Brooklyn College

School of Business

Department of Accounting

Accounting 3011

Professor R. Widman

Handout - Time Value of Money

FUTURE AND PRESENT VALUE OF MONEY

1 On January 1, 2000 Widwoman Company has $10,000 in idle cash available. Widwoman has located a borrower who needs the funds and will pay 12% interest, compounded annually. If the borrower will repay the loan plus accumulated interest on December 31, 2003, what amount will Widwoman receive on that date?
Compute by:

A) successive interest computations, and

B) employing a future value table

2 Assume the same facts as in "1" above except that the borrower feels that the interest rate is too high and offers to pay Widwoman $14,116 on the due date of the loan. What interest rate did the borrower use to arrive at this amount?

3 On January 1, 2000 Widkid Company contracted to buy an office building. Since the Company was experiencing a shortage of cash, the seller agreed to take back a $200,000 mortgage on the building. The mortgage does NOT bear interest and is due ten years from the date of sale.

A) Widkid Company is aware that there is an interest element involved in the mortgage and asks you to determine the cost of the building assuming the market rate of interest is 12%.

B) Prepare the journal entry to record the acquisition of the building.

C) What journal entries should Widkid make at the end of 2000 and 2001 to record interest expense on the mortgage?

4 ANNUITIES

BigTalent Theater is a small company that expects to grow rapidly in the near future. The Company wants to set up a fund to finance the construction to refurbish the entire theater in the future. BigTalent will contribute $100,000 to the fund on December 31 of the current year and December 31 of each of the succeeding three years.

A) Using the table below and assuming an 8% compound annual interest rate, compute the fund balance at the end of the four year period.

	Interest Accumulations	Deposit to Fund	Fund balance end of year
YEAR 1			
YEAR 2			
YEAR 3			
YEAR 4			

B) Compute the fund balance at the end of the four year period using a future value table.

C) Assume that the fund balance at the end of the four year period is $477,933. At what compound annual interest rate did the fund earn Interest?

5 ANNUITY DUE

Assume the same facts as in "4" above, except that BigTalent will contribute $100,000 on January 1, of the current year and each of the succeeding three years. What will be the fund balance at the end of year four.

1) Mr. Adams has $500 to invest. He wishes to know how much it will amount to if he invests it at 8 percent per year for 33 years.

2) Ms. Black wishes to have $15,000 at the end of 8 years. How much must she invest today to accomplish this purpose if the interest rate is 8 percent?

3) Mr. Case plans to set aside $4,000 each year, the first payment to be made on January 1, 2002, and the last on January 1, 2007. How much will he have accumulated by January1, 2007 if the interest rate is 8 percent?

4) Ms. David wants to have $450,000 on her sixty-fifth birthday. She asks you to tell her how much she must deposit on each birthday from her fifty-eighth to sixty-fifth, inclusive, in order to receive this amount. Assume the interest of 12 percent.

5) If Mr. Edward invests $900 on June 1 of each year from 2002 to 2012, inclusive how much will he have accumulated on June 1, 2013 (note that 1 year elapses after last payment) if the interest rate is 10 percent.

6) Mr. Frank has $145,000 with which he purchases an annuity on February 1, 2002. The annuity consists of six annual payments, the first to be made on February 1, 2003. How much will he receive in each payment? Assume an interest rate of 12%.

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Handout
TIME VALUE OF MONEY - LOAN AMORTIZATION

You obtain a $14,000 loan to finance the purchase of a car on January 1, 2010.

The terms of the loan require monthly payments of $465 (fully amortizing loan) the first payment to be made on February 1, 2010, and the last on January 1, 2013 (three years), at a 12% interest rate.

Complete column (a) on attached schedule for this loan.

Alternatively, you could borrow the same $14,000, at the same interest rate (12%), for the same number of periods (thirty-six), by making the following payments:

(b)	270
(c)	140
(d)	70
(e)	0

HINT
First calculate the present value of each of the payment streams above.
Then calculate the remaining balance of the loan (balloon payment).

