Subject A213

Contingencies

Intermediate Technical Syllabus

For the 2020 Examinations

October 2019

Aim

The aim of the Contingencies subject is to provide a grounding in the principles of modelling as applied to actuarial work – focusing particularly on deterministic models which can be used to model and value cashflows that are dependent on death, survival, or other uncertain risks.

Competencies

On the successful completion of this subject, the candidate will be able to describe, interpret and discuss mathematical techniques used to model and value cashflows which are contingent on mortality and morbidity risks.

Links to other subjects

Concepts are introduced in:
A111 – Actuarial Statistics
A211 – Financial Mathematics

Topics in this subject are further built upon in:
A214 – Financial Engineering and Loss Reserving
A311 – Actuarial Risk Management
NA311 – Core Actuarial Professional Practice
F101 – Health and Care Principles
F102 – Life Insurance Principles
F104 – Retirement and Related benefits

Syllabus Topics

1 Single decrement models (20%)

2 Multiple decrement models (20%)

3 Pricing and reserving (60%)

The weightings are indicative of the approximate balance of the assessment of this subject between the main syllabus topics, averaged over a number of examination sessions.

The weightings also have a correspondence with the amount of learning material underlying each syllabus topic. However, this will also reflect aspects such as:

- The relative complexity of each topic, and hence the amount of explanation and support required for it
- The need to provide thorough foundation understanding on which to build the other objectives
- The extent of prior knowledge which is expected
- The degree to which each topic area is more knowledge or application based

Skills Level

The use of a specific command verb within a syllabus objective does not indicate that this is the only form of question which can be asked on the topic covered by that objective. The Examiners may ask a question on any syllabus topic using any of the agreed command verbs, as are defined in the document "Command verbs used in the Associate and Fellowship written examinations".

Questions may be set at any skill level: Knowledge (demonstration of a detailed knowledge and understanding of the topic), Application (demonstration of an ability to apply the principles underlying the topic within a given context) and Higher Order (demonstration of an ability to perform deeper analysis and assessment of situations, including forming judgements, taking into account different points of view, comparing and contrasting situations, suggesting possible solutions and actions, and making recommendations).

In the Contingencies subject, the approximate split of assessment across the three skill types is 20% Knowledge, 65% Application and 15% Higher Order skills.

Detailed Syllabus Objectives

1. Single decrement models

1.1. Define various assurance and annuity contracts.

1.1.1. Define the following terms:
- Whole life assurance
- Term assurance
- Pure endowment
- Endowment assurance
- Whole life level annuity
- Temporary level annuity
- Guaranteed level annuity
- Premium
- Benefit

including assurance and annuity contracts where benefits are deferred.

1.1.2. Describe the operation of conventional with-profits contracts, in which profits are distributed by the use of regular reversionary bonuses, and by terminal bonuses. Describe the benefits payable under the above assurance-type contracts.

1.1.3. Describe the operation of conventional unit-linked contracts, in which death benefits can be expressed as a combination of an absolute amount and the value of a unit fund.

1.1.4. Describe the operation of accumulating with-profits contracts, in which benefits take the form of an accumulating fund of premiums, where either:
- the fund is defined in monetary terms, has no explicit charges, and is increased by the addition of regular guaranteed and bonus interest payments plus a terminal bonus; or
- the fund is defined in terms of the value of a unit fund, is subject to explicit charges, and is increased by regular bonus additions plus a terminal bonus (Unitised with-profits).

In the case of unitised with-profits, the regular additions can take the form of (a) unit price increases (guaranteed and/or discretionary), or (b) allocations of additional units.
In either case a guaranteed minimum monetary death benefit may be applied.

