UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	ENGINEERING ECONOMY
COURSE CODE	:	BPK30902
PROGRAMME	:	BDD, BDP, BEB, BEC, BED, BEK, BEM, BEU, BFF, BNN, BNP, BNQ
EXAMINATION DATE	:	JUNE 2013
DURATION	:	2 HOURS
INSTRUCTION	:	**PART A** ANSWER **ALL** QUESTIONS **PART A** ANSWER **TWO (2)** OUT OF THREE (3) QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SEVENTEEN (17)** PAGES

PART A

Q1 (a) Identify each of the following cash flows whether a benefit, disbenefit, or cost with justification.

(i) RM700,000 per year maintenance by Port Klang authority.

(2 marks)

(ii) Expenditure of RM45 million for tunnel construction on East-West Highway.

(2 marks)

(iii) Reduction of RM375 000 per year in car accident repairs because of improved lighting.

(2 marks)

(iv) RM700 000 per year loss of revenue by farmers because of highway right-of-way purchases.

(2 marks)

(v) RM500,000 saving in toll gate payment for new federal road.

(2 marks)

(b) A project is been considered by UTHM to construct a new runaway on the existing runaway at Tanjung Labuh Campus for the use of Aeronautical Course. The land acquisition is estimated to be RM0.7 Million. Construction cost for the runaway is expected to be RM1.2 Million with an additional annual maintenance cost of RM80 000. Finally, the projected increase in flight will require an additional traffic controller with an annual cost of RM36 000. Annual benefits of the runaway have been estimated as in **Table Q1**.

Table Q1: Annual Benefit of the UTHM Runaway Project

Rental receipt from local flying club	RM400 000
Airport charge to passengers	RM50 000
Convenience benefit to the UTHM community	RM35 000
Additional tourism RM to UTHM	RM40 000

Apply the B-C ratio method for both conventional and modified cases using PW or AW method with the study period of 10 years and a MARR of 12% per year to determine whether the runaway for UTHM should be erected.

(30 marks)

PART B

Q2 (a) As a new project engineer at DIC Epoxy, you and your team are asked by your superior to evaluate alternatives for producing a newly designed packaging machine. The old packaging machine could not meet the standard of efficiency required by a progressive production. DIC Epoxy has RM 80,000 as a budget for the start-up of the new product line from packaging machine. By using *the principles of Engineering Economy*, evaluate on the following information as in **Table Q2**:

Table Q2: Alternatives for producing a newly designed packaging machine

Factor		**External Modification (Alchem)**	**Purchase New Packaging Machine (Alchem)**
Purchased value (RM)	150 000	150 000	370 000
Modification cost (RM)	**25 000**	**45 000**	
Project Punctuality	On Time	On Time	Not sure. Need to pay any lost if late.
Modification meets the full capacity	**Can't Guarantee**	**Guarantee**	**Guarantee**
Advantage	Cheaper cost	Cheaper cost	Environmentally Safe
Disadvantage	**Not Environmentally Safe**	**Not Environmentally Safe**	**Expensive & No Guarantee on Punctuality**

(i) Define the problem.

(3 marks)

(ii) List alternatives facing by DIC Epoxy.

(4 marks)

(iii) Evaluate the alternatives by using consistent viewpoints.

(3 marks)

(iv) Evaluate the alternative by using common unit of measure.

(2 marks)

(v) Make risk and uncertainty explicit for the alternatives.

(3 marks)

(b) An exclusive steel door factory has a production capacity of 5 000 units per month. Financial records show the fixed cost of production is RM 500 000 per month and the variable cost is RM 500 per unit. Doors priced at RM1 000 per unit. If the plant operates at 90% of full capacity:

(i) Calculate the profit / loss if all the goods produced can be sold.

(3 marks)

(ii) Determine the coordinates of the breakeven point.

(3 marks)

(iii) Calculate the percentage increase in the break-even point if fixed costs declined by 10% while the average variable costs increased by 20%.

(3 marks)

(iv) Calculate the profit / loss of the company if only 50% can be sold and there is no value to unsold door.

(4 marks)

(v) Calculate the profit / loss of the company based on **Q2(b)(iv)** if the unsold door has a scrap value (salvage value) of RM500 per unit.

