

**TABLE A.3** Present value of an annuity of \$1 per period for  $t$  periods =  $[1 - 1/(1 + r)^t]/r$ 

Number of Periods	Interest Rate								
	1%	2%	3%	4%	5%	6%	7%	8%	9%
1	.9901	.9804	.9709	.9615	.9524	.9434	.9346	.9259	.9174
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	1.7833	1.7591
3	2.9410	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243	2.5771	2.5313
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3872	3.3121	3.2397
5	4.8534	4.7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927	3.8897
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7665	4.6229	4.4859
7	6.7282	6.4720	6.2303	6.0021	5.7864	5.5824	5.3893	5.2064	5.0330
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5348
9	8.5660	8.1622	7.7861	7.4353	7.1078	6.8017	6.5152	6.2469	5.9952
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177
11	10.3676	9.7868	9.2526	8.7605	8.3064	7.8869	7.4987	7.1390	6.8052
12	11.2551	10.5753	9.9540	9.3851	8.8633	8.3838	7.9427	7.5361	7.1607
13	12.1337	11.3484	10.6350	9.9856	9.3936	8.8527	8.3577	7.9038	7.4869
14	13.0037	12.1062	11.2961	10.5631	9.8986	9.2950	8.7455	8.2442	7.7862
15	13.8651	12.8493	11.9379	11.1184	10.3797	9.7122	9.1079	8.5595	8.0607
16	14.7179	13.5777	12.5611	11.6523	10.8378	10.1059	9.4466	8.8514	8.3126
17	15.5623	14.2919	13.1661	12.1657	11.2741	10.4773	9.7632	9.1216	8.5436
18	16.3983	14.9920	13.7535	12.6593	11.6896	10.8276	10.0591	9.3719	8.7556
19	17.2260	15.6785	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501
20	18.0456	16.3514	14.8775	13.5903	12.4622	11.4699	10.5940	9.8181	9.1285
21	18.8570	17.0112	15.4150	14.0292	12.8212	11.7641	10.8355	10.0168	9.2922
22	19.6604	17.6580	15.9369	14.4511	13.1630	12.0416	11.0612	10.2007	9.4424
23	20.4558	18.2922	16.4436	14.8568	13.4886	12.3034	11.2722	10.3741	9.5802
24	21.2434	18.9139	16.9355	15.2470	13.7986	12.5504	11.4693	10.5288	9.7066
25	22.0232	19.5235	17.4131	15.6221	14.0939	12.7834	11.6536	10.6748	9.8226
30	25.8077	22.3965	19.6004	17.2920	15.3725	13.7648	12.4090	11.2578	10.2737
40	32.8347	27.3555	23.1148	19.7928	17.1591	15.0463	13.3317	11.9246	10.7574
50	39.1961	31.4236	25.7298	21.4822	18.2559	15.7619	13.8007	12.2335	10.9617

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	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%	36%
	.9091	.8929	.8772	.8696	.8621	.8475	.8333	.8065	.7813	.7576	.7353
	1.7355	1.6901	1.6467	1.6257	1.6052	1.5656	1.5278	1.4568	1.3916	1.3315	1.2760
	2.4869	2.4018	2.3216	2.2832	2.2459	2.1743	2.1065	1.9813	1.8684	1.7663	1.6735
	3.1699	3.0373	2.9137	2.8550	2.7982	2.6901	2.5887	2.4043	2.2410	2.0957	1.9658
	3.7908	3.6048	3.4331	3.3522	3.2743	3.1272	2.9906	2.7454	2.5320	2.3452	2.1807
	4.3553	4.1114	3.8887	3.7845	3.6847	3.4976	3.3255	3.0205	2.7594	2.5342	2.3388
	4.8684	4.5638	4.2883	4.1604	4.0386	3.8115	3.6046	3.2423	2.9370	2.6775	2.4550
	5.3349	4.9676	4.6389	4.4873	4.3436	4.0776	3.8372	3.4212	3.0758	2.7860	2.5404
	5.7590	5.3282	4.9464	4.7716	4.6065	4.3030	4.0310	3.5655	3.1842	2.8681	2.6033
	6.1446	5.6502	5.2161	5.0188	4.8332	4.4941	4.1925	3.6819	3.2689	2.9304	2.6495
	6.4951	5.9377	5.4527	5.2337	5.0286	4.6560	4.3271	3.7757	3.3351	2.9776	2.6834
	6.8137	6.1944	5.6603	5.4206	5.1971	4.7932	4.4392	3.8514	3.3868	3.0133	2.7084
	7.1034	6.4235	5.8424	5.5831	5.3423	4.9095	4.5327	3.9124	3.4272	3.0404	2.7268
	7.3667	6.6282	6.0021	5.7245	5.4675	5.0081	4.6106	3.9616	3.4587	3.0609	2.7403
	7.6061	6.8109	6.1422	5.8474	5.5755	5.0916	4.6755	4.0013	3.4834	3.0764	2.7502
	7.8237	6.9740	6.2651	5.9542	5.6685	5.1624	4.7296	4.0333	3.5026	3.0882	2.7575
	8.0216	7.1196	6.3729	6.0472	5.7487	5.2223	4.7746	4.0591	3.5177	3.0971	2.7629
	8.2014	7.2497	6.4674	6.1280	5.8178	5.2732	4.8122	4.0799	3.5294	3.1039	2.7668
	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	4.0967	3.5386	3.1090	2.7697
	8.5136	7.4694	6.6231	6.2593	5.9288	5.3527	4.8696	4.1103	3.5458	3.1129	2.7718
	8.6487	7.5620	6.6870	6.3125	5.9731	5.3837	4.8913	4.1212	3.5514	3.1158	2.7734
	8.7715	7.6446	6.7429	6.3587	6.0113	5.4099	4.9094	4.1300	3.5558	3.1180	2.7746
	8.8832	7.7184	6.7921	6.3988	6.0442	5.4321	4.9245	4.1371	3.5592	3.1197	2.7754
	8.9847	7.7843	6.8351	6.4338	6.0726	5.4509	4.9371	4.1428	3.5619	3.1210	2.7760
	9.0770	7.8431	6.8729	6.4641	6.0971	5.4669	4.9476	4.1474	3.5640	3.1220	2.7765
	9.1629	7.8952	6.9027	6.4944	6.1272	5.4972	4.9789	4.1601	3.5693	3.1242	2.7775
	9.2429	7.9408	6.9302	6.5206	6.1534	5.5234	4.9966	4.1659	3.5712	3.1250	2.7778
	9.3168	7.9800	6.9564	6.5448	6.1772	5.5482	5.0115	4.1699	3.5730	3.1255	2.7780
	9.3847	8.0138	6.9812	6.5680	6.2000	5.5710	5.0255	4.1737	3.5747	3.1259	2.7782
	9.4467	8.0422	7.0047	6.5892	6.2212	5.5922	5.0387	4.1774	3.5763	3.1262	2.7784
	9.5029	8.0652	7.0270	6.6094	6.2414	5.6124	5.0511	4.1810	3.5778	3.1265	2.7786
	9.5534	8.0828	7.0482	6.6286	6.2606	5.6316	5.0627	4.1841	3.5792	3.1267	2.7788
	9.6082	8.0952	7.0684	6.6468	6.2788	5.6500	5.0735	4.1870	3.5805	3.1269	2.7789
	9.6574	8.1024	7.0876	6.6640	6.2960	5.6672	5.0837	4.1897	3.5817	3.1270	2.7790
	9.7011	8.1045	7.1058	6.6802	6.3122	5.6834	5.0935	4.1922	3.5828	3.1271	2.7791
	9.7493	8.1016	7.1230	6.6954	6.3274	5.6986	5.1027	4.1945	3.5838	3.1272	2.7792
	9.7920	8.0937	7.1392	6.7106	6.3426	5.7138	5.1115	4.1967	3.5847	3.1273	2.7793
	9.8393	8.0808	7.1544	6.7258	6.3578	5.7290	5.1203	4.1988	3.5856	3.1274	2.7794
	9.8811	8.0629	7.1696	6.7410	6.3730	5.7442	5.1287	4.2008	3.5864	3.1275	2.7795
	9.9279	8.0400	7.1848	6.7562	6.3882	5.7594	5.1371	4.2027	3.5872	3.1276	2.7796
	9.9697	8.0121	7.1999	6.7714	6.4034	5.7746	5.1455	4.2045	3.5879	3.1277	2.7797
	10.0165	7.9792	7.2151	6.7866	6.4186	5.7898	5.1537	4.2062	3.5886	3.1278	2.7798
	10.0583	7.9413	7.2303	6.8018	6.4338	5.8050	5.1619	4.2079	3.5892	3.1279	2.7799
	10.0950	7.8984	7.2455	6.8170	6.4490	5.8202	5.1701	4.2095	3.5898	3.1280	2.7800
	10.1368	7.8505	7.2607	6.8322	6.4642	5.8354	5.1783	4.2111	3.5904	3.1281	2.7801
	10.1786	7.7976	7.2759	6.8474	6.4794	5.8506	5.1865	4.2127	3.5909	3.1282	2.7802
	10.2204	7.7397	7.2911	6.8626	6.4946	5.8658	5.1947	4.2142	3.5914	3.1283	2.7803
	10.2622	7.6768	7.3063	6.8778	6.5098	5.8810	5.2029	4.2157	3.5919	3.1284	2.7804
	10.3040	7.6089	7.3215	6.8930	6.5250	5.8962	5.2111	4.2172	3.5924	3.1285	2.7805
	10.3458	7.5360	7.3367	6.9082	6.5402	5.9114	5.2193	4.2187	3.5929	3.1286	2.7806
	10.3876	7.4581	7.3519	6.9234	6.5554	5.9266	5.2275	4.2202	3.5934	3.1287	2.7807
	10.4294	7.3752	7.3671	6.9386	6.5706	5.9418	5.2357	4.2217	3.5939	3.1288	2.7808
	10.4712	7.2873	7.3823	6.9538	6.5858	5.9570	5.2439	4.2232	3.5944	3.1289	2.7809
	10.5130	7.1944	7.3975	6.9690	6.6010	5.9722	5.2521	4.2247	3.5949	3.1290	2.7810
	10.5548	7.0965	7.4127	6.9842	6.6162	5.9874	5.2603	4.2262	3.5954	3.1291	2.7811
	10.5966	6.9936	7.4279	6.9994	6.6314	5.9986	5.2685	4.2277	3.5959	3.1292	2.7812
	10.6384	6.8857	7.4431	7.0146	6.6466	6.0098	5.2767	4.2292	3.5964	3.1293	2.7813
	10.6802	6.7728	7.4583	7.0298	6.6618	6.0210	5.2849	4.2307	3.5969	3.1294	2.7814
	10.7220	6.6549	7.4735	7.0450	6.6770	6.0322	5.2931	4.2322	3.5974	3.1295	2.7815
	10.7638	6.5320	7.4887	7.0602	6.6922	6.0434	5.3013	4.2337	3.5979	3.1296	2.7816
	10.8056	6.4041	7.5039	7.0754	6.7074	6.0546	5.3095	4.2352	3.5984	3.1297	2.7817
	10.8474	6.2712	7.5191	7.0906	6.7226	6.0658	5.3177	4.2367	3.5989	3.1298	2.7818
	10.8892	6.1333	7.5343	7.1058	6.7378	6.0770	5.3259	4.2382	3.5994	3.1299	2.7819
	10.9310	5.9904	7.5495	7.1210	6.7530	6.0882	5.3341	4.2397	3.5999	3.1300	2.7820
	10.9728	5.8425	7.5647	7.1362	6.7682	6.0994	5.3423	4.2412	3.6004	3.1301	2.7821
	11.0146	5.6896	7.5799	7.1514	6.7834	6.1106	5.3505	4.2427	3.6009	3.1302	2.7822
	11.0564	5.5317	7.5951	7.1666	6.7986	6.1218	5.3587	4.2442	3.6014	3.1303	2.7823
	11.0982	5.3688	7.6103	7.1818	6.8138	6.1330	5.3669	4.2457	3.6019	3.1304	2.7824
	11.1400	5.2009	7.6255	7.1970	6.8290	6.1442	5.3751	4.2472	3.6024	3.1305	2.7825
	11.1818	5.0280	7.6407	7.2122	6.8442	6.1554	5.3833	4.2487	3.6029	3.1306	2.7826
	11.2236	4.8501	7.6559	7.2274	6.8594	6.1666	5.3915	4.2502	3.6034	3.1307	2.7827
	11.2654	4.6672	7.6711	7.2426	6.8746	6.1778	5.3997	4.2517	3.6039	3.1308	2.7828
	11.3072	4.4793	7.6863	7.2578	6.8898	6.1890	5.4079	4.2532	3.6044	3.1309	2.7829
	11.3490	4.2864	7.7015	7.2730	6.9050	6.2002	5.4161	4.2547	3.6049	3.1310	2.7830
	11.3908	4.0885	7.7167	7.2882	6.9202	6.2114	5.4243	4.2562	3.6054	3.1311	2.7831
	11.4326	3.8856	7.7319	7.3034	6.9354	6.2226	5.4325	4.2577	3.6059	3.1312	2.7832
	11.4744	3.6777	7.7471	7.3186	6.9506	6.2338	5.4407	4.2592	3.6064	3.1313	2.7833
	11.5162	3.4648	7.7623	7.3338	6.9658	6.2450	5.4489	4.2607	3.6069	3.1314	2.7834
	11.5580	3.2469	7.7775	7.3490	6.9810	6.2562	5.4571	4.2622	3.6074	3.1315	2.7835
	11.5998	3.0240	7.7927	7.3642	6.9962	6.2674	5.4653	4.2637	3.6079	3.1316	2.7836
	11.6416	2.7961	7.8079	7.3794	7.0114	6.2786	5.4735	4.2652	3.6084	3.1317	2.7837
	11.6834	2.5682	7.8231	7.3946	7.0266	6.2898	5.4817	4.2667	3.6089	3.1318	2.7838
	11.7252	2.3343	7.8383	7.4098	7.0418	6.3010	5.4899	4.2682	3.6094	3.1319	2.7839
	11.7670	2.0954	7.8535	7.4250	7.0570	6.3122	5.4981	4.2697	3.6099	3.1320	2.7840
	11.8088	1.8515	7.8687	7.4402	7.0722	6.3234	5.5063	4.2712	3.6104	3.1321	2.7841
	11.8506	1.6026	7.8839	7.4554	7.0874	6.3346	5.5145	4.2727	3.6109	3.1322	2.7842
	11.8924	1.3487	7.8991	7.4706	7.1026	6.3458	5.5227	4.2742	3.6114	3.1323	2.7843
	11.9342	1.0898	7.9143	7.4858	7.1178	6.3570	5.5309	4.2757	3.6119	3.1324	2.7844
	11.9760	0.8259	7.9295	7.5010	7.1330	6.3682	5.5391	4.2772	3.6124	3.1325	2.7845
	12.0178	0.5570	7.9447	7.5162	7.1482	6.3794	5.5473	4.2787	3.6129	3.1326	2.7846
	12.0596	0.2831	7.9599	7.5314	7.1634	6.3906	5.5555	4.2802	3.6134	3.1327	2.7847
	12.1014	0.0092	7.9751	7.5466	7.1786	6.4018	5.5637	4.2817	3.6139	3.1328	2.7848
	12.1432		7.9903	7.5618	7.1938	6.4130	5.5719	4.2832	3.6144	3.1329	2.7849
	12.1850		8.0055	7.5770	7.2090	6.4242	5.5801	4.2847			