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Handout - Car Loan Worksheet

	CASE (a)	CASE (b)	CASE (c)	CASE (d)	CASE (e)
Interest rate					
Lenth of period					
Number of periods					
First period payment					
First period expense					
Periodic payments					
Balloon payment					
Total payments					
Present value (amount borrowed)					
Total expense					

PARTIAL AMORTIZATION	270
ZERO AMORTIZATION	140
NEGATIVE AMORTIZATION	70
BALLOON PAYMENT ONLY	*0*

		Interest	Payment	Amortization of Principle	Unamortized Principle
ORIGINAL LOAN					14,000
1	14,000	140	465	325	13,675
2	13,675	137	465	328	13,347
3	13,347	133	465	332	13,015
4	13,015	130	465	335	12,680
5	12,680	127	465	338	12,342
6	12,342	123	465	342	12,001
7	12,001	120	465	345	11,656
8	11,656	117	465	348	11,307
9	11,307	113	465	352	10,955
10	10,955	110	465	355	10,600
11	10,600	106	465	359	10,241
12	10,241	102	465	363	9,878
13	9,878	99	465	366	9,512
14	9,512	95	465	370	9,142
15	9,142	91	465	374	8,769
16	8,769	88	465	377	8,391
17	8,391	84	465	381	8,010
18	8,010	80	465	385	7,625
19	7,625	76	465	389	7,236
20	7,236	72	465	393	6,844
21	6,844	68	465	397	6,447
22	6,447	64	465	401	6,047
23	6,047	60	465	405	5,642
24	5,642	56	465	409	5,234
25	5,234	52	465	413	4,821
26	4,821	48	465	417	4,404
27	4,404	44	465	421	3,983
28	3,983	40	465	425	3,558
29	3,558	36	465	429	3,129
30	3,129	31	465	434	2,695
31	2,695	27	465	438	2,257
32	2,257	23	465	442	1,814
33	1,814	18	465	447	1,368
34	1,368	14	465	451	916
35	916	9	465	456	460
36	460	5	465	460	0

FULLY AMORTIZED	465
PARTIAL AMORTIZATION	270
ZERO AMORTIZATION	140
NEGATIVE AMORTIZATION	70
BALLOON PAYMENT ONLY	*0*

		Interest	Payment	Amortization of Principle	Unamortized Principle
ORIGINAL LOAN					14,000
	1	14,000	140	270	130	13,870
	2	13,870	139	270	131	13,739
	3	13,739	137	270	133	13,606
	4	13,606	136	270	134	13,472
	5	13,472	135	270	135	13,337
	6	13,337	133	270	137	13,200
	7	13,200	132	270	138	13,062
	8	13,062	131	270	139	12,923
	9	12,923	129	270	141	12,782
	10	12,782	128	270	142	12,640
	11	12,640	126	270	144	12,496
	12	12,496	125	270	145	12,351
	13	12,351	124	270	146	12,205
	14	12,205	122	270	148	12,057
	15	12,057	121	270	149	11,907
	16	11,907	119	270	151	11,756
	17	11,756	118	270	152	11,604
	18	11,604	116	270	154	11,450
	19	11,450	115	270	155	11,295
	20	11,295	113	270	157	11,138
	21	11,138	111	270	159	10,979
	22	10,979	110	270	160	10,819
	23	10,819	108	270	162	10,657
	24	10,657	107	270	163	10,493
	25	10,493	105	270	165	10,328
	26	10,328	103	270	167	10,162
	27	10,162	102	270	168	9,993
	28	9,993	100	270	170	9,823
	29	9,823	98	270	172	9,651
	30	9,651	97	270	173	9,478
	31	9,478	95	270	175	9,303
	32	9,303	93	270	177	9,126
	33	9,126	91	270	179	8,947
	34	8,947	89	270	181	8,766
	35	8,766	88	270	182	8,584
	36	8,584	86	270	184	8,400