(3 marks)

Q3 (a) An IBS technology team is developing a weighted index for the price of a ton matrix of Portland cement in year 2011, when 2007 is the reference year having an index value of 935 as in **Table Q3a**.

Table Q3a: Price of Various Portland Cement

	Price (RM/Ton Matrix) in Year		
	2007	*2008*	*2011*
Portland Cement - CEM I	1,020	1,071	1,181
Portland Composite Cement - CEM II	935	982	1,082
Portland Blast Furnace Cement - CEM III	850	893	984

The weightage placed on *Portland Cement CEM I* is 3, *Portland Composite Cement CEM II* is 2 times, *and Portland Blast Furnace Cement CEM III* is 1 time to its quality compared.

Determine the corresponding 2013 prices of Portland cement from I_{2011} if the index value in 2013 to be 1,131.

(6 marks)

(b) We need an early estimating using factor technique for capital expenditure of new factory consisting of 8,000 sq meters, four units of warehouse, three cool rooms & two loading facilities.

Demonstrate the cost estimation using an appropriate table if the unit factors are given as RM155 per square meter, RM25 500 per unit, RM17 500 per cool room and RM9 500 per loading facility respectively.

(8 marks)

(c) Mr. Ali owns a small company that manufactures exclusive wooden doors. Recently his company has been aggressively marketing the products to a new customer. With the recent marketing effort, he expected the customer demands for this year will increase to 50 units per year. He would like to forecast the operation cost so that the financial requirement can be anticipated. After making a review from previous company record, he found that a fairly reliable estimate of operation cost can be determined by knowing the production output. **Table Q3b** shows the record of operation cost and the corresponding production output from previous years.

Table Q3b: Operation cost and production output recorded from previous year

Year	Operation cost (RM)	Production output (unit)
2010	30 000	31
2011	31 000	35
2012	28 300	26

(i) Develop a linear regression equation (Cost Estimating Relation) to relate operation cost as a function of production output.

(3marks)

(ii) Calculate the standard error.

(3marks)

(iii) Calculate the coefficient correlation.

(3marks)

(iv) Determine whether the coefficient correlation shows a strong linear relationship between operation cost and production output. Justify your answer.

(4marks)

(v) Estimate the operation cost for a production output of 50 units.

(3 marks)

Q4 (a) You are given an alternative to invest RM 250,000 for five (5) years in two schemes, firstly with 7% interest per annum (p.a.) using simple interest, and secondly for 6.5% per annum using compounded interest.

Suggest the best investment.

(8 marks)

(b) Calculate the total returns of your savings after five (5) years if you place the amount of RM 250 000 in a fixed deposit account with 5% interest per annum and added RM 50 000 beginning of the third year which received semi-compounded interest of 4.5% yearly.

(8 marks)

(c) A committed young engineer is planning to collect RM 100 000 in 5 years from now to pay for his pre-planned honeymoon package. The bank is willing to give him an attractive 6 % interest compounded monthly for the deposit.

Calculate how much money he needs to deposit now to make his dream comes true. Your answer must also include the cash flow diagram.

(7 marks)

(d) In relation to **Q4(c)**, suppose he wants to deposit the money equally every month, starting from now.

Calculate how much money he is supposed to bank-in every month. Include the cash flow diagram in your answer.

(7 marks)

BAHAGIAN A

S1 (a) Kenalpasti setiap rajah aliran tunai berikut sama ada dalam kategori kebaikan, keburukan atau kos. Berikan justifikasi bagi jawapan anda.

(i) Penyelenggaran RM700 000 setahun oleh Lembaga Pelabuhan Klang.
(2 markah)

(ii) Perbelanjaan RM45 juta untuk pembinaan terowong Lebuhraya Timur Barat.
(2 markah)

(iii) Pengurangan RM375 000 setahun bagi pembaikan kemalangan kereta hasil dari pencahayaan yang lebih baik.
(3 markah)

(iv) Kehilangan RM700 000 setahun kutipan hasil oleh petani akibat dari tempahan hak laluan lebuhraya.
(4 markah)

(v) Simpanan RM500 000 bagi kutipan tol bagi jalanraya persekutuan yang baru.
(2 markah)

(b) UTHM sedang meneliti suatu cadangan projek untuk membina landasan baru diatas landasan sedia ada di Kampus Tanjung Labuh bagi kegunaan kursus Aeronautik. Kos pengambilan tanah dijangka sebanyak RM0.7 juta. Kos pembinaan bagi landasan berkenaan dijangka berjumlah RM 1.2 juta dengan tambahan kos penyelenggaran tahunan sebanyak RM80 000. Selain itu, unjuran penambahan penerbangan akan memerlukan khidmat kawalan trafik dengan kos tahunan sebanyak RM36 000. Kebaikan tahunan bagi landasan berkenaan dapat dianggarkan seperti dalam **Jadual S1**.

