



**UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF INDUSTRIAL TECHNOLOGY**

**FINAL EXAMINATION
JANUARY 2016 SEMESTER**

COURSE CODE : JGB 20502
COURSE TITLE : ENGINEERING ECONOMY
PROGRAMME LEVEL : BACHELOR
DATE : 22 MAY 2016
TIME : 2.30 PM – 5.30 PM
DURATION : 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper **CAREFULLY**.
2. This question paper is printed on both sides of the paper.
3. This question paper consists of **TWO (2)** sections.
4. Answer **ALL** questions in Section A. Choose **FOUR (4)** questions in section B.
5. Please write your answers on the answer booklet provided.
6. Table and formula are enclosed as reference.
7. Please answer all questions in English.

THERE ARE 6 PAGES OF QUESTIONS EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)**INSTRUCTION: Answer ALL questions.****Please use the answer booklet provided.****Question 1**

The basic concepts of engineering economy in making decision is the cash flow. The cash flow is fundamental to every economy study. Cash flow occur in many configurations and amounts. Generally they have two major concepts in discuss the fundamental of cash flow such as arithmetic gradient factor and geometric gradient series factors.

- (a) Define the concepts of arithmetic gradient factor and geometric gradient series factor with inserted the example for each concept. (5 marks)
- (b) When engineer evaluating projects by the present worth method, which one(s) to select if the projects are (a) independent and (b) mutually exclusive? (5 marks)

Question 2

Cost estimation is a major activity performed in the initial stages in industry, business, and government. If a project revolves around a single piece of equipment, for example, an industrial robot, the *cost component* will be significantly simpler and fewer than the components for a complete system such as the manufacturing for a new product. Generally cost component divided to two which are First cost component and the annual operating cost (AOC).

- (a) List three elements of the following costs for a new computer integrated manufacturing system.
- i. First cost component
 - ii. AOC
- (6 marks)
- (b) Distinguish between direct cost and the indirect cost. (4 marks)

Question 3

Visteon, a spin-off company of Ford Motor Company, supplies major automobile components to auto manufacturers worldwide and is Ford's largest supplier. An engineer is on a Visteon committee to evaluate bids for new-generation coordinate-measuring machinery to be directly linked to the automated manufacturing of high-precision components. Three vendor bids the interest rates as below:

Bid #1 : 9% per year, compounded quarterly

Bid #2 : 3% per quarter, compounded quarterly

Bid #3 : 8.8% per year, compounded monthly

Visteon will make payments on a semiannual basis only. The engineer is confused about the effective interest rates – what they are annually and over the payment period of 6-months.

- (a) Determine the 'effective interest rate' for each bid on the basis semiannual payments. (6 marks)
- (b) Which bid will suggested by engineer and give the reason why the bid is choosen. (4 marks)

Question 4

A 15 year RM 50,000 bond that has a dividend rate of 10% per year, payable semiannually, is currently for sale. If the expected rate of return of the purchaser is 8% per year, compounded semiannually, and if the inflation rate is expected to be 2.5% each 6-month period, what is the bond worth now :

- (a) Without an adjustment for inflation (4 marks)
- (b) When inflation is considered (6 marks)

SECTION B (Total: 60 marks)**INSTRUCTION: Answer FOUR (4) questions.****Please use the answer booklet provided.****Question 1**

Encik Zafriel employed with a private university institution while his wife Puan Zarina runs a female boutiques business at Kuala Lumpur. They have four children. The detail information about the children are as follows:

Zamani	24 years	Married, Studying in Multimedia University
Zikri	22 years	Working at Mid Valley, KL
Zabidi	20 years	Studying abroad and received RM4,500 per year doing part time job
Zakri	14 years	Physically disabled and study at SMK Puteri, KL

Other relevant information relating to Encik Zafriel and his wife, Puan Zarina for the year 2013 are as follows:

Encik Zafriel

- a. Monthly salary is RM5,200.
- b. Interest received from Public Bank Berhad amounted to RM725.
- c. Dividend from SYABAS amounted to RM21,000(net of tax 25%).
- d. Royalty from recording tapes amounted to RM14,000.
- e. Zakat / Fitrah amounted to RM330.
- f. Donations to approved institutions:
 - i.) Foods and hamper – RM4,000
 - ii.) Cash donation – RM2,500
- g. Medical expenses for his parents amounted to RM4,775.
- h. Purchased of sports equipment amounted to RM345.
- i. Purchased a wheel chair for his children amounted to RM4,500.
- j. Life insurance premium is RM2,500.