1.2. Develop formulae for the means and variances of the payments under various assurance and annuity contracts, assuming a constant deterministic interest rate.
   1.2.1. Describe the life table functions l_x and d_x and their select equivalents $l_{[x]+r}$ and $d_{[x]+r}$.
   1.2.2. Define the following probabilities: ${}_np_x$, ${}_nq_x$, ${}_{n|m}q_x$, ${}_{n|}q_x$ and their select equivalents ${}_np_{[x]+r}$, ${}_nq_{[x]+r}$, ${}_{n|m}q_{[x]+r}$, ${}_{n|}q_{[x]+r}$.
   1.2.3. Express the probabilities defined in 1.2.2 in terms of life table functions defined in 1.2.1.
   1.2.4. Define the assurance and annuity factors and their select and continuous equivalents. Extend the annuity factors to allow for the possibility that payments are more frequent than annual but less frequent than continuous.
   1.2.5. Understand and use the relations between annuities payable in advance and in arrear, and between temporary, deferred and whole life annuities.
   1.2.6. Understand and use the relations between assurance and annuity factors using equation of value, and their select and continuous equivalents
   1.2.7. Obtain expressions in the form of sums/integrals for the mean and variance of the present value of benefit payments under each contract defined in 1.1.1, in terms of the (curtate) random future lifetime, assuming:
      - contingent benefits (constant, increasing or decreasing) are payable at the middle or end of the year of the contingent event or continuously.
      - annuities are paid in advance, in arrear or continuously, and the amount is constant, or increases or decreases by a constant monetary amount or by a fixed or time-dependent variable rate.
      - premiums are payable in advance, in arrear or continuously; and for the full policy term or for a limited period.

      Where appropriate, simplify the above expressions into a form suitable for evaluation by table look-up or other means.
   1.2.8. Define and evaluate the expected accumulations in terms of expected values for the contracts described in 1.1.1 and contract structures described in 1.2.7.

2. Multiple decrement and multiple life models

2.1. Define and use assurance and annuity functions involving two lives.
   2.1.1. Extend the techniques of objectives 1.2 to deal with cashflows dependent upon the death or survival of either or both of two lives.
   2.1.2. Extend the technique of 2.1.1 to deal with functions dependent upon a fixed term as well as age.

2.2. Describe and illustrate methods of valuing cashflows that are contingent upon multiple transition events.
- 2.2.1. Define health insurance, and describe simple health insurance premium and benefit structures.
- 2.2.2. Explain how a cashflow, contingent upon multiple transition events, may be valued using a multiple-state Markov Model, in terms of the forces and probabilities of transition.
- 2.2.3. Construct formulae for the expected present values of cashflows that are contingent upon multiple transition events, including simple health insurance premiums and benefits, and calculate these in simple cases. Regular premiums and sickness benefits are payable continuously and assurance benefits are payable immediately on transition.

2.3. Describe and use methods of projecting and valuing expected cashflows that are contingent upon multiple decrement events.
- 2.3.1. Describe the construction and use of multiple decrement tables.
- 2.3.2. Define a multiple decrement model as a special case of a multiple-state Markov model.
- 2.3.3. Derive dependent probabilities for a multiple decrement model in terms of given forces of transition, assuming forces of transition are constant over single years of age.
- 2.3.4. Derive forces of transition from given dependent probabilities, assuming forces of transition are constant over single years of age.

3. Pricing and reserving

3.1. Define the gross random future loss under an insurance contract, and state the principle of equivalence.

3.2. Describe and calculate gross premiums and reserves for assurance and annuity contracts.
- 3.2.1. Define and calculate gross premiums for the insurance contract benefits as defined in objective 1.1 under various scenarios, using the equivalence principle or otherwise. This includes scenarios where:
  - Contracts may accept only a single premium
  - Regular premiums and annuity benefits may be payable annually, more frequently than annually, or continuously.
  - Death benefits (which increase or decrease by a constant compound rate or by a constant monetary amount) may be payable at the end of the year of death, or immediately on death.
  - Survival benefits (other than annuities) may be payable at defined intervals other than at maturity.
- 3.2.2. State why an insurance company will set up reserves.
- 3.2.3. Define and calculate gross prospective and retrospective reserves.
- 3.2.4. State the conditions under which in general the prospective reserve is equal to the retrospective reserve allowing for expenses.
- 3.2.5. Prove that, under the appropriate conditions, the prospective reserve is equal to the retrospective reserve, with or without allowance for expenses, for all fixed benefit and increasing/decreasing benefit contracts.