Jadual S1: Kebaikan Tahunan Projek Landasan UTHM

Kutipan cukai dari kelab penerbangan tempatan	RM400 000
Caj lapangan terbang kepada penumpang	RM50 000
Kebaikan keselesaaan kepada komuniti UTHM	RM35 000
Pelancongan tambahan kepada UTHM	RM40 000

Guna kaedah Nisbah B-C untuk menentukan sama ada landasan UTHM sesuai dibina atau tidak bagi kedua-dua kes konvensional dan ubahsuai dengan menggunakan kaedah PW atau AW bagi tempoh kajian selama 10 tahun dan MARR sebanyak 12% setahun.

(30 marks)

BAHAGIAN B

S2 (a) Sebagai seorang jurutera projek yang baru di DIC Epoxy, anda dan kumpulan tenaga kerja anda dikehendaki oleh pihak atasan untuk menilai alternatif-alternatif yang ada untuk menghasilkan mesin pembungkusan yang bakal dipertingkatkan. Mesin pembungkusan yang tersedia ada tida dapat memenuhi piawaian oleh produksi yang kian menaik. DIC Epoxy telah memperuntukan bajet sebanyak RM 80 000 untuk menghasilkan produk baru hasil daripada mesin yang bakal dipertingkatkan. Dengan mengunakan *Prinsip-Prinsip Ekonomi Kejuruteraan*, tafsirkan maklumat dalam **Jadual S2**:

Jadual S2: Alternatif Bagi Pengeluaran Mesin Pembungkusan Rekabentuk Baru

Faktor	Pengubahsuaian dalaman	**Pengubahsuaian Luaran** (Alchem)	**Beli mesin pembungkus baru** (Alchem)
Nilai belian (RM)	150 000	150 000	370 000
Kos pengubahsuaian (RM)	25 000	45 000	-
Ketepatan masa projek	Tepat	Tepat	Tidak pasti. Kerugian akan dibayar sekiranya lewat.
Pengubahsuaian memenuhi kapasiti penuh	Tiada jaminan	Ada jaminan	Ada jaminan
kelebihan	Kos lebih murah	Kos lebih murah	Alam sekitar selamat
Kekurangan	**Tidak menyelamatkan alam sekitar**	**Tidak menyelamatkan alam sekitar**	**Mahal dan tiada jaminan ketepatan masa**

(i) Sebutkan masalah yang dihadapi.

(3 markah)

(ii) Sebutkan alternatif-alternatif yang ada untuk DIC Epoxy.

(4 markah)

(iii) Tafsirkan alternatif-alternatif tersebut dari sudut pandangan yang konsisten.
(3 markah)

(iv) Tafsirkan alternatif-alternatif tersebut menggunakan unit pengukuran yan sama.
(2 markah)

(v) Sebutkan risiko dan ketidakpastian terhadap alternatif-alternatif tersebut secara jelas.
(3 markah)

(b) Sebuah kilang pintu besi eksklusif mempunyai kapasiti pengeluaran 5000 unit sebulan. Rekod kewangan menunjukan kos tetap pengeluaran ialah RM500 000 sebulan dan kos berubah ialah RM500 seunit. Pintu dijual pada harga RM1 000 seunit. Sekiranya kilang beroperasi pada kadar 90% daripada keupayaan penuhnya:

(i) Kira keuntungan/kerugian jika semua barang yang dikeluarkan dapat dijual.
(3 markah)

(ii) Tentukan koordinat titik pulang modal.
(3 markah)

(iii) Kira peratus pertambahan pada titik pulang modal jika kos tetap merosot sebanyak 10% manakala kos berubah purata meningkat sebanyak 20%.
(3 markah)

(iv) Kira keuntungan / kerugian syarikat jika hanya 50% boleh dijual dan tiada nilai untuk pintu yang tidak terjual.
(3 markah)