Puan Zarina

- a. Female boutique business:

Adjusted income	RM85,000
Balancing charge	RM10,500
Capital allowance	RM12,000
Unabsorbed loss brought forward from 2012	(RM4,400)

- b. Gross dividend from Jaya Bumi Berhad amounted to RM2,500.
- c. Dividend income from Salsila (M) Bhd (single-tier) amounted to RM16,100.
- d. Rental Income amounted to RM56,000.
- e. Medical expenses for serious disease for her children amounted to RM2,100.
- f. Education insurance for her children amounted to RM2,900.
- g. Purchase a new personal computer for personal use amounted RM2,990.
(Last purchase during 2009)
- h. Subscription to magazines and journal amounted to RM1,650.
- i. Deposited to SSPN for her children amounted to RM4,750.
- j. Zakat / Fitrah amounted to RM450.

REQUIRED:

Compute the tax payable by Encik Zafriel and Puan Zarina for the year assessment 2013 (separate assessment)

(15 marks)

Question 2

Kasih & Sayang Company has decided to replace its old machine with the new automatic machine. The new technology KSC considering to be introduced is called STBC Machine. The following information provided:

Table 1: Machine

	Manual Machine	STBC Machine
Purchase Price	RM 90,000	RM 180,000
Useful life	10 years (used 5 years)	5 years
Market value	RM 30,000	-
Salvage value	-	RM 12,000
Installation cost	-	RM 3,000
Transportation	-	RM 2,500

The replacement activity will need an additional working capital for RM 14,000. The maintenance cost will reduce by RM 5,000 while defect cost will remain at RM 20,000. The company will save RM 3,000 from employee's salary if using the new machine. Sales will increase by RM 90,000.

KSC adopt a straight line depreciation method and corporate tax charge is 35 percent. The minimum requirement for the company to pay back the cost of new machine is 3 years. The required rate of return will be 10 percent.

Required:

- (a) Compute New Initial Outlay (8 marks)
- (b) Compute Net Operating Cash Flow (7 marks)

Question 3

Consider the following two mutually exclusive projects, with cash flows given:

Table 2: Cash flow

Year	Keris (RM)	Pedang (RM)
0	(210,000)	(21,000)
1	15,000	11,000
2	30,000	9,000
3	30,000	11,000
4	37,000	9,000

Whichever project you choose, if any, you require a 15 percent return on investment.

- (a) If you apply the payback criterion, which investment will you choose? Why? (7 marks)
- (b) Calculate the Net Present Value for both projects. Do you still choose the same project? (8 marks)

Question 4

The federation of Student Societies of Engineering (FeSSE) wants to offer a one-day training course to help students in job hunting and to raise funds. The organizer have classified the costs for room rental, room setup, and advertising as fixed costs. Their total of RM 225 is pegged to a room that will hold 40 people. So, is demand is higher, the fixed costs will also increase. The variable costs for food and bound handouts will be RM20 per students. The organizing committee believes that RM 35 is about the right price to match value to students with their budgets. Since FeSSE has not offered training course before, they are unsure how many students will reserve seats.

Develop equation for FeSSE's total cost and total revenue, and determined the number of registration that would be needed for revenue to equal cost. (15 marks)

Question 5

Money has a time value because it can earn more money over time. It is show that purchasing power changes over time. The questions below show the situation of the time value of money. Please answer the question below carefully.

- (a) How much would Syarifah need to deposit in an account today that pays 5% interest, compounded semiannually, so that he has a balance of RM 50,000 in the account at the end of TEN (10) years? (3 marks)

- (b) Subhi deposits RM50,000 in the bank that pays an annual interest of 4 % compounded monthly. Find the amount of money after **SEVEN (7)** years. (3 marks)
- (c) Based on the question (b) above, Let say Subhi deposit the same amount but choose compounded quarterly at the same rate. Which method of investment is wisely either compounded quarterly or monthly? Prove your answer. (5 marks)
- (d) While you were student in university, you borrowed RM 20,000 in student loans at interest rate of 7 percent, compounded annually. If you repay RM 2,000 per year, how long, to the nearest year, will it take you to repay the loan? (4 marks)

Note: Use the table for calculation where necessary.