FULLY AMORTIZED	465
PARTIAL AMORTIZATION	270
ZERO AMORTIZATION	740
NEGATIVE AMORTIZATION	70
BALLOON PAYMENT ONLY	*0*

		Interest	Payment	Amortization of Principle	Unamortized Principle
ORIGINAL LOAN					14,000
1	14,000	140	140	0	14,000
2	14,000	140	140	0	14,000
3	14,000	140	140	0	14,000
4	14,000	140	140	0	14,000
5	14,000	140	140	0	14,000
6	14,000	140	140	0	14,000
7	14,000	140	140	0	14,000
8	14,000	140	140	0	14,000
9	14,000	140	140	0	14,000
10	14,000	140	140	0	14,000
11	14,000	140	140	0	14,000
12	14,000	140	140	0	14,000
13	14,000	140	140	0	14,000
14	14,000	140	140	0	14,000
15	14,000	140	140	0	14,000
16	14,000	140	140	0	14,000
17	14,000	140	140	0	14,000
18	14,000	140	140	0	14,000
19	14,000	140	140	0	14,000
20	14,000	140	140	0	14,000
21	14,000	140	140	0	14,000
22	14,000	140	140	0	14,000
23	14,000	140	140	0	14,000
24	14,000	140	140	0	14,000
25	14,000	140	140	0	14,000
26	14,000	140	140	0	14,000
27	14,000	140	140	0	14,000
28	14,000	140	140	0	14,000
29	14,000	140	140	0	14,000
30	14,000	140	140	0	14,000
31	14,000	140	140	0	14,000
32	14,000	140	140	0	14,000
33	14,000	140	140	0	14,000
34	14,000	140	140	0	14,000
35	14,000	140	140	0	14,000
36	14,000	140	140	0	14,000

FULLY AMORTIZED	465
PARTIAL AMORTIZATION	270
ZERO AMORTIZATION	140
NEGATIVE AMORTIZATION	70
BALLOON PAYMENT ONLY	*0*

		Interest	Payment	Amortization of Principle	Unamortized Principle
ORIGINAL LOAN					14,000
1	14,000	140	70	-70	14,070
2	14,070	141	70	-71	14,141
3	14,141	141	70	-71	14,212
4	14,212	142	70	-72	14,284
5	14,284	143	70	-73	14,357
6	14,357	144	70	-74	14,431
7	14,431	144	70	-74	14,505
8	14,505	145	70	-75	14,580
9	14,580	146	70	-76	14,656
10	14,656	147	70	-77	14,732
11	14,732	147	70	-77	14,810
12	14,810	148	70	-78	14,888
13	14,888	149	70	-79	14,967
14	14,967	150	70	-80	15,046
15	15,046	150	70	-80	15,127
16	15,127	151	70	-81	15,208
17	15,208	152	70	-82	15,290
18	15,290	153	70	-83	15,373
19	15,373	154	70	-84	15,457
20	15,457	155	70	-85	15,541
21	15,541	155	70	-85	15,627
22	15,627	156	70	-86	15,713
23	15,713	157	70	-87	15,800
24	15,800	158	70	-88	15,888
25	15,888	159	70	-89	15,977
26	15,977	160	70	-90	16,067
27	16,067	161	70	-91	16,157
28	16,157	162	70	-92	16,249
29	16,249	162	70	-92	16,342
30	16,342	163	70	-93	16,435
31	16,435	164	70	-94	16,529
32	16,529	165	70	-95	16,625
33	16,625	166	70	-96	16,721
34	16,721	167	70	-97	16,818
35	16,818	168	70	-98	16,916
36	16,916	169	70	-99	17,015