**TABLE A.4**    Future value of an annuity of \$1 per period for  $t$  periods =  $[(1 + r)^t - 1]/r$

Number of Periods	Interest Rate								
	1%	2%	3%	4%	5%	6%	7%	8%	9%
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	2.0400	2.0500	2.0600	2.0700	2.0800	2.0900
3	3.0301	3.0604	3.0909	3.1216	3.1525	3.1836	3.2149	3.2464	3.2781
4	4.0604	4.1216	4.1836	4.2465	4.3101	4.3746	4.4399	4.5061	4.5731
5	5.1010	5.2040	5.3091	5.4163	5.5256	5.6371	5.7507	5.8666	5.9847
6	6.1520	6.3081	6.4684	6.6330	6.8019	6.9753	7.1533	7.3359	7.5233
7	7.2135	7.4343	7.6625	7.8983	8.1420	8.3938	8.6540	8.9228	9.2004
8	8.2857	8.5830	8.8932	9.2142	9.5491	9.8975	10.260	10.637	11.028
9	9.3685	9.7546	10.159	10.583	11.027	11.491	11.978	12.488	13.021
10	10.462	10.950	11.464	12.006	12.578	13.181	13.816	14.487	15.193
11	11.567	12.169	12.808	13.486	14.207	14.972	15.784	16.645	17.560
12	12.683	13.412	14.192	15.026	15.917	16.870	17.888	18.977	20.141
13	13.809	14.680	15.618	16.627	17.713	18.882	20.141	21.495	22.953
14	14.947	15.974	17.086	18.292	19.599	21.015	22.550	24.215	26.019
15	16.097	17.293	18.599	20.024	21.579	23.276	25.129	27.152	29.361
16	17.258	18.639	20.157	21.825	23.657	25.673	27.888	30.324	33.003
17	18.430	20.012	21.762	23.698	25.840	28.213	30.840	33.750	36.974
18	19.615	21.412	23.414	25.645	28.132	30.906	33.999	37.450	41.301
19	20.811	22.841	25.117	27.671	30.539	33.760	37.379	41.446	46.018
20	22.019	24.297	26.870	29.778	33.066	36.786	40.995	45.762	51.160
21	23.239	25.783	28.676	31.969	35.719	39.993	44.865	50.423	56.765
22	24.472	27.299	30.537	34.248	38.505	43.392	49.006	55.457	62.873
23	25.716	28.845	32.453	36.618	41.430	46.996	53.436	60.893	69.532
24	26.973	30.422	34.426	39.083	44.502	50.816	58.177	66.765	76.790
25	28.243	32.030	36.459	41.646	47.727	54.865	63.249	73.106	84.701
30	34.785	40.568	47.575	56.085	66.439	79.058	94.461	113.28	136.31
40	48.886	60.402	75.401	95.026	120.80	154.76	199.64	259.06	337.88
50	64.463	84.579	112.80	152.67	209.35	290.34	406.53	573.77	815.08
60	81.670	114.05	163.05	237.99	353.58	533.13	813.52	1253.2	1944.8