END OF EXAMINATION PAPER

Assesment Year 2013 and 2014

Chargeable income (RM)	Calculations (RM)	Tax Rate %	Tax Amount (RM)
0-2500	On the First 2,500	0	0
2,501-5,000	Next 2,500	0	0
5,001-10,000	On the First 5,000 Next 5,000	2	0 100
10,001-20,000	On the First 10,000 Next 10,000	2	100 200
20,001-35,000	On the First 20,000 Next 15,000	6	300 900
35,001-50,000	On the First 35,000 Next 15,000	11	1,200 1,650
50,001-70,000	On the First 50,000 Next 20,000	19	2,850 3,800
70,001-100,000	On the First 70,000 Next 30,000	24	6,650 7,200
More than 100,000	On the First 100,000 Next RM	26	13,850

Tax Relief for Resident Individual

Year 2016

No.	Individual Relief Types	Amount (RM)
1	Self and Dependent Special relief of RM2,000 will be given to tax payers earning on income of up to RM8,000 per month (aggregate income of up to RM96,000 annually). This relief is applicable for Year Assessment 2013 only.	9,000
2	Medical expenses for parents	5,000 (Limited)
3	Basic supporting equipment	i) 5,000 (Limited) - year of assessment 2014 and before ii) 6,000 (Limited) - with effect from year of assessment 2015
4	Disabled Individual	6,000
5	Education Fees (Individual)	5,000 (Limited)
6	Medical expenses for serious diseases	i) 5,000 (Limited) - year of assessment 2014 and before ii) 6,000 (Limited) - with effect from year of assessment 2015
7	Complete medical examination	500 (Limited)
8	Purchase of books, journals, magazines and publications	1,000 (Limited)
9	Purchase of personal computer (once in every 3 years)	3,000 (Limited)
10	Net saving in SSPN's scheme	3,000 (Limited)

11	Net saving in SSPN's scheme (with effect from year assessment 2012 until year assessment 2017)	6,000 (Limited)
12	Purchase of sport equipment for sport activities	300 (Limited)
13	Subscription fees for broadband registered in the name of the individual (with effect from year of assessment 2010 - 2012)	500 (Limited)
14	<p>Interest expended to finance purchase of residential property. Relief of up to RM10,000 a year for three consecutive years from the first year the interest is paid.</p> <p>Subject to the following conditions:</p> <p>(i) the taxpayer is a Malaysian citizen and a resident;</p> <p>(ii) limited to one residential unit;</p> <p>(iii) the sale and purchase agreement is signed between 10th March 2009 and 31st December 2010; and</p> <p>(iv) the residential property is not rented out.</p> <p>Where:</p> <p>(a) 2 or more individuals are eligible to claim relief for the same property ; and</p> <p>(b) total interest expended by those individuals exceeds the allowable amount for that year. Each individual is allowed an amount of relief for each year based on the following formula:</p> $\frac{A \times B}{C}$ <p>where;</p> <p>A = total interest allowable in the relevant year;</p> <p>B = total interest expended by the relevant individual in the relevant year;</p> <p>C = total interest expended by all the individuals.</p>	10,000 (Limited)
15	Husband/Wife/Alimony Payments	3,000 (Limited)
16	Disable Wife/Husband	3,500
17	Ordinary Child relief	1,000
18	Each unmarried child of 18 years and above who is receiving full-time education ("A-Level", certificate, matriculation or preparatory courses).	1,000
19	<p>Each unmarried child of 18 years and above that:</p> <p>(i) receiving further education in Malaysia in respect of an award of diploma or higher (excluding matriculation/preparatory courses).</p> <p>(ii) receiving further education outside Malaysia in respect of an award</p>	<p>4,000</p> <p>6000</p> <p>(with effect from</p>

	of degree or its equivalent (including Master or Doctorate). (iii) the instruction and educational establishment shall be approved by the relevant government authority.	year of assessment 2013)
20	<p>Disabled child</p> <p>Additional exemption of RM4,000 disable child age 18 years old and above, not married and pursuing diplomas or above qualification in Malaysia @ bachelor degree or above outside Malaysia in program and in Higher Education Institute that is accredited by related Government authorities</p> <p>With effect from year of assessment 2013 additional exemption is RM6,000</p>	<p>i) 5,000 - year of assessment 2014 and before</p> <p>ii) 6,000 - with effect from year of assessment 2015</p>
21	Life insurance dan EPF	6,000 (Limited)
22	Premium on new annuity scheme or additional premium paid on existing annuity scheme commencing payment from 01/01/2010 (amount exceeding RM1,000 can be claimed together with life insurance premium) - deleted from year assessment 2012 until year assessment 2021	1,000 (Limited)
23	Deferred Annuity and Private Retirement Scheme (PRS) - with effect from year assessment 2012 until year assessment 2021	3,000 (Limited)
24	Insurance premium for education or medical benefit	3,000 (Limited)