FULLY AMORTIZED	465
PARTIAL AMORTIZATION	270
ZERO AMORTIZATION	140
NEGATIVE AMORTIZATION	70
BALLOON PAYMENT ONLY	410

		Interest	Payment	Amortization of Principle	Unamortized Principle
ORIGINAL LOAN					14,000
1	14,000	140	0	-140	14,140
2	14,140	141	0	-141	14,281
3	14,281	143	0	-143	14,424
4	14,424	144	0	-144	14,568
5	14,568	146	0	-146	14,714
6	14,714	147	0	-147	14,861
7	14,861	149	0	-149	15,010
8	15,010	150	0	-150	15,160
9	15,160	152	0	-152	15,312
10	15,312	153	0	-153	15,465
11	15,465	155	0	-155	15,619
12	15,619	156	0	-156	15,776
13	15,776	158	0	-158	15,933
14	15,933	159	0	-159	16,093
15	16,093	161	0	-161	16,254
16	16,254	163	0	-163	16,416
17	16,416	164	0	-164	16,580
18	16,580	166	0	-166	16,746
19	16,746	167	0	-167	16,914
20	16,914	169	0	-169	17,083
21	17,083	171	0	-171	17,253
22	17,253	173	0	-173	17,426
23	17,426	174	0	-174	17,600
24	17,600	176	0	-176	17,776
25	17,776	178	0	-178	17,954
26	17,954	180	0	-180	18,134
27	18,134	181	0	-181	18,315
28	18,315	183	0	-183	18,498
29	18,498	185	0	-185	18,683
30	18,683	187	0	-187	18,870
31	18,870	189	0	-189	19,059
32	19,059	191	0	-191	19,249
33	19,249	192	0	-192	19,442
34	19,442	194	0	-194	19,636
35	19,636	196	0	-196	19,832
36	19,832	198	0	-198	20,031

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Handout - Car Loan Worksheet

	CASE (a)	CASE (b)	CASE (c)	CASE (d)	CASE (e)
Interest rate	1%	1%	1%	1%	1%
Lenth of period	1 month	1 month	1 month	1 month	1 month
Number of periods	36	36	36	36	36
First period payment	465	270	140	70	0
First period expense	140	140	140	140	140
Periodic payments	16,740	9,720	5,040	2,520	-
Balloon payment	-	8,400	14,000	17,015	20,031
Total payments	16,740	18,120	19,040	19,535	20,031
Present value (amount borrowed)	14,000	14,000	14,000	14,000	14,000
Total expense	2,740	4,120	5,040	5,535	6,031