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	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%	36%
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
	2.1000	2.1200	2.1400	2.1500	2.1600	2.1800	2.2000	2.2400	2.2800	2.3200	2.3600
	3.3100	3.3744	3.4396	3.4725	3.5056	3.5724	3.6400	3.7776	3.9184	4.0624	4.2096
	4.6410	4.7793	4.9211	4.9934	5.0665	5.2154	5.3680	5.6842	6.0156	6.3624	6.7251
	6.1051	6.3528	6.6101	6.7424	6.8771	7.1542	7.4416	8.0484	8.6999	9.3983	10.146
	7.7156	8.1152	8.5355	8.7537	8.9775	9.4420	9.9299	10.980	12.136	13.406	14.799
	9.4872	10.089	10.730	11.067	11.414	12.142	12.916	14.615	16.534	18.696	21.126
	11.436	12.300	13.233	13.727	14.240	15.327	16.499	19.123	22.163	25.678	29.732
	13.579	14.776	16.085	16.786	17.519	19.086	20.799	24.712	29.369	34.895	41.435
	15.937	17.549	19.337	20.304	21.321	23.521	25.959	31.643	38.593	47.062	57.352
	18.531	20.655	23.045	24.349	25.733	28.755	32.150	40.238	50.398	63.122	78.998
	21.384	24.133	27.271	29.002	30.850	34.931	39.581	50.895	65.510	84.320	108.44
	24.523	28.029	32.089	34.352	36.786	42.219	48.497	64.110	84.853	112.30	148.47
	27.975	32.393	37.581	40.505	43.672	50.818	59.196	80.496	109.61	149.24	202.93
	31.772	37.280	43.842	47.580	51.660	60.965	72.035	100.82	141.30	198.00	276.98
	35.950	42.753	50.980	55.717	60.925	72.939	87.442	126.01	181.87	262.36	377.69
	40.545	48.884	59.118	65.075	71.673	87.068	105.93	157.25	233.79	347.31	514.66
	45.599	55.750	68.394	75.836	84.141	103.74	128.12	195.99	300.25	459.45	700.94
	51.159	63.440	78.969	88.212	98.603	123.41	154.74	244.03	385.32	607.47	954.28
	57.275	72.052	91.025	102.44	115.38	146.63	186.69	303.60	494.21	802.86	1298.8
	64.002	81.699	104.77	118.81	134.84	174.02	225.03	377.46	633.59	1060.8	1767.4
	71.403	92.503	120.44	137.63	157.41	206.34	271.03	469.06	812.00	1401.2	2404.7
	79.543	104.60	138.30	159.28	183.60	244.49	326.24	582.63	1040.4	1850.6	3271.3
	88.497	118.16	158.66	184.17	213.98	289.49	392.48	723.46	1332.7	2443.8	4450.0
	98.347	133.33	181.87	212.79	249.21	342.60	471.98	898.09	1706.8	3226.8	6053.0
	164.49	241.33	356.79	434.75	530.31	790.95	1181.9	2640.9	5873.2	12940.9	28172.3
	442.59	767.09	1342.0	1779.1	2360.8	4163.2	7343.9	22728.8	69377.5	*	*
	1163.9	2400.0	4994.5	7217.7	10435.7	21813.1	45497.2	*	*	*	*
	3043.8	7471.6	18535.1	29220.0	46057.5	*	*	*	*	*	*

\*The factor is greater than 99,999.

**TABLE A.5** Cumulative normal distribution

<i>d</i>	<i>N(d)</i>	<i>d</i>	<i>N(d)</i>	<i>d</i>	<i>N(d)</i>	<i>d</i>	<i>N(d)</i>	<i>d</i>	<i>N(d)</i>	<i>d</i>	<i>N(d)</i>
-3.00	.0013	-1.58	.0571	-.76	.2236	.06	.5239	.86	.8051	1.66	.9515
-2.95	.0016	-1.56	.0594	-.74	.2297	.08	.5319	.88	.8106	1.68	.9535
-2.90	.0019	-1.54	.0618	-.72	.2358	.10	.5398	.90	.8159	1.70	.9554
-2.85	.0022	-1.52	.0643	-.70	.2420	.12	.5478	.92	.8212	1.72	.9573
-2.80	.0026	-1.50	.0668	-.68	.2483	.14	.5557	.94	.8264	1.74	.9591
-2.75	.0030	-1.48	.0694	-.66	.2546	.16	.5636	.96	.8315	1.76	.9608
-2.70	.0035	-1.46	.0721	-.64	.2611	.18	.5714	.98	.8365	1.78	.9625
-2.65	.0040	-1.44	.0749	-.62	.2676	.20	.5793	1.00	.8413	1.80	.9641
-2.60	.0047	-1.42	.0778	-.60	.2743	.22	.5871	1.02	.8461	1.82	.9656
-2.55	.0054	-1.40	.0808	-.58	.2810	.24	.5948	1.04	.8508	1.84	.9671
-2.50	.0062	-1.38	.0838	-.56	.2877	.26	.6026	1.06	.8554	1.86	.9686
-2.45	.0071	-1.36	.0869	-.54	.2946	.28	.6103	1.08	.8599	1.88	.9699
-2.40	.0082	-1.34	.0901	-.52	.3015	.30	.6179	1.10	.8643	1.90	.9713
-2.35	.0094	-1.32	.0934	-.50	.3085	.32	.6255	1.12	.8686	1.92	.9726
-2.30	.0107	-1.30	.0968	-.48	.3156	.34	.6331	1.14	.8729	1.94	.9738
-2.25	.0122	-1.28	.1003	-.46	.3228	.36	.6406	1.16	.8770	1.96	.9750
-2.20	.0139	-1.26	.1038	-.44	.3300	.38	.6480	1.18	.8810	1.98	.9761
-2.15	.0158	-1.24	.1075	-.42	.3372	.40	.6554	1.20	.8849	2.00	.9772
-2.10	.0179	-1.22	.1112	-.40	.3446	.42	.6628	1.22	.8888	2.05	.9798
-2.05	.0202	-1.20	.1151	-.38	.3520	.44	.6700	1.24	.8925	2.10	.9821
-2.00	.0228	-1.18	.1190	-.36	.3594	.46	.6772	1.26	.8962	2.15	.9842
-1.98	.0239	-1.16	.1230	-.34	.3669	.48	.6844	1.28	.8997	2.20	.9861
-1.96	.0250	-1.14	.1271	-.32	.3745	.50	.6915	1.30	.9032	2.25	.9878
-1.94	.0262	-1.12	.1314	-.30	.3821	.52	.6985	1.32	.9066	2.30	.9893
-1.92	.0274	-1.10	.1357	-.28	.3897	.54	.7054	1.34	.9099	2.35	.9906
-1.90	.0287	-1.08	.1401	-.26	.3974	.56	.7123	1.36	.9131	2.40	.9918
-1.88	.0301	-1.06	.1446	-.24	.4052	.58	.7190	1.38	.9162	2.45	.9929
-1.86	.0314	-1.04	.1492	-.22	.4129	.60	.7257	1.40	.9192	2.50	.9938
-1.84	.0329	-1.02	.1539	-.20	.4207	.62	.7324	1.42	.9222	2.55	.9946
-1.82	.0344	-1.00	.1587	-.18	.4286	.64	.7389	1.44	.9251	2.60	.9953
-1.80	.0359	-.98	.1635	-.16	.4364	.66	.7454	1.46	.9279	2.65	.9960
-1.78	.0375	-.96	.1685	-.14	.4443	.68	.7518	1.48	.9306	2.70	.9965
-1.76	.0392	-.94	.1736	-.12	.4522	.70	.7580	1.50	.9332	2.75	.9970
-1.74	.0409	-.92	.1788	-.10	.4602	.72	.7642	1.52	.9357	2.80	.9974
-1.72	.0427	-.90	.1841	-.08	.4681	.74	.7704	1.54	.9382	2.85	.9978
-1.70	.0446	-.88	.1894	-.06	.4761	.76	.7764	1.56	.9406	2.90	.9981
-1.68	.0465	-.86	.1949	-.04	.4840	.78	.7823	1.58	.9429	2.95	.9984
-1.66	.0485	-.84	.2005	-.02	.4920	.80	.7881	1.60	.9452	3.00	.9987
-1.64	.0505	-.82	.2061	.00	.5000	.82	.7939	1.62	.9474	3.05	.9989
-1.62	.0526	-.80	.2119	.02	.5080	.84	.7995	1.64	.9495		
-1.60	.0548	-.78	.2177	.04	.5160						

This table shows the probability  $[N(d)]$  of observing a value less than or equal to  $d$ . For example, as illustrated, if  $d$  is  $-.24$ , then  $N(d)$  is  $.4052$ .

# KEY EQUATIONS

## CHAPTER 2

1. The balance sheet identity or equation:

$$\text{Assets} = \text{Liabilities} + \text{Shareholders' equity} \quad [2.1]$$

2. The income statement equation:

$$\text{Revenues} - \text{Expenses} = \text{Income} \quad [2.2]$$

3. The cash flow identity:

$$\begin{aligned} \text{Cash flow from assets} &= \\ \text{Cash flow to creditors} + \\ \text{Cash flow to stockholders} \end{aligned} \quad [2.3]$$

where:

- a.  $\text{Cash flow from assets} = \text{Operating cash flow (OCF)} - \text{Net capital spending} - \text{Change in net working capital (NWC)}$ 
  - (1)  $\text{Operating cash flow} = \text{Earnings before interest and taxes (EBIT)} + \text{Depreciation} - \text{Taxes}$
  - (2)  $\text{Net capital spending} = \text{Ending net fixed assets} - \text{Beginning net fixed assets} + \text{Depreciation}$
  - (3)  $\text{Change in net working capital} = \text{Ending NWC} - \text{Beginning NWC}$
- b.  $\text{Cash flow to creditors} = \text{Interest paid} - \text{Net new borrowing}$
- c.  $\text{Cash flow to stockholders} = \text{Dividends paid} - \text{Net new equity raised}$

## CHAPTER 3

1. The current ratio:

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} \quad [3.1]$$

2. The quick or acid-test ratio:

$$\text{Quick ratio} = \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}} \quad [3.2]$$

3. The cash ratio:

$$\text{Cash ratio} = \frac{\text{Cash}}{\text{Current liabilities}} \quad [3.3]$$

4. The ratio of net working capital to total assets:

$$\begin{aligned} \text{Net working capital to total assets} \\ = \frac{\text{Net working capital}}{\text{Total assets}} \end{aligned} \quad [3.4]$$

5. The interval measure:

$$\begin{aligned} \text{Interval measure} \\ = \frac{\text{Current assets}}{\text{Average daily operating costs}} \end{aligned} \quad [3.5]$$

6. The total debt ratio:

$$\begin{aligned} \text{Total debt ratio} \\ = \frac{\text{Total assets} - \text{Total equity}}{\text{Total assets}} \end{aligned} \quad [3.6]$$