3.2.6. Obtain recursive relationships between successive periodic gross premium reserves, and use this relationship to calculate the profit earned from a contract during the period.

3.2.7. Outline the concepts of net premiums and net premium valuation and how they relate to gross premiums and gross premium valuation, respectively.

3.3. Define and calculate, for a single policy or a portfolio of policies (as appropriate):

- death strain at risk
- expected death strain
- actual death strain
- mortality profit

for policies with death benefits payable immediately on death or at the end of the year of death; for policies paying annuity benefits at the start of the year or on survival to the end of the year; and for policies where single or non-single premiums are payable.

3.4. Project expected future cashflows for whole life, endowment and term assurances, annuities, unit-linked contracts, and conventional/unitised with-profits contracts, incorporating multiple decrement models as appropriate.

3.4.1. Profit test life insurance contracts of the types listed above and determine the profit vector, the profit signature, the net present value, and the profit margin

3.4.2. Show how a profit test may be used to price a product, and use a profit test to calculate a premium for life insurance contracts of the types listed above.

3.4.3. Show how gross premium reserves can be computed, using the above cashflow projection model, and included as part of profit testing.

3.5. Show how, for unit-linked contracts, non-unit reserves can be established to eliminate ("zeroise") future negative cashflows, using a profit test model.

Assessment

Combination of a one hour 45 minute computer based modelling assignment and a two hour written examination.

End of Syllabus

ASSURED LIVES MORTALITY TABLE

AM92

This table is based on the mortality of assured male lives in the UK during the years 1991, 1992, 1993, and 1994. Full details are given in *C.M.I.R.* **17**.

Due to potential rounding errors at high ages, the commutation functions (D_x, N_x, S_x, C_x, M_x and R_x) are tabulated here to age 110 only.

AM92

x	$l_{[x]}$	$l_{[x-1]+1}$	l_x	x
17	9 997.809 1		10 000.000 0	17
18	9 991.890 4	9 993.540 0	9 994.000 0	18
19	9 986.035 1	9 987.633 8	9 988.063 6	19
20	9 980.243 2	9 981.791 1	9 982.200 6	20
21	9 974.504 6	9 976.001 6	9 976.390 9	21
22	9 968.839 1	9 970.265 4	9 970.634 6	22
23	9 963.196 7	9 964.582 4	9 964.931 3	23
24	9 957.577 5	9 958.922 5	9 959.261 3	24
25	9 951.991 3	9 953.285 8	9 953.614 4	25
26	9 946.398 2	9 947.662 2	9 947.980 7	26
27	9 940.798 4	9 942.021 8	9 942.340 2	27
28	9 935.181 8	9 936.354 9	9 936.673 0	28
29	9 929.508 8	9 930.661 3	9 930.969 4	29
30	9 923.749 7	9 924.891 6	9 925.209 4	30
31	9 917.914 5	9 919.026 0	9 919.353 5	31
32	9 911.953 8	9 913.054 7	9 913.382 1	32
33	9 905.828 2	9 906.928 5	9 907.265 5	33
34	9 899.498 4	9 900.607 8	9 900.964 5	34
35	9 892.915 1	9 894.053 6	9 894.429 9	35
36	9 886.039 5	9 887.206 9	9 887.612 6	36
37	9 878.812 8	9 880.028 8	9 880.454 0	37
38	9 871.166 5	9 872.450 8	9 872.895 4	38
39	9 863.022 7	9 864.404 7	9 864.868 8	39
40	9 854.303 6	9 855.793 1	9 856.286 3	40
41	9 844.902 5	9 846.538 4	9 847.051 0	41
42	9 834.703 0	9 836.524 5	9 837.066 1	42
43	9 823.599 4	9 825.635 4	9 826.206 0	43
44	9 811.447 3	9 813.746 3	9 814.335 9	44
45	9 798.083 7	9 800.693 9	9 801.312 3	45
46	9 783.337 1	9 786.316 2	9 786.953 4	46
47	9 766.998 3	9 770.423 1	9 771.078 9	47
48	9 748.860 3	9 752.787 4	9 753.471 4	48
49	9 728.649 9	9 733.193 8	9 733.886 5	49
50	9 706.097 7	9 711.352 4	9 712.072 8	50
51	9 680.899 0	9 686.966 9	9 687.714 9	51
52	9 652.696 5	9 659.707 5	9 660.502 1	52
53	9 621.100 6	9 629.211 5	9 630.052 2	53
54	9 585.691 6	9 595.056 3	9 595.971 5	54
55	9 545.992 9	9 556.800 3	9 557.817 9	55
56	9 501.483 9	9 513.937 5	9 515.104 0	56
57	9 451.593 8	9 465.929 3	9 467.290 6	57
58	9 395.697 1	9 412.171 2	9 413.800 4	58
59	9 333.128 4	9 352.016 5	9 354.004 0	59
60	9 263.142 2	9 284.764 1	9 287.216 4	60
61	9 184.968 7	9 209.656 8	9 212.714 3	61
62	9 097.740 5	9 125.881 8	9 129.717 0	62
63	9 000.588 4	9 032.564 2	9 037.397 3	63
64	8 892.574 1	8 928.817 7	8 934.877 1	64