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Future Value of $1

Periods	0.5%	1%	1.5%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	16%	18%	20%
1	1.005	1.010	1.015	1.020	1.030	1.040	1.050	1.060	1.070	1.080	1.090	1.100	1.120	1.140	1.160	1.180	1.200
2	1.010	1.020	1.030	1.040	1.061	1.082	1.103	1.124	1.145	1.166	1.188	1.210	1.254	1.300	1.346	1.392	1.440
3	1.015	1.030	1.046	1.061	1.093	1.125	1.158	1.191	1.225	1.260	1.295	1.331	1.405	1.482	1.561	1.643	1.728
4	1.020	1.041	1.061	1.082	1.126	1.170	1.216	1.262	1.311	1.360	1.412	1.464	1.574	1.689	1.811	1.939	2.074
5	1.025	1.051	1.077	1.104	1.159	1.217	1.276	1.338	1.403	1.469	1.539	1.611	1.762	1.925	2.100	2.288	2.488
6	1.030	1.062	1.093	1.126	1.194	1.265	1.340	1.419	1.501	1.587	1.677	1.772	1.974	2.195	2.436	2.700	2.986
7	1.036	1.072	1.110	1.149	1.230	1.316	1.407	1.504	1.606	1.714	1.828	1.949	2.211	2.502	2.826	3.185	3.583
8	1.041	1.083	1.126	1.172	1.267	1.369	1.477	1.594	1.718	1.851	1.993	2.144	2.476	2.853	3.278	3.759	4.300
9	1.046	1.094	1.143	1.195	1.305	1.423	1.551	1.689	1.838	1.999	2.172	2.358	2.773	3.252	3.803	4.435	5.160
10	1.051	1.105	1.161	1.219	1.344	1.480	1.629	1.791	1.967	2.159	2.367	2.594	3.106	3.707	4.411	5.234	6.192
11	1.056	1.116	1.178	1.243	1.384	1.539	1.710	1.898	2.105	2.332	2.580	2.853	3.479	4.226	5.117	6.176	7.430
12	1.062	1.127	1.196	1.268	1.426	1.601	1.796	2.012	2.252	2.518	2.813	3.138	3.896	4.818	5.936	7.288	8.916
13	1.067	1.138	1.214	1.294	1.469	1.665	1.886	2.133	2.410	2.720	3.066	3.452	4.363	5.492	6.886	8.599	10.699
14	1.072	1.149	1.232	1.319	1.513	1.732	1.980	2.261	2.579	2.937	3.342	3.797	4.887	6.261	7.988	10.147	12.839
15	1.078	1.161	1.250	1.346	1.558	1.801	2.079	2.397	2.759	3.172	3.642	4.177	5.474	7.138	9.266	11.974	15.407
16	1.083	1.173	1.269	1.373	1.605	1.873	2.183	2.540	2.952	3.426	3.970	4.595	6.130	8.137	10.748	14.129	18.488
18	1.094	1.196	1.307	1.428	1.702	2.026	2.407	2.854	3.380	3.996	4.717	5.560	7.690	10.575	14.463	19.673	26.623
20	1.105	1.220	1.347	1.486	1.806	2.191	2.653	3.207	3.870	4.661	5.604	6.727	9.646	13.743	19.461	27.393	38.338
22	1.116	1.245	1.388	1.546	1.916	2.370	2.925	3.604	4.430	5.437	6.659	8.140	12.100	17.861	26.186	38.142	55.206
24	1.127	1.270	1.430	1.608	2.033	2.563	3.225	4.049	5.072	6.341	7.911	9.850	15.179	23.212	35.236	53.109	79.497
26	1.138	1.295	1.473	1.673	2.157	2.772	3.556	4.549	5.807	7.396	9.399	11.918	19.040	30.167	47.414	73.949	114.475
28	1.150	1.321	1.517	1.741	2.288	2.999	3.920	5.112	6.649	8.627	11.167	14.421	23.884	39.204	63.800	102.967	164.845
30	1.161	1.348	1.563	1.811	2.427	3.243	4.322	5.743	7.612	10.063	13.268	17.449	29.960	50.950	85.850	143.371	237.376
32	1.173	1.375	1.610	1.885	2.575	3.508	4.765	6.453	8.715	11.737	15.763	21.114	37.582	66.215	115.520	199.629	341.822
34	1.185	1.403	1.659	1.961	2.732	3.794	5.253	7.251	9.978	13.690	18.728	25.548	47.143	86.053	155.443	277.964	492.224
36	1.197	1.431	1.709	2.040	2.898	4.104	5.792	8.147	11.424	15.968	22.251	30.913	59.136	111.834	209.164	387.037	708.802
40	1.221	1.489	1.814	2.208	3.262	4.801	7.040	10.286	14.974	21.725	31.409	45.259	93.051	188.884	378.721	750.378	1469.722
44	1.245	1.549	1.925	2.390	3.671	5.617	8.557	12.985	19.628	29.556	44.337	66.264	146.418	319.017	685.727	1454.817	3047.718
48	1.270	1.612	2.043	2.587	4.132	6.571	10.401	16.394	25.729	40.211	62.585	97.017	230.391	538.807	1241.605	2820.567	6319.749