7. The debt-equity ratio:

$$\begin{aligned} \text{Debt-equity ratio} \\ = \frac{\text{Total debt}}{\text{Total equity}} \end{aligned} \quad [3.7]$$

8. The equity multiplier:

$$\begin{aligned} \text{Equity multiplier} \\ = \frac{\text{Total assets}}{\text{Total equity}} \end{aligned} \quad [3.8]$$

9. The long-term debt ratio:

$$\begin{aligned} \text{Long-term debt ratio} \\ = \frac{\text{Long-term debt}}{\text{Long-term debt} + \text{Total equity}} \end{aligned} \quad [3.9]$$

10. The times interest earned (TIE) ratio:

$$\text{Times interest earned ratio} = \frac{\text{EBIT}}{\text{Interest}} \quad [3.10]$$

11. The cash coverage ratio:

$$\begin{aligned} \text{Cash coverage ratio} \\ = \frac{\text{EBIT} + \text{Depreciation}}{\text{Interest}} \end{aligned} \quad [3.11]$$

12. The inventory turnover ratio:

$$\begin{aligned} \text{Inventory turnover} \\ = \frac{\text{Cost of goods sold}}{\text{Inventory}} \end{aligned} \quad [3.12]$$

13. The average days' sales in inventory:

$$\begin{aligned} \text{Days' sales in inventory} \\ = \frac{365 \text{ days}}{\text{Inventory turnover}} \end{aligned} \quad [3.13]$$

14. The receivables turnover ratio:

$$\text{Receivables turnover} = \frac{\text{Sales}}{\text{Accounts receivable}} \quad [3.14]$$

15. The days' sales in receivables:

$$\text{Days' sales in receivables} = \frac{365 \text{ days}}{\text{Receivables turnover}} \quad [3.15]$$

16. The net working capital (NWC) turnover ratio:

$$\text{NWC turnover} = \frac{\text{Sales}}{\text{NWC}} \quad [3.16]$$

17. The fixed asset turnover ratio:

$$\text{Fixed asset turnover} = \frac{\text{Sales}}{\text{Net fixed assets}} \quad [3.17]$$

18. The total asset turnover ratio:

$$\text{Total asset turnover} = \frac{\text{Sales}}{\text{Total assets}} \quad [3.18]$$

19. Profit margin:

$$\text{Profit margin} = \frac{\text{Net income}}{\text{Sales}} \quad [3.19]$$

20. Return on assets (ROA):

$$\text{Return on assets} = \frac{\text{Net income}}{\text{Total assets}} \quad [3.20]$$

21. Return on equity (ROE):

$$\text{Return on equity} = \frac{\text{Net income}}{\text{Total equity}} \quad [3.21]$$

22. The price-earnings (PE) ratio:

$$\text{PE ratio} = \frac{\text{Price per share}}{\text{Earnings per share}} \quad [3.22]$$

23. The market-to-book ratio:

$$\text{Market-to-book ratio} = \frac{\text{Market value per share}}{\text{Book value per share}} \quad [3.23]$$

24. Enterprise value:

$$\text{Enterprise value} = \text{Total market value of the stock} + \text{Book value of all liabilities} - \text{Cash} \quad [3.24]$$

25. The EBITDA (earnings before interest, tax, depreciation, and amortization) ratio:

$$\text{EBITDA ratio} = \frac{\text{Enterprise value}}{\text{EBITDA}} \quad [3.25]$$

26. The DuPont identity:

$$\text{ROE} = \underbrace{\frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}}}_{\text{Return on assets}} \times \frac{\text{Assets}}{\text{Equity}} \quad [3.26]$$

= Profit margin  
× Total asset turnover  
× Equity multiplier

## CHAPTER 4

1. The dividend payout ratio:

$$\text{Dividend payout ratio} = \frac{\text{Cash dividends}}{\text{Net income}} \quad [4.1]$$

2. The internal growth rate:

$$\text{Internal growth rate} = \frac{\text{ROA} \times b}{1 - \text{ROA} \times b} \quad [4.2]$$

3. The sustainable growth rate:

$$\text{Sustainable growth rate} = \frac{\text{ROE} \times b}{1 - \text{ROE} \times b} \quad [4.3]$$

## CHAPTER 5

1. The future value of \$1 invested for  $t$  periods at a rate of  $r$  per period:

$$\text{Future value} = \$1 \times (1 + r)^t \quad [5.1]$$

2. The present value of \$1 to be received  $t$  periods into the future at a discount rate of  $r$ :

$$\text{PV} = \$1 \times [1/(1 + r)^t] = \$1/(1 + r)^t \quad [5.2]$$

3. The relationship between future value and present value (the basic present value equation):

$$\begin{aligned} \text{PV} \times (1 + r)^t &= \text{FV}_t \\ \text{PV} &= \text{FV}_t / (1 + r)^t = \text{FV}_t \times [1/(1 + r)^t] \end{aligned} \quad [5.3]$$

## CHAPTER 6

1. The present value of an annuity of  $C$  dollars per period for  $t$  periods when the rate of return or interest rate is  $r$ :

$$\text{Annuity present value}$$

$$\begin{aligned} &= C \times \left( \frac{1 - \text{Present value factor}}{r} \right) \\ &= C \times \left\{ \frac{1 - [1/(1 + r)^t]}{r} \right\} \end{aligned} \quad [6.1]$$

2. The future value factor for an annuity:

$$\begin{aligned} \text{Annuity FV factor} &= (\text{Future value factor} - 1)/r \\ &= [(1 + r)^t - 1]/r \end{aligned} \quad [6.2]$$

3. Annuity due value = Ordinary annuity value

$$\times (1 + r) \quad [6.3]$$

4. Present value of a perpetuity:

$$\text{PV for a perpetuity} = C/r \quad [6.4]$$

5. Growing annuity present value

$$= C \times \left[ \frac{1 - \left( \frac{1 + g}{1 + r} \right)^t}{r - g} \right] \quad [6.5]$$

6. Growing perpetuity present value

$$= \frac{C}{r - g} \quad [6.6]$$

7. Effective annual rate (EAR), where  $m$  is the number of times the interest is compounded during the year:

$$\text{EAR} = [1 + (\text{Quoted rate}/m)]^m - 1 \quad [6.7]$$

8. Effective annual rate (EAR), where  $q$  stands for the continuously compounded quoted rate:

$$\text{EAR} = e^q - 1 \quad [6.8]$$

## CHAPTER 7

1. Bond value if bond has (1) a face value of  $F$  paid at maturity, (2) a coupon of  $C$  paid per period, (3)  $t$  periods to maturity, and (4) a yield of  $r$  per period:

$$\begin{aligned} \text{Bond value} &= C \times [1 - 1/(1+r)^t]/r + F/(1+r)^t \\ &= \text{Present value of the coupons} + \text{Present value of the face amount} \end{aligned} \quad [7.1]$$

2. The Fisher effect:

$$1 + R = (1 + r) \times (1 + h) \quad [7.2]$$

$$R = r + h + r \times h \quad [7.3]$$

$$R \approx r + h \quad [7.4]$$

## CHAPTER 8

1. Per-share present value of common stock, where  $D_1$  is the cash dividend paid at the end of the period, and  $R$  is the required return:

$$P_0 = (D_1 + P_1)/(1 + R) \quad [8.1]$$

2. Per-share present value of common stock with zero growth, where the dividend is constant and  $R$  is the required return:

$$P_0 = D/R \quad [8.2]$$

3. The dividend growth model:

$$P_0 = \frac{D_0 \times (1 + g)}{R - g} = \frac{D_1}{R - g} \quad [8.3]$$

4. The dividend growth model can be modified slightly to give the price of a stock as of Time  $t$ :

$$P_t = \frac{D_t \times (1 + g)}{R - g} = \frac{D_{t+1}}{R - g} \quad [8.4]$$

5. Two-stage growth model:

$$P_0 = \frac{D_1}{R - g_1} \times \left[ 1 - \left( \frac{1 + g_1}{1 + R} \right)^t \right] + \frac{P_t}{(1 + R)^t} \quad [8.5]$$

6. The two-stage growth model can be modified to give the price of a stock at Time  $t$ :

$$P_t = \frac{D_{t+1}}{R - g_2} = \frac{D_0 \times (1 + g_1)^t \times (1 + g_2)}{R - g_2} \quad [8.6]$$

7. Required return:

$$R = D_1/P_0 + g \quad [8.7]$$

8. Stock valuation using benchmark PE evaluation:

$$\text{Price at Time } t = P_t = \text{Benchmark PE ratio} \times \text{EPS}_t \quad [8.8]$$

## CHAPTER 9

1. Net present value (NPV):

$$\text{NPV} = \text{Present value of future cash flows} - \text{Investment cost}$$

2. Payback period:

$$\text{Payback period} = \text{Number of years that pass before the sum of an investment's cash flows equals the cost of the investment}$$

3. Discounted payback period:

$$\text{Discounted payback period} = \text{Number of years that pass before the sum of an investment's discounted cash flows equals the cost of the investment}$$

4. The average accounting return (AAR):

$$\text{AAR} = \frac{\text{Average net income}}{\text{Average book value}}$$

5. Internal rate of return (IRR):

$$\text{IRR} = \text{Discount rate or required return such that the net present value of an investment is zero}$$

6. Profitability index:

$$\text{Profitability index} = \frac{\text{PV of cash flows}}{\text{Cost of investment}}$$

## CHAPTER 10

1. Bottom-up approach to operating cash flow (OCF):

$$\text{OCF} = \text{Net income} + \text{Depreciation} \quad [10.1]$$

2. Top-down approach to operating cash flow (OCF):

$$\text{OCF} = \text{Sales} - \text{Costs} - \text{Taxes} \quad [10.2]$$

3. Tax shield approach to operating cash flow (OCF):

$$\begin{aligned} \text{OCF} &= (\text{Sales} - \text{Costs}) \times (1 - T_c) \\ &\quad + \text{Depreciation} \times T_c \end{aligned} \quad [10.3]$$