AM92

x	$l_{[x]}$	$l_{[x-1]+1}$	l_x	x
65	8 772.735 9	8 813.688 1	8 821.261 2	65
66	8 640.048 1	8 686.201 6	8 695.619 9	66
67	8 493.518 7	8 545.353 2	8 557.011 8	67
68	8 332.139 6	8 390.161 1	8 404.491 6	68
69	8 154.931 8	8 219.639 0	8 237.132 9	69
70	7 960.977 6	8 032.860 6	8 054.054 4	70
71	7 749.465 9	7 828.968 6	7 854.450 8	71
72	7 519.702 7	7 607.240 0	7 637.620 8	72
73	7 271.146 1	7 367.082 8	7 403.008 4	73
74	7 003.521 6	7 108.105 2	7 150.240 1	74
75	6 716.823 1	6 830.184 4	6 879.167 3	75
76	6 411.345 9	6 533.500 8	6 589.925 8	76
77	6 087.808 4	6 218.575 9	6 282.980 3	77
78	5 747.362 4	5 886.362 8	5 959.168 0	78
79	5 391.640 0	5 538.279 1	5 619.757 7	79
80	5 022.793 1	5 176.222 4	5 266.460 4	80
81	4 643.512 9	4 802.629 0	4 901.478 9	81
82	4 257.005 6	4 420.452 5	4 527.496 0	82
83	3 866.988 4	4 033.146 7	4 147.670 8	83
84	3 477.592 9	3 644.632 7	3 765.599 8	84
85	3 093.286 3	3 259.186 2	3 385.247 9	85
86	2 718.712 8	2 881.346 7	3 010.839 5	86
87	2 358.529 9	2 515.731 0	2 646.741 6	87
88	2 017.229 8	2 166.880 5	2 297.297 6	88
89	1 698.908 9	1 839.045 8	1 966.649 9	89
90	1 407.055 0	1 535.980 1	1 658.554 5	90
91		1 260.735 4	1 376.190 6	91
92			1 121.988 9	92
93			897.502 5	93
94			703.324 2	94
95			539.064 3	95
96			403.402 3	96
97			294.206 1	97
98			208.706 0	98
99			143.712 0	99
100			95.847 6	100
101			61.773 3	101
102			38.379 6	102
103			22.928 4	103
104			13.135 9	104
105			7.196 8	105
106			3.759 6	106
107			1.866 9	107
108			0.878 4	108
109			0.390 3	109
110			0.163 2	110
111			0.064 0	111
112			0.023 4	112
113			0.008 0	113
114			0.002 5	114
115			0.000 7	115
116			0.000 2	116
117			0.000 0	117
118			0.000 0	118
119			0.000 0	119
120			0.000 0	120

