1799	0.1528	0.1300	0.1108	0.0946	0.0808	0.0691	0.0592	0.0508	0.0437	0.0376
19	0.2317	0.2122	0.1945	0.1635	0.1377	0.1161	0.0981	0.0829	0.0703	0.0596	0.0506	0.0431	0.0367	0.0313
20	0.2145	0.1956	0.1784	0.1486	0.1240	0.1037	0.0868	0.0728	0.0611	0.0514	0.0433	0.0365	0.0308	0.0261

Present Value of an Ordinary Annuity Table

n	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%	7.0%	7.5%
1	0.9901	0.9852	0.9804	0.9756	0.9709	0.9662	0.9615	0.9569	0.9524	0.9479	0.9434	0.9390	0.9346	0.9302
2	1.9704	1.9559	1.9416	1.9274	1.9135	1.8997	1.8861	1.8727	1.8594	1.8463	1.8334	1.8206	1.8080	1.7956
3	2.9410	2.9122	2.8839	2.8560	2.8286	2.8016	2.7751	2.7490	2.7232	2.6979	2.6730	2.6485	2.6243	2.6005
4	3.9020	3.8544	3.8077	3.7620	3.7171	3.6731	3.6299	3.5875	3.5460	3.5052	3.4651	3.4258	3.3872	3.3493
5	4.8534	4.7826	4.7135	4.6458	4.5797	4.5151	4.4518	4.3900	4.3295	4.2703	4.2124	4.1557	4.1002	4.0459
6	5.7955	5.6972	5.6014	5.5081	5.4172	5.3286	5.2421	5.1579	5.0757	4.9955	4.9173	4.8410	4.7665	4.6938
7	6.7282	6.5982	6.4720	6.3494	6.2303	6.1145	6.0021	5.8927	5.7864	5.6830	5.5824	5.4845	5.3893	5.2966
8	7.6517	7.4859	7.3255	7.1701	7.0197	6.8740	6.7327	6.5959	6.4632	6.3346	6.2098	6.0888	5.9713	5.8573
9	8.5660	8.3605	8.1622	7.9709	7.7861	7.6077	7.4353	7.2688	7.1078	6.9522	6.8017	6.6561	6.5152	6.3789
10	9.4713	9.2222	8.9826	8.7521	8.5302	8.3166	8.1109	7.9127	7.7217	7.5376	7.3601	7.1888	7.0236	6.8641
11	10.3676	10.0711	9.7868	9.5142	9.2526	9.0016	8.7605	8.5289	8.3064	8.0925	7.8869	7.6890	7.4987	7.3154
12	11.2551	10.9075	10.5753	10.2578	9.9540	9.6633	9.3851	9.1186	8.8633	8.6185	8.3838	8.1587	7.9427	7.7353
13	12.1337	11.7315	11.3484	10.9832	10.6350	10.3027	9.9856	9.6829	9.3936	9.1171	8.8527	8.5997	8.3577	8.1258
14	13.0037	12.5434	12.1062	11.6909	11.2961	10.9205	10.5631	10.2228	9.8986	9.5896	9.2950	9.0138	8.7455	8.4892
15	13.8651	13.3432	12.8493	12.3814	11.9379	11.5174	11.1184	10.7395	10.3797	10.0376	9.7122	9.4027	9.1079	8.8271
16	14.7179	14.1313	13.5777	13.0550	12.5611	12.0941	11.6523	11.2340	10.8378	10.4622	10.1059	9.7678	9.4466	9.1415
17	15.5623	14.9076	14.2919	13.7122	13.1661	12.6513	12.1657	11.7072	11.2741	10.8646	10.4773	10.1106	9.7632	9.4340
18	16.3983	15.6726	14.9920	14.3534	13.7535	13.1897	12.6593	12.1600	11.6896	11.2461	10.8276	10.4325	10.0591	9.7060
19	17.2260	16.4262	15.6785	14.9789	14.3238	13.7098	13.1339	12.5933	12.0853	11.6077	11.1581	10.7347	10.3356	9.9591
20	18.0456	17.1686	16.3514	15.5892	14.8775	14.2124	13.5903	13.0079	12.4622	11.9504	11.4699	11.0185	10.5940	10.1945

Present Value of an Ordinary Annuity Table

n	8.0%	8.5%	9.0%	10.0%	11.0%	12.0%	13.0%	14.0%	15.0%	16.0%	17.0%	18.0%	19.0%	20.0%
1	0.9901	0.9852	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850
2	1.9704	1.9559	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	1.7833	1.7591	1.7355	1.7125	1.6901	1.6681
3	2.9410	2.9122	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243	2.5771	2.5313	2.4869	2.4437	2.4018	2.3612
4	3.9020	3.8544	3.8077	3.7171	3.6299	3.5460	3.4651	3.3872	3.3121	3.2397	3.1699	3.1024	3.0373	2.9745
5	4.8534	4.7826	4.7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927	3.8897	3.7908	3.6959	3.6048	3.5172
6	5.7955	5.6972	5.6014	5.4172	5.2421	5.0757	4.9173	4.7665	4.6229	4.4859	4.3553	4.2305	4.1114	3.9975
7	6.7282	6.5982	6.4720	6.2303	6.0021	5.7864	5.5824	5.3893	5.2064	5.0330	4.8684	4.7122	4.5638	4.4226
8	7.6517	7.4859	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	5.1461	4.9676	4.7988
9	8.5660	8.3605	8.1622	7.7861	7.4353	7.1078	6.8017	6.5152	6.2469	5.9952	5.7590	5.5370	5.3282	5.1317
10	9.4713	9.2222	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	6.1446	5.8892	5.6502	5.4262
11	10.3676	10.0711	9.7868	9.2526	8.7605	8.3064	7.8869	7.4987	7.1390	6.8052	6.4951	6.2065	5.9377	5.6869
12	11.2551	10.9075	10.5753	9.9540	9.3851	8.8633	8.3838	7.9427	7.5361	7.1607	6.8137	6.4924	6.1944	5.9176
13	12.1337	11.7315	11.3484	10.6350	9.9856	9.3936	8.8527	8.3577	7.9038	7.4869	7.1034	6.7499	6.4235	6.1218
14	13.0037	12.5434	12.1062	11.2961	10.5631	9.8986	9.2950	8.7455	8.2442	7.7862	7.3667	6.9819	6.6282	6.3025
15	13.8651	13.3432	12.8493	11.9379	11.1184	10.3797	9.7122	9.1079	8.5595	8.0607	7.6061	7.1909	6.8109	6.4624
16	14.7179	14.1313	13.5777	12.5611	11.6523	10.8378	10.1059	9.4466	8.8514	8.3126	7.8237	7.3792	6.9740	6.6039
17	15.5623	14.9076	14.2919	13.1661	12.1657	11.2741	10.4773	9.7632	9.1216	8.5436	8.0216	7.5488	7.1196	6.7291
18	16.3983	15.6726	14.9920	13.7535	12.6593	11.6896	10.8276	10.0591	9.3719	8.7556	8.2014	7.7016	7.2497	6.8399
19	17.2260	16.4262	15.6785	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.8393	7.3658	6.9380
20	18.0456	17.1686	16.3514	14.8775	13.5903	12.4622	11.4699	10.5940	9.8181	9.1285	8.5136	7.9633	7.4694	7.0248

NOTES

[illegible]

NOTES

Handwriting practice lines consisting of 20 horizontal dotted lines.



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