## CHAPTER 11

1. Accounting break-even point:

$$Q = (\text{FC} + D)/(P - v) \quad [11.1]$$

2. Project operating cash flow (OCF), ignoring taxes:

$$\text{OCF} = (P - v) \times Q - \text{FC} \quad [11.2]$$

3. Relationship between operating cash flow (OCF) and sales volume, ignoring taxes:

$$Q = (\text{FC} + \text{OCF})/(P - v) \quad [11.3]$$

4. Cash break-even point:

$$Q = \text{FC}/(P - v)$$

5. Cash break-even point:

$$Q = (\text{FC} + \text{OCF}^*)/(P - v)$$

where

$$\text{OCF}^* = \text{Zero NPV cash flow}$$

6. Degree of operating leverage (DOL):

$$\text{DOL} = 1 + \text{FC}/\text{OCF} \quad [11.4]$$

## CHAPTER 12

1. Total dollar return on an investment:

$$\begin{aligned} \text{Total dollar return} &= \text{Dividend income} + \\ &\quad \text{Capital gain (or loss)} \end{aligned} \quad [12.1]$$

2. Total cash if stock is sold = Initial investment +

$$\text{Total return} \quad [12.2]$$

3. Standard deviation of returns,  $SD(R)$  or  $\sigma$ :

$$SD(R) = \sqrt{\text{Var}(R)}$$

4. Variance of returns,  $\text{Var}(R)$  or  $\sigma^2$ :

$$\text{Var}(R) = \frac{1}{T-1} [(R_1 - \bar{R})^2 + \dots + (R_T - \bar{R})^2] \quad [12.3]$$

5. Geometric average return:

$$\text{Geometric average return} = [(1 + R_1) \times (1 + R_2) \times \dots \times (1 + R_T)]^{1/T} - 1 \quad [12.4]$$

6. Blume's formula:

$$R(T) = \frac{T-1}{N-1} \times \text{Geometric average} + \frac{N-T}{N-1} \times \text{Arithmetic average} \quad [12.5]$$

## CHAPTER 13

1. Risk premium:

$$\text{Risk premium} = \text{Expected return} - \text{Risk-free rate} \quad [13.1]$$

2. Expected return on a portfolio:

$$E(R_p) = x_1 \times E(R_1) + x_2 \times E(R_2) + \dots + x_n \times E(R_n) \quad [13.2]$$

3. Risk and return:

$$\begin{aligned} \text{Total return} &= \text{Expected return} + \text{Unexpected return} \\ R &= E(R) + U \end{aligned} \quad [13.3]$$

4. Components of an announcement:

$$\text{Announcement} = \text{Expected part} + \text{Surprise} \quad [13.4]$$

5. Systematic and unsystematic components of return:

$$R = E(R) + \text{Systematic portion} + \text{Unsystematic portion} \quad [13.5]$$

6. Total risk:

$$\text{Total risk} = \text{Systematic risk} + \text{Unsystematic risk} \quad [13.6]$$

7. The reward-to-risk ratio:

$$\text{Reward-to-risk ratio} = \frac{E(R_i) - R_f}{\beta_i}$$

8. The market risk premium:

$$\text{SML slope} = E(R_M) - R_f$$

9. The capital asset pricing model (CAPM):

$$E(R_i) = R_f + [E(R_M) - R_f] \times \beta_i \quad [13.7]$$

## CHAPTER 14

1. Required return on equity,  $R_E$  (dividend growth model):

$$R_E = D_1/P_0 + g \quad [14.1]$$

2. Required return on equity,  $R_E$ :

$$R_E = R_f + \beta_E \times (R_M - R_f) \quad [14.2]$$

3. The cost of preferred stock,  $R_p$ :

$$R_p = D/P_0 \quad [14.3]$$

4. The market value of a firm's debt and equity:

$$V = E + D \quad [14.4]$$

5. The percentages of a firm's capital represented by debt and equity:

$$100\% = E/V + D/V \quad [14.5]$$

6. The weighted average cost of capital (WACC):

$$\text{WACC} = (E/V) \times R_E + (D/V) \times R_D \times (1 - T_c) \quad [14.6]$$

7. The weighted average cost of capital (WACC) with preferred stock:

$$\text{WACC} = (E/V) \times R_E + (P/V) \times R_p + (D/V) \times R_D \times (1 - T_c) \quad [14.7]$$

8. Calculating a firm's "adjusted" taxes:

$$\text{Taxes}^* = \text{EBIT} \times T_c \quad [14.8]$$

9. Adjusted cash flow from assets (CFA):

$$\begin{aligned} \text{CFA}^* &= \text{EBIT} + \text{Depreciation} - \text{Taxes}^* - \\ &\quad \text{Change in NWC} - \text{Capital spending} \\ &= \text{EBIT} + \text{Depreciation} - \text{EBIT} \times T_c - \\ &\quad \text{Change in NWC} - \text{Capital spending} \end{aligned} \quad [14.9]$$

10. Simplified adjusted cash flow from assets (CFA):

$$\text{CFA}^* = \text{EBIT} \times (1 - T_c) + \text{Depreciation} - \text{Change in NWC} - \text{Capital spending} \quad [14.10]$$

11. The value of a firm today is:

$$\begin{aligned} V_0 &= \frac{\text{CFA}_1^*}{1 + \text{WACC}} + \frac{\text{CFA}_2^*}{(1 + \text{WACC})^2} + \\ &\quad \frac{\text{CFA}_3^*}{(1 + \text{WACC})^3} + \dots + \frac{\text{CFA}_t^* + V_t}{(1 + \text{WACC})^t} \end{aligned} \quad [14.11]$$

12. Firm value, using the growing perpetuity formula:

$$V_t = \frac{\text{CFA}_{t+1}^*}{\text{WACC} - g} \quad [14.12]$$

13. Weighted average flotation cost,  $f_A$ :

$$f_A = (E/V) \times f_E + (D/V) \times f_D \quad [14.13]$$

## CHAPTER 15

1. Rights offerings:

- a. Number of new shares:

$$\begin{aligned} &\text{Number of new shares} \\ &= \frac{\text{Funds to be raised}}{\text{Subscription price}} \end{aligned} \quad [15.1]$$

- b. Number of rights needed:

$$\begin{aligned} &\text{Number of rights needed to buy a share of stock} \\ &= \frac{\text{Old shares}}{\text{New shares}} \end{aligned} \quad [15.2]$$

- c. Value of a right:

$$\begin{aligned} &\text{Value of a right} = \text{Rights-on price} - \\ &\quad \text{Ex-rights price} \end{aligned}$$

## CHAPTER 16

1. Modigliani-Miller propositions (no taxes):
  - a. Proposition I:  

$$V_L = V_U$$
  - b. Proposition II:  

$$R_E = R_A + (R_A - R_D) \times (D/E) \quad [16.1]$$
2. Modigliani-Miller propositions (with taxes):
  - a. Value of the interest tax shield:  
 Present value of the interest tax shield  

$$= T_C \times D \quad [16.2]$$
  - b. Proposition I:  

$$V_L = V_U + T_C \times D \quad [16.3]$$
  - c. Proposition II:  

$$R_E = R_U + (R_U - R_D) \times (D/E) \times (1 - T_C) \quad [16.4]$$

## CHAPTER 18

1. Basic balance sheet identity:  
 Net working capital + Fixed assets  
 = Long-term debt + Equity [18.1]
2. Net working capital:  
 Net working capital = (Cash + Other current assets)  
 – Current liabilities [18.2]
3. Cash identity:  
 Cash = Long-term debt + Equity +  
 Current liabilities –  
 Current assets other than cash –  
 Fixed assets [18.3]
4. The operating cycle:  
 Operating cycle = Inventory period +  
 Accounts receivable period [18.4]
5. The cash cycle:  
 Cash cycle = Operating cycle –  
 Accounts payable period [18.5]
6. Total cash collections:  
 Cash collections = Beginning accounts receivable +  
 $1/2 \times \text{Sales}$  [18.6]

## CHAPTER 19

1. Float measurement:
  - a. Average daily float:  

$$\text{Average daily float} = \frac{\text{Total float}}{\text{Total days}} \quad [19.1]$$
  - b. Average daily float:  

$$\begin{aligned} &\text{Average daily float} \\ &= \text{Average daily receipts} \\ &\times \text{Weighted average delay} \end{aligned} \quad [19.2]$$

2. The Baumol-Allais-Tobin (BAT) model:
  - a. Opportunity costs:  

$$\text{Opportunity costs} = (C/2) \times R \quad [19A.1]$$
  - b. Trading costs:  

$$\text{Trading costs} = (T/C) \times F \quad [19A.2]$$
  - c. Total cost:  

$$\text{Total cost} = \text{Opportunity costs} + \text{Trading costs} \quad [19A.3]$$
  - d. The optimal initial cash balance:  

$$C^* = \sqrt{(2T \times F)/R} \quad [19A.4]$$
3. The Miller-Orr model:
  - a. The optimal cash balance:  

$$C^* = L + (3/4 \times F \times \sigma^2/R)^{(1/3)} \quad [19A.5]$$
  - b. The upper limit:  

$$U^* = 3 \times C^* - 2 \times L \quad [19A.6]$$
  - c. The average cash balance:  

$$\text{Average cash balance} = (4 \times C^* - L)/3 \quad [19A.7]$$

## CHAPTER 20

1. The size of receivables:  

$$\text{Accounts receivable} = \frac{\text{Average daily sales} \times \text{ACP}}{\text{ACP}} \quad [20.1]$$
2. NPV of switching credit terms:
  - a. Cash flow with old policy =  $(P - v)Q$  [20.2]
  - b. Cash flow with new policy =  $(P - v)Q'$  [20.3]
  - c. Present value of switching:  

$$PV = [(P - v)(Q' - Q)]/R \quad [20.4]$$
  - d. Cost of switching:  

$$\text{Cost of switching} = PQ + v(Q' - Q) \quad [20.5]$$
  - e. NPV of switching:  

$$\begin{aligned} \text{NPV of switching} = & -[PQ + v(Q' - Q)] + \\ & [(P - v)(Q' - Q)]/R \end{aligned} \quad [20.6]$$
  - f. Break-even point of switching:  

$$Q' - Q = PQ/[(P - v)/R - v] \quad [20.7]$$
3. NPV of granting credit:
  - a. With no repeat business:  

$$\text{NPV} = -v + (1 - \pi)P/(1 + R) \quad [20.8]$$
  - b. With repeat business:  

$$\text{NPV} = -v + (1 - \pi)(P - v)/R \quad [20.9]$$
4. The economic order quantity (EOQ) model:
  - a. Total carrying costs:  

$$\begin{aligned} &\text{Total carrying costs} \\ &= \text{Average inventory} \\ &\times \text{Carrying cost per unit} \\ &= (Q/2) \times CC \end{aligned} \quad [20.10]$$