AM92

x	$d_{[x]}$	$d_{[x-1]+1}$	d_x	x
17	4.269 1		6.000 0	17
18	4.256 5	5.476 5	5.936 4	18
19	4.244 1	5.433 3	5.863 0	19
20	4.241 6	5.400 1	5.809 6	20
21	4.239 2	5.367 1	5.756 4	21
22	4.256 7	5.334 1	5.703 2	22
23	4.274 2	5.321 1	5.670 0	23
24	4.291 7	5.308 1	5.646 9	24
25	4.329 1	5.305 1	5.633 7	25
26	4.376 4	5.322 0	5.640 5	26
27	4.443 5	5.348 8	5.667 1	27
28	4.520 5	5.385 5	5.703 7	28
29	4.617 2	5.451 9	5.760 0	29
30	4.723 7	5.538 1	5.855 9	30
31	4.859 8	5.643 9	5.971 5	31
32	5.025 4	5.789 2	6.116 6	32
33	5.220 4	5.964 0	6.301 0	33
34	5.444 7	6.178 0	6.534 6	34
35	5.708 2	6.441 0	6.817 3	35
36	6.010 7	6.753 0	7.158 6	36
37	6.362 0	7.133 4	7.558 5	37
38	6.761 7	7.582 0	8.026 7	38
39	7.229 6	8.118 4	8.582 4	39
40	7.765 2	8.742 1	9.235 3	40
41	8.378 0	9.472 4	9.984 9	41
42	9.067 6	10.318 5	10.860 1	42
43	9.853 1	11.299 5	11.870 1	43
44	10.753 3	12.434 0	13.023 6	44
45	11.767 5	13.740 6	14.358 9	45
46	12.914 0	15.237 3	15.874 4	46
47	14.211 0	16.951 7	17.607 5	47
48	15.666 4	18.900 9	19.585 0	48
49	17.297 5	21.121 0	21.813 6	49
50	19.130 7	23.637 4	24.357 9	50
51	21.191 5	26.464 8	27.212 8	51
52	23.485 0	29.655 3	30.449 9	52
53	26.044 3	33.240 0	34.080 8	53
54	28.891 3	37.238 4	38.153 6	54
55	32.055 4	41.696 3	42.713 9	55
56	35.554 6	46.646 8	47.813 4	56
57	39.422 6	52.128 9	53.490 2	57
58	43.680 6	58.167 2	59.796 5	58
59	48.364 3	64.800 1	66.787 6	59
60	53.485 4	72.049 8	74.502 0	60
61	59.086 9	79.939 8	82.997 3	61
62	65.176 2	88.484 6	92.319 7	62
63	71.770 7	97.687 2	102.520 2	63
64	78.886 0	107.556 5	113.615 9	64

AM92

x	$d_{[x]}$	$d_{[x-1]+1}$	d_x	x
65	86.534 3	118.068 2	125.641 2	65
66	94.694 9	129.189 9	138.608 2	66
67	103.357 6	140.861 6	152.520 2	67
68	112.500 5	153.028 1	167.358 6	68
69	122.071 2	165.584 6	183.078 5	69
70	132.008 9	178.409 8	199.603 6	70
71	142.225 9	191.347 8	216.830 0	71
72	152.619 9	204.231 6	234.612 4	72
73	163.040 9	216.842 7	252.768 3	73
74	173.337 2	228.937 9	271.072 8	74
75	183.322 3	240.258 6	289.241 5	75
76	192.769 9	250.520 6	306.945 6	76
77	201.445 6	259.407 9	323.812 2	77
78	209.083 3	266.605 1	339.410 4	78
79	215.417 6	271.818 7	353.297 3	79
80	220.164 1	274.743 5	364.981 5	80
81	223.060 4	275.133 0	373.982 8	81
82	223.858 9	272.781 7	379.825 2	82
83	222.355 7	267.546 8	382.071 0	83
84	218.406 7	259.384 9	380.351 9	84
85	211.939 6	248.346 7	374.408 4	85
86	202.981 8	234.605 0	364.097 8	86
87	191.649 4	218.433 4	349.444 0	87
88	178.183 9	200.230 6	330.647 8	88
89	162.928 8	180.491 3	308.095 4	89
90	146.319 7	159.789 5	282.363 9	90
91		138.746 4	254.201 7	91
92			224.486 4	92
93			194.178 3	93
94			164.260 0	94
95			135.662 0	95
96			109.196 2	96
97			85.500 1	97
98			64.994 0	98
99			47.864 4	99
100			34.074 3	100
101			23.393 7	101
102			15.451 2	102
103			9.792 5	103
104			5.939 1	104
105			3.437 3	105
106			1.892 7	106
107			.988 5	107
108			.488 1	108
109			.227 1	109
110			.099 2	110
111			.040 5	111
112			.015 4	112
113			.005 5	113
114			.001 8	114
115			.000 5	115
116			.000 1	116
117			.000 0	117
118			.000 0	118
119			.000 0	119
120			.000 0	120