(v) Kira keuntungan / kerugian syarikat berdasarkan soalan **S2(b)(iv)** jika pintu tidak terjual mempunyai nilai sekerap (nilai sisa) sebanyak RM500 seunit.
(3 markah)

S3 (a) Sekumpulan Teknologi IBS adalah dalam usaha membangunkan indeks pemberat *(weighted index)* untuk harga satu (1) tan matrik Simen Portland bagi tahun 2011, di mana tahun 2007 adalah sebagai tahun rujukan *(reference year)* yang menunjukan nilai kos indeks 935 seperti dalam **Jadual S3a**.

Jadual S3a: Harga Pelbagai Jenis Portland Cement

	Harga (RM/Tan Matrik) Tahun		
	2007	***2008***	***2011***
Simen *Portland - CEM I*	1,020	1,071	1,181
Simen *Portland Composite - CEM II*	935	982	1,082
Simen *Portland Blast Furnace - CEM III*	850	893	984

Pemberat untuk Simen *Portland CEM I* adalah tiga (3) kali, Simen *Portland Composite CEM II* adalah dua (2) kali dan Simen *Portland Blast Furnace CEM III* adalah satu (1) kali jika dibandingkan tahap kualiti masing-masing.

Tentukan harga satu tan matrik Simen Portland bagi tahun semasa 2013 dari I_{2011} jika nilai kos indeks 2013 adalah 1,131.

(6 markah)

(b) Kita memerlukan anggaran awal dengan menggunakan teknik faktor untuk perbelanjaan modal untuk membina sebuah kilang baharu yang mengandungi keluasan tanah 8,000 meter persegi, empat (4) unit gudang, tiga (3) unit bilik sejuk dan dua (2) fasiliti pemunggahan.

Tunjukkan anggaran kos dengan menggunakan jadual yang bersesuaian jika unit faktor diberi adalah RM155 satu meter persegi, RM25 500 seunit, RM17 500 seunit bilik sejuk dan RM9 500 seunit fasiliti pemunggahan.

(8 markah)

(c) Encik Ali mempunyai sebuah syarikat yang terlibat dengan pengeluran pintu kayu eksklusif. Baru-baru ini syarikat beliau telah memasarkan secara agresif produk mereka kepada pelanggan baru. Dengan usaha pemasaran baru-baru ini, beliau menjangkakan permintaan pelanggan akan meningkat kepada 50 unit setahun. Beliau ingin meramal kos operasi supaya keperluan kewangan boleh dijangkakan. Selepas membuat kajian daripada rekod syarikat sebelum ini, beliau mendapati bahawa anggaran yang agak dipercayai bahawa kos operasi boleh ditentukan dengan mengetahui unit pengeluaran. **Jadual S3b** menunjukan kos operasi dan unit pengeluran yang direkodkan dari tahun sebelumnya

Jadual S3b: Kos operasi dan hasil pengeluaran tahun sebelumnya

Tahun	Kos Operasi (RM)	Kos Pengeluaran (unit)
2010	30 000	31
2011	31 000	35
2012	28 300	26

(i) Bina persamaan regresi linear (Hubungan Pengagaran Kos) yang menunjukan hubungan kos operasi terhadap pengeluaran.

(3 markah)

(ii) Kirakan ralat piawai.

(3 markah)

(iii) Kirakan pekali korelasi.

(3 markah)

(iv) Tentukan samada pekali korelasi menunjukkan hubungan linear yang kuat antara kos operasi dan pengeluaran. Berikan justifikasi anda.

(4 markah)

(v) Anggarkan kos operasi apabila hasil pengeluaran 50 unit.

(3 markah)

S4 (a) Anda diberi pilihan untuk melabur RM250 000 selama lima (5) tahun dengan dua (2) skim: pertama dengan kadar faedah 7% setahun menggunakan faedah mudah (simple interest), dan kedua pada kadar faedah 6.5% setahun menggunakan faedah kompaun.

Cadangkan pelaburan yang terbaik.