606 APPENDIX C: COMPOUND INTEREST TABLES

4% Compound Interest Factors 4%									
n	Single Payment		Uniform Payment Series				Arithmetic Gradient		n
	Compound Amount Factor Find F Given P F/P	Present Worth Factor Find P Given F P/F	Sinking Fund Factor Find A Given F A/F	Capital Recovery Factor Find A Given P A/P	Compound Amount Factor Find F Given A F/A	Present Worth Factor Find P Given A P/A	Gradient Uniform Series Find A Given G A/G	Gradient Present Worth Find P Given G P/G	
	1	1.040	.9615	1.0000	1.0400	1.000	0.962	0	
2	1.082	.9246	.4902	.5302	2.040	1.886	0.490	0.925	2
3	1.125	.8890	.3203	.3603	3.122	2.775	0.974	2.702	3
4	1.170	.8548	.2355	.2755	4.246	3.630	1.451	5.267	4
5	1.217	.8219	.1846	.2246	5.416	4.452	1.922	8.555	5
6	1.265	.7903	.1508	.1908	6.633	5.242	2.386	12.506	6
7	1.316	.7599	.1266	.1666	7.898	6.002	2.843	17.066	7
8	1.369	.7307	.1085	.1485	9.214	6.733	3.294	22.180	8
9	1.423	.7026	.0945	.1345	10.583	7.435	3.739	27.801	9
10	1.480	.6756	.0833	.1233	12.006	8.111	4.177	33.881	10
11	1.539	.6496	.0741	.1141	13.486	8.760	4.609	40.377	11
12	1.601	.6246	.0666	.1066	15.026	9.385	5.034	47.248	12
13	1.665	.6006	.0601	.1001	16.627	9.986	5.453	54.454	13
14	1.732	.5775	.0547	.0947	18.292	10.563	5.866	61.962	14
15	1.801	.5553	.0499	.0899	20.024	11.118	6.272	69.735	15
16	1.873	.5339	.0458	.0858	21.825	11.652	6.672	77.744	16
17	1.948	.5134	.0422	.0822	23.697	12.166	7.066	85.958	17
18	2.026	.4936	.0390	.0790	25.645	12.659	7.453	94.350	18
19	2.107	.4746	.0361	.0761	27.671	13.134	7.834	102.893	19
20	2.191	.4564	.0336	.0736	29.778	13.590	8.209	111.564	20
21	2.279	.4388	.0313	.0713	31.969	14.029	8.578	120.341	21
22	2.370	.4220	.0292	.0692	34.248	14.451	8.941	129.202	22
23	2.465	.4057	.0273	.0673	36.618	14.857	9.297	138.128	23
24	2.563	.3901	.0256	.0656	39.083	15.247	9.648	147.101	24
25	2.666	.3751	.0240	.0640	41.646	15.622	9.993	156.104	25
26	2.772	.3607	.0226	.0626	44.312	15.983	10.331	165.121	26
27	2.883	.3468	.0212	.0612	47.084	16.330	10.664	174.138	27
28	2.999	.3335	.0200	.0600	49.968	16.663	10.991	183.142	28
29	3.119	.3207	.0189	.0589	52.966	16.984	11.312	192.120	29
30	3.243	.3083	.0178	.0578	56.085	17.292	11.627	201.062	30
31	3.373	.2965	.0169	.0569	59.328	17.588	11.937	209.955	31
32	3.508	.2851	.0159	.0559	62.701	17.874	12.241	218.792	32
33	3.648	.2741	.0151	.0551	66.209	18.148	12.540	227.563	33
34	3.794	.2636	.0143	.0543	69.858	18.411	12.832	236.260	34
35	3.946	.2534	.0136	.0536	73.652	18.665	13.120	244.876	35
40	4.801	.2083	.0105	.0505	95.025	19.793	14.476	286.530	40
45	5.841	.1712	.00826	.0483	121.029	20.720	15.705	325.402	45
50	7.107	.1407	.00655	.0466	152.667	21.482	16.812	361.163	50
55	8.646	.1157	.00523	.0452	191.159	22.109	17.807	393.689	55
60	10.520	.0951	.00420	.0442	237.990	22.623	18.697	422.996	60
65	12.799	.0781	.00339	.0434	294.968	23.047	19.491	449.201	65
70	15.572	.0642	.00275	.0427	364.290	23.395	20.196	472.479	70
75	18.945	.0528	.00223	.0422	448.630	23.680	20.821	493.041	75
80	23.050	.0434	.00181	.0418	551.244	23.915	21.372	511.116	80
85	28.044	.0357	.00148	.0415	676.089	24.109	21.857	526.938	85
90	34.119	.0293	.00121	.0412	827.981	24.267	22.283	540.737	90
95	41.511	.0241	.00099	.0410	1012.8	24.398	22.655	552.730	95
100	50.505	.0198	.00081	.0408	1237.6	24.505	22.980	563.125	100