Future Value of an Ordinary Annuity of $1

Payments	0.5%	1%	1.5%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	16%	18%	20%
1	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	1.000
2	2.005	2.010	2.015	2.020	2.030	2.040	2.050	2.060	2.070	2.080	2.090	2.100	2.120	2.140	2.160	2.180	2.200
3	3.015	3.030	3.045	3.060	3.091	3.122	3.153	3.184	3.215	3.246	3.278	3.310	3.374	3.440	3.506	3.572	3.640
4	4.030	4.060	4.091	4.122	4.184	4.246	4.310	4.375	4.440	4.506	4.573	4.641	4.779	4.921	5.066	5.215	5.368
5	5.050	5.101	5.152	5.204	5.309	5.416	5.526	5.637	5.751	5.867	5.985	6.105	6.353	6.610	6.877	7.154	7.442
6	6.076	6.152	6.230	6.308	6.468	6.633	6.802	6.975	7.153	7.336	7.523	7.716	8.115	8.536	8.977	9.442	9.930
7	7.106	7.214	7.323	7.434	7.662	7.898	8.142	8.394	8.654	8.923	9.200	9.487	10.089	10.730	11.414	12.142	12.916
8	8.141	8.286	8.433	8.583	8.892	9.214	9.549	9.897	10.260	10.637	11.028	11.436	12.300	13.233	14.240	15.327	16.499
9	9.182	9.369	9.559	9.755	10.159	10.583	11.027	11.491	11.978	12.488	13.021	13.579	14.776	16.085	17.519	19.086	20.799
10	10.228	10.462	10.703	10.950	11.464	12.006	12.578	13.181	13.816	14.487	15.193	15.937	17.549	19.337	21.321	23.521	25.959
11	11.279	11.567	11.863	12.169	12.808	13.486	14.207	14.972	15.784	16.645	17.560	18.531	20.655	23.045	25.733	28.755	32.150
12	12.336	12.683	13.041	13.412	14.192	15.026	15.917	16.870	17.888	18.977	20.141	21.384	24.133	27.271	30.850	34.931	39.581
13	13.397	13.809	14.237	14.680	15.618	16.627	17.713	18.882	20.141	21.495	22.953	24.523	28.029	32.089	36.786	42.219	48.497
14	14.464	14.947	15.450	15.974	17.086	18.292	19.599	21.015	22.550	24.215	26.019	27.975	32.393	37.581	43.672	50.818	59.196
15	15.537	16.097	16.682	17.293	18.599	20.024	21.579	23.276	25.129	27.152	29.361	31.772	37.280	43.842	51.660	60.965	72.035
16	16.614	17.258	17.932	18.639	20.157	21.825	23.657	25.673	27.888	30.324	33.003	35.950	42.753	50.980	60.925	72.939	87.442
18	18.786	19.615	20.489	21.412	23.414	25.645	28.132	30.906	33.999	37.450	41.301	45.599	55.750	68.394	84.141	103.740	128.117
20	20.979	22.019	23.124	24.297	26.870	29.778	33.066	36.786	40.995	45.762	51.160	57.275	72.052	91.025	115.380	146.628	186.688
22	23.194	24.472	25.838	27.299	30.537	34.248	38.505	43.392	49.006	55.457	62.873	71.403	92.503	120.436	157.415	206.345	271.031
24	25.432	26.973	28.634	30.422	34.426	39.083	44.502	50.816	58.177	66.765	76.790	88.497	118.155	158.659	213.978	289.494	392.484
26	27.692	29.526	31.514	33.671	38.553	44.312	51.113	59.156	68.676	79.954	93.324	109.182	150.334	208.333	290.088	405.272	567.377
28	29.975	32.129	34.481	37.051	42.931	49.968	58.403	68.528	80.698	95.339	112.968	134.210	190.699	272.889	392.503	566.481	819.223
30	32.280	34.785	37.539	40.568	47.575	56.085	66.439	79.058	94.461	113.283	136.308	164.494	241.333	356.787	530.312	790.948	1181.882
32	34.609	37.494	40.688	44.227	52.503	62.701	75.299	90.890	110.218	134.214	164.037	201.138	304.848	465.820	715.747	1103.496	1704.109
34	36.961	40.258	43.933	48.034	57.730	69.858	85.067	104.184	128.259	158.627	196.982	245.477	384.521	607.520	965.270	1538.688	2456.118
36	39.336	43.077	47.276	51.994	63.276	77.598	95.836	119.121	148.913	187.102	236.125	299.127	484.463	791.673	1301.027	2144.649	3539.009
40	44.159	48.886	54.268	60.402	75.401	95.026	120.800	154.762	199.635	259.057	337.882	442.593	767.091	1342.025	2360.757	4163.213	7343.858
44	49.079	54.932	61.689	69.503	89.048	115.413	151.143	199.758	266.121	356.950	481.522	652.641	1211.813	2271.548	4279.546	8076.760	15233.592
48	54.098	61.223	69.565	79.354	104.408	139.263	188.025	256.565	353.270	490.132	684.280	960.172	1911.590	3841.475	7753.782	15664.259	31593.744