- b. Total restocking cost:  
 Total restocking cost  
 = Fixed cost per order  
 × Number of orders  
 =  $F \times (T/Q)$  [20.11]
- c. Total costs:  
 Total costs = Carrying costs  
 + Restocking costs  
 =  $(Q/2) \times CC + F \times (T/Q)$  [20.12]
- d.  $Q^*$ :  
 Carrying costs = Restocking costs  
 $(Q^*/2) \times CC = F \times (T/Q^*)$  [20.13]
- e. The optimal order size  $Q^*$ :  
 $Q^* = \sqrt{\frac{2T \times F}{CC}}$  [20.14]
5. Net incremental cash flow =  $P'Q \times (d - \pi)$  [20A.1]
6. NPV =  $-PQ + P'Q \times (d - \pi)/R$  [20A.2]

## CHAPTER 21

1. Expected percentage change in the exchange rate:  
 a.  $[E(S_1) - S_0]/S_0 = h_{FC} - h_{US}$  [21.1]  
 b.  $E(S_1) = S_0 \times [1 + (h_{FC} - h_{US})]$  [21.2]
2. Purchasing power parity (PPP):  
 $E(S_1) = S_0 \times [1 + (h_{FC} - h_{US})]^t$  [21.3]
3. Interest rate parity (IRP) condition:  
 a. Exact, single period:  
 $F_1/S_0 = (1 + R_{FC})/(1 + R_{US})$  [21.4]  
 b. Approximate, single period:  
 $(F_1 - S_0)/S_0 = R_{FC} - R_{US}$  [21.5]  
 c.  $F_1 = S_0 \times [1 + (R_{FC} - R_{US})]$  [21.6]
4. International Fisher effect (IFE):  
 $R_{US} - h_{US} = R_{FC} - h_{FC}$  [21.7]

## CHAPTER 24

1. Value of a call option at maturity:  
 a.  $C_1 = 0$  if  $S_1 - E \leq 0$  [24.1]  
 b.  $C_1 = S_1 - E$  if  $S_1 - E > 0$  [24.2]
2. Bounds on the value of a call option:  
 a. Upper bound:  
 $C_0 \leq S_0$  [24.3]  
 b. Lower bound:  
 $C_0 \geq 0$  if  $S_0 - E < 0$  [24.4]  
 $C_0 \geq S_0 - E$  if  $S_0 - E \geq 0$

3. Value of a call option (simple case):  
 $S_0 = C_0 + E/(1 + R_f)$   
 $C_0 = S_0 - E/(1 + R_f)$  [24.5]
4. Value of a call that is certain to finish in the money:  
 Call option value  
 = Stock value  
 – Present value of the exercise price  
 $C_0 = S_0 - E/(1 + R_f)^t$  [24.6]

## CHAPTER 25

1. Put-call parity condition (PCP):  
 a. Share of stock + A put option  
 = Present value of strike price + A call option [25.1]  
 b.  $S + P = PV(E) + C$  [25.2]  
 c. Stock price:  
 $S = PV(E) + C - P$  [25.3]  
 d.  $S + P = E \times e^{-Rt} + C$  [25.4]
2. The Black-Scholes call option formula:  
 $C = S \times N(d_1) - E \times e^{-Rt} \times N(d_2)$  [25.5]  
 PCP and the balance sheet identity:  
 $d_1 = [\ln(S/E) + (R + \sigma^2/2) \times t]/(\sigma \times \sqrt{t})$   
 $d_2 = d_1 - \sigma \times \sqrt{t}$  [25.6]
3. PCP and the balance sheet identity:  
 a. Value of risky bond + Put option  
 = Value of risk-free bond [25.7]  
 b. Value of risky bond = Value of risk-free bond  
 – Put option  
 $= E \times e^{-Rt} - P$  [25.8]  
 c. Value of assets ( $S$ ) = Value of stock ( $C$ )  
 +  $(E \times e^{-Rt} - P)$  [25.9]  
 d. Value of assets ( $S$ )  
 = Value of stock ( $C$ )  
 + Value of bonds  $(E \times e^{-Rt} - P)$  [25.10]

## CHAPTER 26

4. The NPV of a merger:  
 $NPV = V_B^* - \text{Cost to Firm A of the acquisition}$  [26.1]

# ANSWERS TO SELECTED END-OF-CHAPTER PROBLEMS



## CHAPTER 2

- 2. \$310,470
- 6. \$1,219,000
- 10. \$1,290,000
- 12. a. \$96,755  
b. \$17,800  
c. \$13,100  
d. \$1,155
- 18. a. -\$45,000  
b. \$165,000
- 19. a. 2017: \$3,069  
2018: \$3,959  
b. \$42  
c. Fixed assets sold = \$118  
Cash flow from assets = \$4,399  
d. Cash flow to creditors = \$221  
Debt retired = \$337

## CHAPTER 3

- 2. Net income = \$835,000  
ROA = 6.47%  
ROE = 11.60%
- 6. EPS = \$3.74  
DPS = \$1.29  
BVPS = \$32.94  
Market-to-book ratio = 1.97 times  
PE ratio = 17.40 times  
P/S ratio = 1.48 times
- 10. 82.74 days
- 18. \$208.37
- 22. Firm A: 14.29%  
Firm B: 16.36%
- 26. a. 1.17 times; 1.30 times  
b. .69 times; .79 times  
c. .45 times; .45 times  
d. .81 times  
e. 8.19 times  
f. 18.24 times  
g. .34 times; .36 times  
h. .53 times; .57 times  
i. 1.53 times; 1.57 times  
j. 5.22 times

- k. 7.47%
- l. 12.29%
- m. 9.91%
- n. 15.58%

## CHAPTER 4

- 2. \$990
- 5. \$318.00
- 12. 6.04%
- 16. 9.89%
- 19. 1.36 times
- 21. Sustainable growth rate = 15.46%  
New borrowing = \$11,904.11  
Internal growth rate = 6.17%

## CHAPTER 5

- 2. \$8,929.88; \$13,734.06; \$363,508.30;  
\$487,874.54
- 6. 9.01%
- 10. \$150,568,214.49
- 14. -4.46%
- 18. \$400,897.66; \$154,563.40

## CHAPTER 6

- 2. @ 5%:  $PV_x = \$27,145.49$   
 $PV_y = \$26,409.81$   
@ 15%:  $PV_x = \$18,846.75$   
 $PV_y = \$20,448.15$
- 6. \$252,415.91
- 10. \$744,680.85
- 14. First National EAR = 13.92%  
First United EAR = 13.85%
- 18. \$32,529.18
- 22. APR = 1,733.33%  
EAR = 313,916,515.69%
- 26. \$38,126.53
- 30. 5.64% semiannual  
2.78% quarterly  
.92% monthly
- 38. \$3,058,897.35
- 42. \$343,996.22
- 46. Profit = \$3,815.99  
Break-even rate = 12.14%

50. \$84,121.21  
 54. \$1,103.54  
 58. PV of lease payments = \$20,899.86  
 PV of purchase = \$19,601.94  
 Break-even resale price = \$26,446.80  
 60. 17.51%  
 64. 3.033 points  
 70. Value of payments at 65 = \$328,996.36  
 74. \$178,442.82; \$144,645.85

## CHAPTER 7

4. 2.97%  
 8. 5.75%  
 12. Approximate real rate = 2.50%  
 Exact real rate = 2.45%  
 26. YTM = 4.89%; Current yield = 5.23%  
 28. a. \$298.13  
 b. First year = \$14.79; Last year = \$47.26  
 c. \$28.07

## CHAPTER 8

2. 10.82%  
 6. \$3.72  
 10. \$13,975,043  
 14. \$33.22  
 18. \$68.64  
 20. \$69.69

## CHAPTER 9

4. 1.89 years; 2.23 years; 3.40 years  
 8. \$2,816.58; -\$4,028.70  
 12. a. 19.71%; 18.76%  
 b. \$6,330.67; \$8,138.59  
 c. 16.48%  
 16. a. 1.141; 1.267  
 b. \$8,870.02; \$4,146.13  
 22. a.  $C = I/N$   
 b.  $C > I/PVIFA_{R\%,N}$   
 c.  $C = 2.0 * I/PVIFA_{R\%,N}$

## CHAPTER 10

2. \$703,400,000  
 8. \$1,348,448  
 12.  $CF_0 = -\$2,570,000$   
 $CF_1 = \$1,034,389.60$   
 $CF_2 = \$1,124,684.00$   
 $CF_3 = \$1,311,176.40$   
 NPV = \$183,422.80  
 16. -\$122,979.65  
 22. .03126