APPENDIX C: COMPOUND INTEREST TABLES 607

Compound Interest Factors									
4 1/2 %									
n	Single Payment		Uniform Payment Series				Arithmetic Gradient		n
	Compound Amount Factor Find F Given P F/P	Present Worth Factor Find P Given F P/F	Sinking Fund Factor Find A Given F A/F	Capital Recovery Factor Find A Given P A/P	Compound Amount Factor Find F Given A F/A	Present Worth Factor Find P Given A P/A	Gradient Uniform Series Find A Given G A/G	Gradient Present Worth Find P Given G P/G	
1	1.045	.9569	1.0000	1.0450	1.000	0.957	0	0	1
2	1.092	.9157	.4890	.5340	2.045	1.873	0.489	0.916	2
3	1.141	.8763	.3188	.3638	3.137	2.749	0.971	2.668	3
4	1.193	.8386	.2337	.2787	4.278	3.588	1.445	5.184	4
5	1.246	.8025	.1828	.2278	5.471	4.390	1.912	8.394	5
6	1.302	.7679	.1489	.1939	6.717	5.158	2.372	12.233	6
7	1.361	.7348	.1247	.1697	8.019	5.893	2.824	16.642	7
8	1.422	.7032	.1066	.1516	9.380	6.596	3.269	21.564	8
9	1.486	.6729	.0926	.1376	10.802	7.269	3.707	26.948	9
10	1.553	.6439	.0814	.1264	12.288	7.913	4.138	32.743	10
11	1.623	.6162	.0722	.1172	13.841	8.529	4.562	38.905	11
12	1.696	.5897	.0647	.1097	15.464	9.119	4.978	45.391	12
13	1.772	.5643	.0583	.1033	17.160	9.683	5.387	52.163	13
14	1.852	.5400	.0528	.0978	18.932	10.223	5.789	59.182	14
15	1.935	.5167	.0481	.0931	20.784	10.740	6.184	66.416	15
16	2.022	.4945	.0440	.0890	22.719	11.234	6.572	73.833	16
17	2.113	.4732	.0404	.0854	24.742	11.707	6.953	81.404	17
18	2.208	.4528	.0372	.0822	26.855	12.160	7.327	89.102	18
19	2.308	.4333	.0344	.0794	29.064	12.593	7.695	96.901	19
20	2.412	.4146	.0319	.0769	31.371	13.008	8.055	104.779	20
21	2.520	.3968	.0296	.0746	33.783	13.405	8.409	112.715	21
22	2.634	.3797	.0275	.0725	36.303	13.784	8.755	120.689	22
23	2.752	.3634	.0257	.0707	38.937	14.148	9.096	128.682	23
24	2.876	.3477	.0240	.0690	41.689	14.495	9.429	136.680	24
25	3.005	.3327	.0224	.0674	44.565	14.828	9.756	144.665	25
26	3.141	.3184	.0210	.0660	47.571	15.147	10.077	152.625	26
27	3.282	.3047	.0197	.0647	50.711	15.451	10.391	160.547	27
28	3.430	.2916	.0185	.0635	53.993	15.743	10.698	168.420	28
29	3.584	.2790	.0174	.0624	57.423	16.022	10.999	176.232	29
30	3.745	.2670	.0164	.0614	61.007	16.289	11.295	183.975	30
31	3.914	.2555	.0154	.0604	64.752	16.544	11.583	191.640	31
32	4.090	.2445	.0146	.0596	68.666	16.789	11.866	199.220	32
33	4.274	.2340	.0137	.0587	72.756	17.023	12.143	206.707	33
34	4.466	.2239	.0130	.0580	77.030	17.247	12.414	214.095	34
35	4.667	.2143	.0123	.0573	81.497	17.461	12.679	221.380	35
40	5.816	.1719	.00934	.0543	107.030	18.402	13.917	256.098	40
45	7.248	.1380	.00720	.0522	138.850	19.156	15.020	287.732	45
50	9.033	.1107	.00560	.0506	178.503	19.762	15.998	316.145	50
55	11.256	.0888	.00439	.0494	227.918	20.248	16.860	341.375	55
60	14.027	.0713	.00345	.0485	289.497	20.638	17.617	363.571	60
65	17.481	.0572	.00273	.0477	366.237	20.951	18.278	382.946	65
70	21.784	.0459	.00217	.0472	461.869	21.202	18.854	399.750	70
75	27.147	.0368	.00172	.0467	581.043	21.404	19.354	414.242	75
80	33.830	.0296	.00137	.0464	729.556	21.565	19.785	426.680	80
85	42.158	.0237	.00109	.0461	914.630	21.695	20.157	437.309	85
90	52.537	.0190	.00087	.0459	1145.3	21.799	20.476	446.359	90
95	65.471	.0153	.00070	.0457	1432.7	21.883	20.749	454.039	95
100	81.588	.0123	.00056	.0456	1790.9	21.950	20.981	460.537	100