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Present Value of $1

Periods	0.5%	1%	1.5%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	16%	18%	20%
1	0.995	0.990	0.985	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.893	0.877	0.862	0.847	0.833
2	0.990	0.980	0.971	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826	0.797	0.769	0.743	0.718	0.694
3	0.985	0.971	0.956	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751	0.712	0.675	0.641	0.609	0.579
4	0.980	0.961	0.942	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683	0.636	0.592	0.552	0.516	0.482
5	0.975	0.951	0.928	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621	0.567	0.519	0.476	0.437	0.402
6	0.971	0.942	0.915	0.888	0.837	0.790	0.746	0.705	0.666	0.630	0.596	0.564	0.507	0.456	0.410	0.370	0.335
7	0.966	0.933	0.901	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513	0.452	0.400	0.354	0.314	0.279
8	0.961	0.923	0.888	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467	0.404	0.351	0.305	0.266	0.233
9	0.956	0.914	0.875	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424	0.361	0.308	0.263	0.225	0.194
10	0.951	0.905	0.862	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386	0.322	0.270	0.227	0.191	0.162
11	0.947	0.896	0.849	0.804	0.722	0.650	0.585	0.527	0.475	0.429	0.388	0.350	0.287	0.237	0.195	0.162	0.135
12	0.942	0.887	0.836	0.788	0.701	0.625	0.557	0.497	0.444	0.397	0.356	0.319	0.257	0.208	0.168	0.137	0.112
13	0.937	0.879	0.824	0.773	0.681	0.601	0.530	0.469	0.415	0.368	0.326	0.290	0.229	0.182	0.145	0.116	0.093
14	0.933	0.870	0.812	0.758	0.661	0.577	0.505	0.442	0.388	0.340	0.299	0.263	0.205	0.160	0.125	0.099	0.078
15	0.928	0.861	0.800	0.743	0.642	0.555	0.481	0.417	0.362	0.315	0.275	0.239	0.183	0.140	0.108	0.084	0.065
16	0.923	0.853	0.788	0.728	0.623	0.534	0.458	0.394	0.339	0.292	0.252	0.218	0.163	0.123	0.093	0.071	0.054
18	0.914	0.836	0.765	0.700	0.587	0.494	0.416	0.350	0.296	0.250	0.212	0.180	0.130	0.095	0.069	0.051	0.038
20	0.905	0.820	0.742	0.673	0.554	0.456	0.377	0.312	0.258	0.215	0.178	0.149	0.104	0.073	0.051	0.037	0.026
22	0.896	0.803	0.721	0.647	0.522	0.422	0.342	0.278	0.226	0.184	0.150	0.123	0.083	0.056	0.038	0.026	0.018
24	0.887	0.788	0.700	0.622	0.492	0.390	0.310	0.247	0.197	0.158	0.126	0.102	0.066	0.043	0.028	0.019	0.013
26	0.878	0.772	0.679	0.598	0.464	0.361	0.281	0.220	0.172	0.135	0.106	0.084	0.053	0.033	0.021	0.014	0.009
28	0.870	0.757	0.659	0.574	0.437	0.333	0.255	0.196	0.150	0.116	0.090	0.069	0.042	0.026	0.016	0.010	0.006
30	0.861	0.742	0.640	0.552	0.412	0.308	0.231	0.174	0.131	0.099	0.075	0.057	0.033	0.020	0.012	0.007	0.004
32	0.852	0.727	0.621	0.531	0.388	0.285	0.210	0.155	0.115	0.085	0.063	0.047	0.027	0.015	0.009	0.005	0.003
34	0.844	0.713	0.603	0.510	0.366	0.264	0.190	0.138	0.100	0.073	0.053	0.039	0.021	0.012	0.006	0.004	0.002
36	0.836	0.699	0.585	0.490	0.345	0.244	0.173	0.123	0.088	0.063	0.045	0.032	0.017	0.009	0.005	0.003	0.001
40	0.819	0.672	0.551	0.453	0.307	0.208	0.142	0.097	0.067	0.046	0.032	0.022	0.011	0.005	0.003	0.001	0.001
44	0.803	0.645	0.519	0.418	0.272	0.178	0.117	0.077	0.051	0.034	0.023	0.015	0.007	0.003	0.001	0.001	<.001
48	0.787	0.620	0.489	0.387	0.242	0.152	0.096	0.061	0.039	0.025	0.016	0.010	0.004	0.002	0.001	<.001	<.001