(8 markah)

(b) Kira jumlah pulangan ke atas simpanan setelah lima (5) tahun sekiranya anda menyimpan sebanyak RM250 000 di dalam akaun simpanan tetap dengan kadar faedah 5% setahun dan menambah simpanan anda sebanyak RM50,000 pada awal tahun ke tiga (3) yang menerima faedah dwi-kompaun *(semi-compounding)* 4.5% setahun

(8 markah)

(c) Seorang jurutera muda yang komited merancang untuk mengumpul RM100 000 dalam masa lima (5) tahun dari sekarang bagi pembiayaan pakej pra-rancang bulan madu. Pihak bank bersetuju untuk memberi 6% faedah dikompaun setiap bulan bagi simpanan berkenaan.

Kira berapa wang yang perlu dia simpan sekarang bagi merealisasikan impian beliau. Jawapan anda perlu menyertakan rajah aliran tunai.

(7 markah)

(d) Berkaitan dengan **S4 (c)**, jika beliau ingin menyimpan sejumlah wang yang sama setiap bulan, bermula dari sekarang, berapakah wang yang perlu dia simpan pada setiap akhir bulan. Sertakan rajah aliran tunai dalam jawapan anda.

(7 markah)

Table 0.5%

½% — Compound Interest Factors — ½%

	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	n
1	1.005	.9950	1.0000	1.0050	1.000	0.995	0	0	1
2	1.010	.9901	.4988	.5038	2.005	1.985	0.499	0.991	2
3	1.015	.9851	.3317	.3367	3.015	2.970	0.996	2.959	3
4	1.020	.9802	.2481	.2531	4.030	3.951	1.494	5.903	4
5	1.025	.9754	.1980	.2030	5.050	4.926	1.990	9.803	5
6	1.030	.9705	.1646	.1696	6.076	5.896	2.486	14.660	6
7	1.036	.9657	.1407	.1457	7.106	6.862	2.980	20.448	7
8	1.041	.9609	.1228	.1278	8.141	7.823	3.474	27.178	8
9	1.046	.9561	.1089	.1139	9.182	8.779	3.967	34.825	9
10	1.051	.9513	.0978	.1028	10.228	9.730	4.459	43.389	10
11	1.056	.9466	.0887	.0937	11.279	10.677	4.950	52.855	11
12	1.062	.9419	.0811	.0861	12.336	11.619	5.441	63.218	12
13	1.067	.9372	.0746	.0796	13.397	12.556	5.931	74.465	13
14	1.072	.9326	.0691	.0741	14.464	13.489	6.419	86.590	14
15	1.078	.9279	.0644	.0694	15.537	14.417	6.907	99.574	15
16	1.083	.9233	.0602	.0652	16.614	15.340	7.394	113.427	16
17	1.088	.9187	.0565	.0615	17.697	16.259	7.880	128.125	17
18	1.094	.9141	.0532	.0582	18.786	17.173	8.366	143.668	18
19	1.099	.9096	.0503	.0553	19.880	18.082	8.850	160.037	19
20	1.105	.9051	.0477	.0527	20.979	18.987	9.334	177.237	20
21	1.110	.9006	.0453	.0503	22.084	19.888	9.817	195.245	21
22	1.116	.8961	.0431	.0481	23.194	20.784	10.300	214.070	22
23	1.122	.8916	.0411	.0461	24.310	21.676	10.781	233.680	23
24	1.127	.8872	.0393	.0443	25.432	22.563	11.261	254.088	24
25	1.133	.8828	.0377	.0427	26.559	23.446	11.741	275.273	25
26	1.138	.8784	.0361	.0411	27.692	24.324	12.220	297.233	26
27	1.144	.8740	.0347	.0397	28.830	25.198	12.698	319.955	27
28	1.150	.8697	.0334	.0384	29.975	26.068	13.175	343.439	28
29	1.156	.8653	.0321	.0371	31.124	26.933	13.651	367.672	29
30	1.161	.8610	.0310	.0360	32.280	27.794	14.127	392.640	30
36	1.197	.8356	.0254	.0304	39.336	32.871	16.962	557.564	36
40	1.221	.8191	.0226	.0276	44.159	36.172	18.836	681.341	40
48	1.270	.7871	.0185	.0235	54.098	42.580	22.544	959.928	48
50	1.283	.7793	.0177	.0227	56.645	44.143	23.463	1 035.70	50
52	1.296	.7716	.0169	.0219	59.218	45.690	24.378	1 113.82	52
60	1.349	.7414	.0143	.0193	69.770	51.726	28.007	1 448.65	60
70	1.418	.7053	.0120	.0170	83.566	58.939	32.468	1 913.03	70
72	1.432	.6983	.0116	.0166	86.409	60.340	33.351	2 012.35	72
80	1.490	.6710	.0102	.0152	98.068	65.802	36.848	2 424.65	80
84	1.520	.6577	.00961	.0146	104.074	68.453	38.576	2 640.67	84
90	1.567	.6383	.00883	.0138	113.311	72.331	41.145	2 976.08	90
96	1.614	.6195	.00814	.0131	122.829	76.095	43.685	3 324.19	96
100	1.647	.6073	.00773	.0127	129.334	78.543	45.361	3 562.80	100
104	1.680	.5953	.00735	.0134	135.970	80.942	47.025	3 806.29	104
120	1.819	.5496	.00610	.0111	163.880	90.074	53.551	4 823.52	120
240	3.310	.3021	.00216	.00716	462.041	139.581	96.113	13 415.56	240
360	6.023	.1660	.00100	.00600	1 004.5	166.792	128.324	21 403.32	360
480	10.957	.0913	.00050	.00550	1 991.5	181.748	151.795	27 588.37	480