608 APPENDIX C: COMPOUND INTEREST TABLES

5% Compound Interest Factors 5%									
n	Single Payment		Uniform Payment Series				Arithmetic Gradient		
	Compound Amount Factor Find F Given P F/P	Present Worth Factor Find P Given F P/F	Sinking Fund Factor Find A Given F A/F	Capital Recovery Factor Find A Given P A/P	Compound Amount Factor Find F Given A F/A	Present Worth Factor Find P Given A P/A	Gradient Uniform Series Find A Given G A/G	Gradient Present Worth Find P Given G P/G	n
1	1.050	.9524	1.0000	1.0500	1.000	0.952	0	0	1
2	1.102	.9070	.4878	.5378	2.050	1.859	0.488	0.907	2
3	1.158	.8638	.3172	.3672	3.152	2.723	0.967	2.635	3
4	1.216	.8227	.2320	.2820	4.310	3.546	1.439	5.103	4
5	1.276	.7835	.1810	.2310	5.526	4.329	1.902	8.237	5
6	1.340	.7462	.1470	.1970	6.802	5.076	2.358	11.968	6
7	1.407	.7107	.1228	.1728	8.142	5.786	2.805	16.232	7
8	1.477	.6768	.1047	.1547	9.549	6.463	3.244	20.970	8
9	1.551	.6446	.0907	.1407	11.027	7.108	3.676	26.127	9
10	1.629	.6139	.0795	.1295	12.578	7.722	4.099	31.652	10
11	1.710	.5847	.0704	.1204	14.207	8.306	4.514	37.499	11
12	1.796	.5568	.0628	.1128	15.917	8.863	4.922	43.624	12
13	1.886	.5303	.0565	.1065	17.713	9.394	5.321	49.988	13
14	1.980	.5051	.0510	.1010	19.599	9.899	5.713	56.553	14
15	2.079	.4810	.0463	.0963	21.579	10.380	6.097	63.288	15
16	2.183	.4581	.0423	.0923	23.657	10.838	6.474	70.159	16
17	2.292	.4363	.0387	.0887	25.840	11.274	6.842	77.140	17
18	2.407	.4155	.0355	.0855	28.132	11.690	7.203	84.204	18
19	2.527	.3957	.0327	.0827	30.539	12.085	7.557	91.327	19
20	2.653	.3769	.0302	.0802	33.066	12.462	7.903	98.488	20
21	2.786	.3589	.0280	.0780	35.719	12.821	8.242	105.667	21
22	2.925	.3419	.0260	.0760	38.505	13.163	8.573	112.846	22
23	3.072	.3256	.0241	.0741	41.430	13.489	8.897	120.008	23
24	3.225	.3101	.0225	.0725	44.502	13.799	9.214	127.140	24
25	3.386	.2953	.0210	.0710	47.727	14.094	9.524	134.227	25
26	3.556	.2812	.0196	.0696	51.113	14.375	9.827	141.258	26
27	3.733	.2678	.0183	.0683	54.669	14.643	10.122	148.222	27
28	3.920	.2551	.0171	.0671	58.402	14.898	10.411	155.110	28
29	4.116	.2429	.0160	.0660	62.323	15.141	10.694	161.912	29
30	4.322	.2314	.0151	.0651	66.439	15.372	10.969	168.622	30
31	4.538	.2204	.0141	.0641	70.761	15.593	11.238	175.233	31
32	4.765	.2099	.0133	.0633	75.299	15.803	11.501	181.739	32
33	5.003	.1999	.0125	.0625	80.063	16.003	11.757	188.135	33
34	5.253	.1904	.0118	.0618	85.067	16.193	12.006	194.416	34
35	5.516	.1813	.0111	.0611	90.320	16.374	12.250	200.580	35
40	7.040	.1420	.00828	.0583	120.799	17.159	13.377	229.545	40
45	8.985	.1113	.00626	.0563	159.699	17.774	14.364	255.314	45
50	11.467	.0872	.00478	.0548	209.347	18.256	15.223	277.914	50
55	14.636	.0683	.00367	.0537	272.711	18.633	15.966	297.510	55
60	18.679	.0535	.00283	.0528	353.582	18.929	16.606	314.343	60
65	23.840	.0419	.00219	.0522	456.795	19.161	17.154	328.691	65
70	30.426	.0329	.00170	.0517	588.525	19.343	17.621	340.841	70
75	38.832	.0258	.00132	.0513	756.649	19.485	18.018	351.072	75
80	49.561	.0202	.00103	.0510	971.222	19.596	18.353	359.646	80
85	63.254	.0158	.00080	.0508	1245.1	19.684	18.635	366.800	85
90	80.730	.0124	.00063	.0506	1594.6	19.752	18.871	372.749	90
95	103.034	.00971	.00049	.0505	2040.7	19.806	19.069	377.677	95
100	131.500	.00760	.00038	.0504	2610.0	19.848	19.234	381.749	100