Present Value of an Ordinary Annuity of $1

Payments	0.5%	1%	1.5%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	16%	18%	20%
1	0.995	0.990	0.985	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.893	0.877	0.862	0.847	0.833
2	1.985	1.970	1.956	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736	1.690	1.647	1.605	1.566	1.528
3	2.970	2.941	2.912	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487	2.402	2.322	2.246	2.174	2.106
4	3.950	3.902	3.854	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170	3.037	2.914	2.798	2.690	2.589
5	4.926	4.853	4.783	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791	3.605	3.433	3.274	3.127	2.991
6	5.896	5.795	5.697	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355	4.111	3.889	3.685	3.498	3.326
7	6.862	6.728	6.598	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868	4.564	4.288	4.039	3.812	3.605
8	7.823	7.652	7.486	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335	4.968	4.639	4.344	4.078	3.837
9	8.779	8.566	8.361	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759	5.328	4.946	4.607	4.303	4.031
10	9.730	9.471	9.222	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145	5.650	5.216	4.833	4.494	4.192
11	10.677	10.368	10.071	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495	5.937	5.453	5.029	4.656	4.327
12	11.619	11.255	10.908	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814	6.194	5.660	5.197	4.793	4.439
13	12.556	12.134	11.732	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103	6.424	5.842	5.342	4.910	4.533
14	13.489	13.004	12.543	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367	6.628	6.002	5.468	5.008	4.611
15	14.417	13.865	13.343	12.849	11.938	11.118	10.380	9.712	9.108	8.559	8.061	7.606	6.811	6.142	5.575	5.092	4.675
16	15.340	14.718	14.131	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.313	7.824	6.974	6.265	5.668	5.162	4.730
18	17.173	16.398	15.673	14.992	13.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201	7.250	6.467	5.818	5.273	4.812
20	18.987	18.046	17.169	16.351	14.877	13.590	12.462	11.470	10.594	9.818	9.129	8.514	7.469	6.623	5.929	5.353	4.870
22	20.784	19.660	18.621	17.658	15.937	14.451	13.163	12.042	11.061	10.201	9.442	8.772	7.645	6.743	6.011	5.410	4.909
24	22.563	21.243	20.030	18.914	16.936	15.247	13.799	12.550	11.469	10.529	9.707	8.985	7.784	6.835	6.073	5.451	4.937
26	24.324	22.795	21.399	20.121	17.877	15.983	14.375	13.003	11.826	10.810	9.929	9.161	7.896	6.906	6.118	5.480	4.956
28	26.068	24.316	22.727	21.281	18.764	16.663	14.898	13.406	12.137	11.051	10.116	9.307	7.984	6.961	6.152	5.502	4.970
30	27.794	25.808	24.016	22.396	19.600	17.292	15.372	13.765	12.409	11.258	10.274	9.427	8.055	7.003	6.177	5.517	4.979
32	29.503	27.270	25.267	23.468	20.389	17.874	15.803	14.084	12.647	11.435	10.406	9.526	8.112	7.035	6.196	5.528	4.985
34	31.196	28.703	26.482	24.499	21.132	18.411	16.193	14.368	12.854	11.587	10.518	9.609	8.157	7.060	6.210	5.536	4.990
36	32.871	30.108	27.661	25.489	21.832	18.908	16.547	14.621	13.035	11.717	10.612	9.677	8.192	7.079	6.220	5.541	4.993
40	36.172	32.835	29.916	27.355	23.115	19.793	17.159	15.046	13.332	11.925	10.757	9.779	8.244	7.105	6.233	5.548	4.997
44	39.408	35.455	32.041	29.080	24.254	20.549	17.663	15.383	13.558	12.077	10.861	9.849	8.276	7.120	6.241	5.552	4.998
48	42.580	37.974	34.043	30.673	25.267	21.195	18.077	15.650	13.730	12.189	10.934	9.897	8.297	7.130	6.245	5.554	4.999

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