## CHAPTER 11

2. Total costs = \$10,093,300  
 Marginal cost = \$57.54  
 Average cost = \$69.61  
 Minimum revenue = \$287,700  
 8.  $D = \$311,624$   
 $P = \$46.97$   
 $VC = \$74.94$   
 12. OCF = \$85,642  
 DOL = 3.043  
 18. DOL = 1.53  
 $DOL_A = 2.63$   
 22.  $\Delta NPV/\Delta P = \$219,078.85$   
 $\Delta NPV/\Delta Q = \$1,606.58$   
 30. DOL = 1.35  
 $\Delta OCF = +4.51\%$

## CHAPTER 12

2.  $R_D = 2.23\%$   
 $R_C = 9.23\%$   
 6.  $r_G = 2.91\%$   
 $r_C = 3.20\%$   
 16.  $R_A = 10.89\%$   
 $R_G = 10.62\%$   
 20. 11.02%; 10.78%; 10.32%

## CHAPTER 13

2. 10.04%  
 6. 10.80%  
 10. a. 10.51%  
 b.  $\sigma_P^2 = .01378$   
 $\sigma_P = 11.74\%$   
 14. .88  
 16. 3.32%  
 24.  $C = \$383,070.87$   
 $R_F = \$101,929.13$   
 26.  $\beta_1 = 1.74$   
 $\sigma_1 = 6.78\%$   
 $\beta_{II} = .83$   
 $\sigma_{II} = 18.08\%$

## CHAPTER 14

2. 10.46%  
 4.  $R_A = 11.89\%$   
 $R_G = 11.88\%$   
 8. Book value = \$135,000,000  
 Market value = \$115,150,000  
 Aftertax cost = 4.84%  
 12. a.  $E/V = .3373$   
 $D/V = .6627$   
 b.  $E/V = .8108$   
 $D/V = .1892$

16. a.  $D/V = .2684$

$P/V = .0461$

$E/V = .6854$

b. 8.68%

20. \$25,626,741

8. a. \$264.00; \$252.00; \$279.00; \$279.45

b. \$243.00; \$264.00; \$252.00; \$279.00

c. \$250.00; \$260.00; \$261.00; \$279.15

14. a. 3.03%

b. 6.87%

c. 6.77%

18. 9.51%

**CHAPTER 15**

2. a. \$53; anything greater than \$0

b. 744,681; 5.24

c. \$52.04; \$.96

6. 3,133,641

12. \$22.05

14. \$29,904.31

**CHAPTER 16**

2. a. \$1.86; \$3.10; \$4.02

b. \$2.11; \$4.02; \$5.46

6. a. \$5.36; \$5.54; \$5.27

b. \$71,250; \$71,250

c. \$71,250

d. \$4.23; \$4.38; \$4.16

e. \$71,250; \$71,250; \$71,250

10. \$1,369,200

12. a. 13.64%

b. 9.40%

c. 16.18%; 12.79%; 9.40%

16. \$446,147.50

**CHAPTER 17**

2. a. 5,000 new shares

b. 12,500 new shares

4. a. \$40.80

b. \$59.13

c. \$47.72

d. \$119.00

e. 883,333; 609,500; 755,250; 302,857

8. Shares outstanding = 281,750

Capital surplus = \$2,529,000

10.  $P_0 = \$45.84$

$D = \$28.20$

**CHAPTER 18**

2. Cash = \$1,385

Current assets = \$6,160

4. a.  $I, I$

b.  $I, N$

c.  $D, D$

d.  $D, D$

e.  $D, N$

f.  $I, I$

**CHAPTER 19**

2. a. \$68,000

–\$44,000

\$24,000

b. \$68,000

–\$22,000

\$46,000

6. a. \$26,712

b. 2.53 days

c. \$26,712

d. \$4.95

e. \$10,865

10. NPV = \$4,450,000

Net savings = \$111,250

**APPENDIX 19A**

A.2 \$3,366.50

A.4 a. Opportunity cost = \$30

Trading cost = \$350

b. \$5,123.48

A.10 2.38%

**CHAPTER 20**

2. \$2,608,219.18

6. Sales = \$625,907.41

Accounts receivable turnover = 13.5185 times

10. NPV = \$160,207.89

12. Carrying cost = \$7,650

Order cost = \$6,760

EOQ = 423.01

Orders = 55.32 per year

16. Net savings = \$1,631.25

**APPENDIX 20A**

A.2 a. 1/20, net 30

b. \$240,000

d. NPV = –\$2,477,600

Break-even price = \$108.42

Break-even discount = 8.68%

A.4 b. \$70.45

c. NPV = \$151,131.30

**CHAPTER 21**

6. Great Britain: 1.45%  
 Japan: 1.19%  
 Switzerland: 1.14%
10. b. Krone 8.4693
12. b. U.S. 1.64% greater

**CHAPTER 23**

2. Price = \$17.81: Loss = \$1,725  
 Price = \$17.64: Gain = \$2,525

**CHAPTER 24**

4. a. \$7.69  
 b. \$4.85
8. a.  $E_0 = \$117.04$   
 $D_0 = \$922.96$   
 b.  $E_0 = \$190.78$
14. a. \$273,927.58  
 b. Abandon if  $Q < 4,332$
20. a. \$4,274,450.63  
 b. \$3,819,874.85

**CHAPTER 25**

2. \$6,791.91
6. 2.29%

10. \$263,144.11
14. \$5.48
16. Equity = \$3,245.62  
 Debt = \$12,954.38
22. a. \$45,804.73  
 b. \$9,044.63  
 c. \$36,760.10; 11.40%  
 d. \$33,098.68; 13.50%  
 e. Bondholders lose \$3,661.42  
 Stockholders gain \$3,661.42

**CHAPTER 26**

7. a. EPS = \$5.40  
 PE = 11.11
9. .4215
13. a. £25.89  
 b. .8045

**CHAPTER 27**

2. -\$47,138.11
6. \$18,948.58


# USING THE HP 10B AND TI BA II PLUS FINANCIAL CALCULATORS






This appendix is intended to help you use your Hewlett-Packard HP 10B or Texas Instruments TI BA II Plus financial calculator to solve problems encountered in an introductory finance course. It describes the various calculator settings and provides keystroke solutions for nine selected problems from this book. Please see your owner's manual for more complete instructions. For more examples and problem-solving techniques, please see *Financial Analysis with an Electronic Calculator*, 7th edition, by Mark A. White (New York: McGraw-Hill, 2007).

## CALCULATOR SETTINGS




Most calculator errors in introductory finance courses are the result of inappropriate settings. Before beginning a calculation, you should ask yourself the following questions:






1. Did I clear the financial registers?
2. Is the compounding frequency set to once per period?
3. Is the calculator in END mode?
4. Did I enter negative numbers using the  key?

## Clearing the Registers





All calculators have areas of memory, called registers, where variables and intermediate results are stored. There are two sets of financial registers, the time value of money (TVM) registers and the cash flow (CF) registers. These must be cleared before beginning a new calculation. On the Hewlett-Packard HP 10B, pressing  {CLEAR ALL} clears both the TVM and the CF registers.<sup>1</sup> To clear the TVM registers on the TI BA II Plus, press  {CLR TVM}. Press  {CLR Work} from within the cash flow worksheet to clear the CF registers.


## Compounding Frequency

Both the HP 10B and the TI BA II Plus are hard-wired to assume monthly compounding, that is, compounding 12 times per period. Because very few problems in introductory finance courses make this assumption, you should change this default setting to once per period. On the HP 10B, press 1  {P/YR}. To verify that the default has been changed, press the  key, then press and briefly hold the  key.<sup>2</sup> The display should read “1P\_Yr”.

On the TI BA II Plus, you can specify both payment frequency and compounding frequency, although they should normally be set to the same number. To set both to once per period, press the key sequence  {P/Y} 1 , then press  1 . Pressing  {QUIT} returns you to standard calculator mode.

## END Mode and Annuities Due

In most problems, payment is made at the end of a period, and this is the default setting (end mode) for both the HP 10B and the TI BA II Plus. *Annuities due* assume payments are made at the *beginning* of each period (begin mode). On the HP 10B, pressing  {BEG/END} toggles between begin and end mode. Press the key sequence  {BGN}  [SET]  {QUIT} to accomplish the same task on the TI BA II Plus. Both calculators will indicate on the display that your calculator is set for begin mode.

<sup>1</sup>The  key is colored orange and serves as a Shift key for the functions in curly brackets.

<sup>2</sup>This is the same keystroke used to clear all registers; pretty handy, eh?

## Sign Changes

Sign changes are used to identify the direction of cash inflows and outflows. Generally, cash inflows are entered as positive numbers and cash outflows are entered as negative numbers. To enter a negative number on either the HP 10B or the TI BA II Plus, first press the appropriate digit keys and then press the change sign key,  $\pm/\mp$ . Do *not* use the minus sign key,  $-$ , as its effects are quite unpredictable.

## SAMPLE PROBLEMS

This section provides keystroke solutions for selected problems from the text illustrating the nine basic financial calculator skills.

### 1. Future Value or Present Value of a Single Sum

Compute the future value of \$2,250 at a 17 percent annual rate for 30 years.

HP 10B	TI BA II PLUS
-2,250.00 <b>PV</b>	-2,250.00 <b>PV</b>
30.00 <b>N</b>	30.00 <b>N</b>
17.00 <b>I/YR</b>	17.00 <b>I/Y</b>
<b>FV</b> 249,895.46	<b>CPT FV</b> 249,895.46

The future value is \$249,895.46.

### 2. Present Value or Future Value of an Ordinary Annuity

Betty's Bank offers you a \$20,000, seven-year term loan at 11 percent annual interest. What will your annual loan payment be?

HP 10B	TI BA II PLUS
-20,000.00 <b>PV</b>	-20,000.00 <b>PV</b>
7.00 <b>N</b>	7.00 <b>N</b>
11.00 <b>I/YR</b>	11.00 <b>I/Y</b>
<b>PMT</b> 4,244.31	<b>CPT PMT</b> 4,244.31

Your annual loan payment will be \$4,244.31.