6% Compound Interest Factors 6%									
n	Single Payment		Uniform Payment Series				Arithmetic Gradient		n
	Compound Amount	Present Worth	Sinking Fund	Capital Recovery	Compound Amount	Present Worth	Gradient Uniform Series	Gradient Present Worth	
	Factor Find F Given P F/P	Factor Find P Given F P/F	Factor Find A Given F A/F	Factor Find A Given P A/P	Factor Find F Given A F/A	Factor Find P Given A P/A	Find A Given G A/G	Find P Given G P/G	
1	1.060	.9434	1.0000	1.0600	1.000	0.943	0	0	1
2	1.124	.8900	.4854	.5454	2.060	1.833	0.485	0.890	2
3	1.191	.8396	.3141	.3741	3.184	2.673	0.961	2.569	3
4	1.262	.7921	.2286	.2886	4.375	3.465	1.427	4.945	4
5	1.338	.7473	.1774	.2374	5.637	4.212	1.884	7.934	5
6	1.419	.7050	.1434	.2034	6.975	4.917	2.330	11.459	6
7	1.504	.6651	.1191	.1791	8.394	5.582	2.768	15.450	7
8	1.594	.6274	.1010	.1610	9.897	6.210	3.195	19.841	8
9	1.689	.5919	.0870	.1470	11.491	6.802	3.613	24.577	9
10	1.791	.5584	.0759	.1359	13.181	7.360	4.022	29.602	10
11	1.898	.5268	.0668	.1268	14.972	7.887	4.421	34.870	11
12	2.012	.4970	.0593	.1193	16.870	8.384	4.811	40.337	12
13	2.133	.4688	.0530	.1130	18.882	8.853	5.192	45.963	13
14	2.261	.4423	.0476	.1076	21.015	9.295	5.564	51.713	14
15	2.397	.4173	.0430	.1030	23.276	9.712	5.926	57.554	15
16	2.540	.3936	.0390	.0990	25.672	10.106	6.279	63.459	16
17	2.693	.3714	.0354	.0954	28.213	10.477	6.624	69.401	17
18	2.854	.3503	.0324	.0924	30.906	10.828	6.960	75.357	18
19	3.026	.3305	.0296	.0896	33.760	11.158	7.287	81.306	19
20	3.207	.3118	.0272	.0872	36.786	11.470	7.605	87.230	20
21	3.400	.2942	.0250	.0850	39.993	11.764	7.915	93.113	21
22	3.604	.2775	.0230	.0830	43.392	12.042	8.217	98.941	22
23	3.820	.2618	.0213	.0813	46.996	12.303	8.510	104.700	23
24	4.049	.2470	.0197	.0797	50.815	12.550	8.795	110.381	24
25	4.292	.2330	.0182	.0782	54.864	12.783	9.072	115.973	25
26	4.549	.2198	.0169	.0769	59.156	13.003	9.341	121.468	26
27	4.822	.2074	.0157	.0757	63.706	13.211	9.603	126.860	27