-SOALAN TAMAT-

$$Standard\ error, SE = \sqrt{\frac{\sum_{i=1}^{n}(y_i - Cost_i)^2}{n-2}}$$

$$Coefficient\ correlation, R = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{[\sum_{i=1}^{n}(x_i - \bar{x})^2][\sum_{i=1}^{n}(y_i - \bar{y})^2]}}$$

$$F = P(1+i)^n$$

$$A = P\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right]$$

APPENDIX

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2012/2013 PROGRAMME : BDD, BDP, BEB, BEC, BED, BEK, BEM, BEU, BFF, BNN, BNP, BNQ

COURSE NAME : ENGINEERING ECONOMY COURSE CODE : BPK30902

Table of Formulas

Conventional B-C Ratio with PW

$$B\text{-}C = \frac{PW(B)}{I + PW(O\&M)}$$

Modified B-C Ratio with PW

$$B\text{-}C = \frac{PW(B) - PW(O\&M)}{I}$$

Conventional B-C Ratio with AW

$$B\text{-}C = \frac{AW(B)}{CR + AW(O\&M)}$$

Modified B-C Ratio with AW

$$B\text{-}C = \frac{AW(B) - AW(O\&M)}{CR}$$

Profit/Loss = Total revenue – Total Cost

Total Revenue = Price x Quantity

Total Cost = Fixed Cost + Variable Cost

$$Cost_i = b_1 x_i + b_0$$

$$\bar{y} = \frac{\sum_{i=1}^{n} y_i}{n}$$

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

$$b_1 = \frac{n\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{n\sum_{i=1}^{n} {x_i}^2 - \left(\sum_{i=1}^{n} x_i\right)^2}$$

$$b_0 = \frac{\sum_{i=1}^{n} y_i - b_1 \sum_{i=1}^{n} x_i}{n}$$

Table 6%

6% Compound Interest Factors 6%

	Single Payment		Uniform Payment Series				Arithmetic Gradient		
	Compound Amount Factor	Present Worth Factor	Sinking Fund Factor	Capital Recovery Factor	Compound Amount Factor	Present Worth Factor	Gradient Uniform Series	Gradient Present Worth	
	Find *F* Given *P*	Find *P* Given *F*	Find *A* Given *F*	Find *A* Given *P*	Find *F* Given *A*	Find *P* Given *A*	Find *A* Given *G*	Find *P* Given *G*	
n	*F/P*	*P/F*	*A/F*	*A/P*	*F/A*	*P/A*	*A/G*	*P/G*	*n*
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	1 300.9	16.456	15.706	258.453	75
80	105.796	.00945	.00057	.0606	1 746.6	16.509	15.903	262.549	80
85	141.578	.00706	.00043	.0604	2 343.0	16.549	16.062	265.810	85
90	189.464	.00528	.00032	.0603	3 141.1	16.579	16.189	268.395	90
95	253.545	.00394	.00024	.0602	4 209.1	16.601	16.290	270.437	95
100	339.300	.00295	.00018	.0602	5 638.3	16.618	16.371	272.047	100