### 3. Finding an Unknown Interest Rate

Assume that the total cost of a college education will be \$75,000 when your child enters college in 18 years. You presently have \$7,000 to invest. What rate of interest

must you earn on your investment to cover the cost of your child's college education?

HP 10B	TI BA II PLUS
-7,000.00 <b>PV</b>	-7,000.00 <b>PV</b>
18.00 <b>N</b>	18.00 <b>N</b>
75,000.00 <b>FV</b>	75,000.00 <b>FV</b>
<b>I/YR</b> 14.08	<b>CPT I/Y</b> 14.08

You must earn an annual interest rate of at least 14.08 percent to cover the expected future cost of your child's education.

### 4. Finding an Unknown Number of Periods

One of your customers is delinquent on his accounts payable balance. You've mutually agreed to a repayment schedule of \$374 per month. You will charge 1.4 percent per month interest on the overdue balance. If the current balance is \$12,000, how long will it take for the account to be paid off?

HP 10B	TI BA II PLUS
-12,000.00 <b>PV</b>	-12,000.00 <b>PV</b>
1.40 <b>I/YR</b>	1.40 <b>I/Y</b>
374.00 <b>PMT</b>	374.00 <b>PMT</b>
<b>N</b> 42.90	<b>CPT N</b> 42.90

The loan will be paid off in 42.90 months.

### 5. Simple Bond Pricing

Mullineaux Co. issued 11-year bonds one year ago at a coupon rate of 8.25 percent. The bonds make semiannual payments. If the YTM on these bonds is 7.10 percent, what is the current bond price?

HP 10B	TI BA II PLUS
41.25 <b>PMT</b>	41.25 <b>PMT</b>
1,000.00 <b>FV</b>	1,000.00 <b>FV</b>
20.00 <b>N</b>	20.00 <b>N</b>
3.55 <b>I/YR</b>	3.55 <b>I/Y</b>
<b>PV</b> -1,081.35	<b>CPT PV</b> -1,081.35

Because the bonds make semiannual payments, we must halve the coupon payment ( $8.25 \div 2 = 4.125$  ==>

\$41.25), halve the YTM ( $7.10 \div 2 \Rightarrow 3.55$ ), and double the number of periods (10 years remaining  $\times 2 = 20$  periods). Then, the current bond price is \$1,081.35.

## 6. Simple Bond Yields to Maturity

Vasicek Co. has 12.5 percent coupon bonds on the market with eight years left to maturity. The bonds make annual payments. If one of these bonds currently sells for \$1,145.68, what is its YTM?

HP 10B	TI BA II PLUS
-1,145.68 <b>PV</b>	-1,145.68 <b>PV</b>
125.00 <b>PMT</b>	125.00 <b>PMT</b>
1,000.00 <b>FV</b>	1,000.00 <b>FV</b>
8.00 <b>N</b>	8.00 <b>N</b>
<b>I/YR</b> 9.79	<b>CPT I/Y</b> 9.79

The bond has a yield to maturity of 9.79 percent.

## 7. Cash Flow Analysis

What are the IRR and NPV of the following set of cash flows? Assume a discount rate of 10 percent.

YEAR	CASH FLOW
0	-\$1,300
1	400
2	300
3	1,200

HP 10B	TI BA II PLUS
-1,300.00 <b>CFj</b>	<b>CF</b>
400.00 <b>CFj</b>	<b>2nd</b> {CLR Work}
1.00 <b>{Nj}</b>	-1,300.00 <b>ENTER</b> ↓
300.00 <b>CFj</b>	400.00 <b>ENTER</b> ↓
1.00 <b>{Nj}</b>	1.00 <b>ENTER</b> ↓
1,200.00 <b>CFj</b>	300.00 <b>ENTER</b> ↓
1.00 <b>{Nj}</b>	1.00 <b>ENTER</b> ↓
<b>{IRR/YR}</b> 17.40	1,200.00 <b>ENTER</b> ↓
10.00 <b>I/YR</b>	1.00 <b>ENTER</b> ↓
<b>{NPV}</b> 213.15	<b>IRR CPT</b> 17.40
	<b>NPV</b>
	10.00 <b>ENTER</b>
	↓ <b>CPT</b> 213.15

The project has an IRR of 17.40 percent and an NPV of \$213.15.

## 8. Loan Amortization

Prepare an amortization schedule for a three-year loan of \$24,000. The interest rate is 16 percent per year, and the loan calls for equal annual payments. How much interest is paid in the third year? How much total interest is paid over the life of the loan?

To prepare a complete amortization schedule, you must amortize each payment one at a time:

HP 10B	TI BA II PLUS
-24,000.00 <b>PV</b>	-24,000.00 <b>PV</b>
16.00 <b>I/YR</b>	16.00 <b>I/Y</b>
3.00 <b>N</b>	3.00 <b>N</b>
<b>PMT</b> 10,686.19	<b>CPT PMT</b> 10,686.19
1.00 <b>INPUT</b> <b>{AMORT}</b> = 3,840.00 <== Interest	<b>2nd</b> {AMORT} <b>2nd</b> {CLR Work}
= 6,846.19 <== Principal	
= -17,153.81 <== Balance	1.00 <b>ENTER</b> ↓
2.00 <b>INPUT</b> <b>{AMORT}</b> = 2,744.61 <== Interest	1.00 <b>ENTER</b> ↓ -17,153.81 <== Balance
= 7,941.58 <== Principal	↓ 6,846.19 <== Principal
= -9,212.23 <== Balance	↓ 3,840.00 <== Interest
	↓

(Continued)

3.00=

1,473.96 <== Interest

= 9,212.23 <== Principal

= 0.00 <== Balance

2.00

2.00-9,212.23 <== Balance

7,941.58 <== Principal

2,744.61 <== Interest

3.00

3.000.00 <== Balance

9,212.23 <== Principal

1,473.96 <== Interest

Interest of \$1,473.96 is paid in the third year.

Enter both a beginning and an ending period to compute the total amount of interest or principal paid over a particular period of time.

HP 10B	TI BA II PLUS
-24,000.00 <input type="button" value="PV"/>	-24,000.00 <input type="button" value="PV"/>
16.00 <input type="button" value="I/YR"/>	16.00 <input type="button" value="I/Y"/>
3.00 <input type="button" value="N"/>	3.00 <input type="button" value="N"/>
<input type="button" value="PMT"/> 10,686.19	<input type="button" value="CPT"/> <input type="button" value="PMT"/> 10,686.19
1.00 <input type="button" value="INPUT"/>	<input type="button" value="2nd"/> <input type="button" value="{AMORT}"/> <input type="button" value="2nd"/> <input <="" td="" type="button" value="{CLR Work}"/>
3.00 <input type="button" value="{AMORT}"/> = <div>8,058.57 &lt;== Interest</div> <div>= 24,000.00 &lt;== Principal</div> <div>= 0.00 &lt;== Balance</div>	<div>1.00<input type="button" value="ENTER"/><input type="button" value="↓"/></div> <div>3.00<input type="button" value="ENTER"/><input type="button" value="↓"/>0.00 &lt;== Balance</div> <div><input type="button" value="↓"/>24,000.00 &lt;== Principal</div> <div><input type="button" value="↓"/>8,058.57 &lt;== Interest</div>

Total interest of \$8,058.57 is paid over the life of the loan.

9. Interest Rate Conversions

Find the effective annual rate (EAR) corresponding to a 7 percent annual percentage rate (APR) compounded quarterly.

HP 10B	TI BA II PLUS
4.00 <input <="" td="" type="button" value="{P/YR}"/> <td><input type="button" value="2nd"/><input <="" td="" type="button" value="{IConv}"/></td>	<input type="button" value="2nd"/> <input <="" td="" type="button" value="{IConv}"/>
7.00 <input <="" td="" type="button" value="{NOM%}"/> <td>7.00<input type="button" value="ENTER"/></td>	7.00 <input type="button" value="ENTER"/>
<input type="button" value="{EFF%}"/> 7.19	<input type="button" value="↓"/> <input type="button" value="↓"/>
	4.00 <input type="button" value="ENTER"/>
	<input type="button" value="↑"/> <input type="button" value="CPT"/> 7.19

The effective annual rate equals 7.19 percent.



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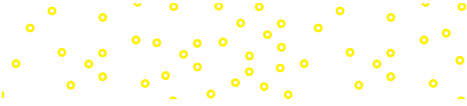
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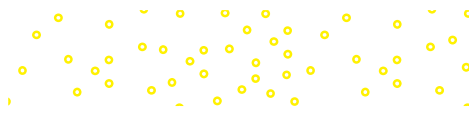
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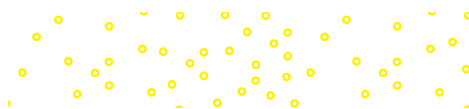
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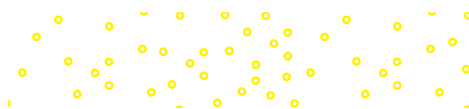
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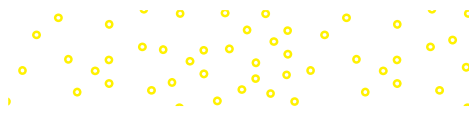
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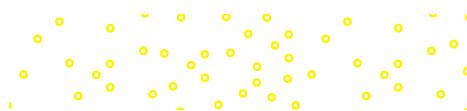
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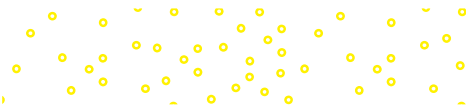
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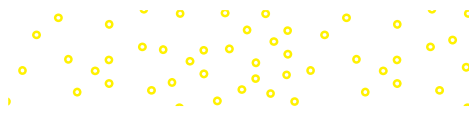
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