28	5.112	.1956	.0146	.0746	68.528	13.406	9.857	132.142	28
29	5.418	.1846	.0136	.0736	73.640	13.591	10.103	137.309	29
30	5.743	.1741	.0126	.0726	79.058	13.765	10.342	142.359	30
31	6.088	.1643	.0118	.0718	84.801	13.929	10.574	147.286	31
32	6.453	.1550	.0110	.0710	90.890	14.084	10.799	152.090	32
33	6.841	.1462	.0103	.0703	97.343	14.230	11.017	156.768	33
34	7.251	.1379	.00960	.0696	104.184	14.368	11.228	161.319	34
35	7.686	.1301	.00897	.0690	111.435	14.498	11.432	165.743	35
40	10.286	.0972	.00646	.0665	154.762	15.046	12.359	185.957	40
45	13.765	.0727	.00470	.0647	212.743	15.456	13.141	203.109	45
50	18.420	.0543	.00344	.0634	290.335	15.762	13.796	217.457	50
55	24.650	.0406	.00254	.0625	394.171	15.991	14.341	229.322	55
60	32.988	.0303	.00188	.0619	533.126	16.161	14.791	239.043	60
65	44.145	.0227	.00139	.0614	719.080	16.289	15.160	246.945	65
70	59.076	.0169	.00103	.0610	967.928	16.385	15.461	253.327	70
75	79.057	.0126	.00077	.0608	1300.9	16.456	15.706	258.453	75
80	105.796	.00945	.00057	.0606	1746.6	16.509	15.903	262.549	80
85	141.578	.00706	.00043	.0604	2343.0	16.549	16.062	265.810	85
90	189.464	.00528	.00032	.0603	3141.1	16.579	16.189	268.395	90
95	253.545	.00394	.00024	.0602	4209.1	16.601	16.290	270.437	95
100	339.300	.00295	.00018	.0602	5638.3	16.618	16.371	272.047	100

$FV = PV(1+r)^n$ or using table $FV = PV(FVIF_{r,n})$
$FV = PV(1+r/m)^{nm}$ or using table $FV = PV(FVIF_{r/m, nm})$
$FVA = C \frac{(1+r)^n - 1}{r}$ or using table $FVA = C(FVIFA_{r,n})$
$FVAD = C \frac{(1+r)^n - 1}{r} (1+r)$ or using table $FVAD = C(FVIFA_{r,n})(1+r)$
$PV = \frac{FV}{(1+r)^n}$ or using table $PV = FV(PVIF_{r,n})$
$PV = \frac{FV}{(1+r/m)^{nm}}$ or using table $PV = FV(PVIF_{r/m, nm})$
$PVA = C \frac{1 - \frac{1}{(1+r)^n}}{r}$ or using table $PVA = C(PVIFA_{r,n})$
$PVAD = C \frac{1 - \frac{1}{(1+r)^n}}{r} (1+r)$ $PVAD = C(PVIFA_{r,n})(1+r)$
Effective interest $i = (1 + r/m)^m - 1$
$i_t = i + f + if$
$(P/A, i, n) = \frac{(1+i)^n - 1}{i(1+i)^n}$
$(P/F, i, n) = \frac{1}{(1+i)^n}$