AM92

x	$q_{[x]}$	$q_{[x-1]+1}$	q_x	x
17	.000 427		.000 600	17
18	.000 426	.000 548	.000 594	18
19	.000 425	.000 544	.000 587	19
20	.000 425	.000 541	.000 582	20
21	.000 425	.000 538	.000 577	21
22	.000 427	.000 535	.000 572	22
23	.000 429	.000 534	.000 569	23
24	.000 431	.000 533	.000 567	24
25	.000 435	.000 533	.000 566	25
26	.000 440	.000 535	.000 567	26
27	.000 447	.000 538	.000 570	27
28	.000 455	.000 542	.000 574	28
29	.000 465	.000 549	.000 580	29
30	.000 476	.000 558	.000 590	30
31	.000 490	.000 569	.000 602	31
32	.000 507	.000 584	.000 617	32
33	.000 527	.000 602	.000 636	33
34	.000 550	.000 624	.000 660	34
35	.000 577	.000 651	.000 689	35
36	.000 608	.000 683	.000 724	36
37	.000 644	.000 722	.000 765	37
38	.000 685	.000 768	.000 813	38
39	.000 733	.000 823	.000 870	39
40	.000 788	.000 887	.000 937	40
41	.000 851	.000 962	.001 014	41
42	.000 922	.001 049	.001 104	42
43	.001 003	.001 150	.001 208	43
44	.001 096	.001 267	.001 327	44
45	.001 201	.001 402	.001 465	45
46	.001 320	.001 557	.001 622	46
47	.001 455	.001 735	.001 802	47
48	.001 607	.001 938	.002 008	48
49	.001 778	.002 170	.002 241	49
50	.001 971	.002 434	.002 508	50
51	.002 189	.002 732	.002 809	51
52	.002 433	.003 070	.003 152	52
53	.002 707	.003 452	.003 539	53
54	.003 014	.003 881	.003 976	54
55	.003 358	.004 363	.004 469	55
56	.003 742	.004 903	.005 025	56
57	.004 171	.005 507	.005 650	57
58	.004 649	.006 180	.006 352	58
59	.005 182	.006 929	.007 140	59
60	.005 774	.007 760	.008 022	60
61	.006 433	.008 680	.009 009	61
62	.007 164	.009 696	.010 112	62
63	.007 974	.010 815	.011 344	63
64	.008 871	.012 046	.012 716	64

AM92

x	$q_{[x]}$	$q_{[x-1]+1}$	q_x	x
65	.009 864	.013 396	.014 243	65
66	.010 960	.014 873	.015 940	66
67	.012 169	.016 484	.017 824	67
68	.013 502	.018 239	.019 913	68
69	.014 969	.020 145	.022 226	69
70	.016 582	.022 210	.024 783	70
71	.018 353	.024 441	.027 606	71
72	.020 296	.026 847	.030 718	72
73	.022 423	.029 434	.034 144	73
74	.024 750	.032 208	.037 911	74
75	.027 293	.035 176	.042 046	75
76	.030 067	.038 344	.046 578	76
77	.033 090	.041 715	.051 538	77
78	.036 379	.045 292	.056 956	78
79	.039 954	.049 080	.062 867	79
80	.043 833	.053 078	.069 303	80
81	.048 037	.057 288	.076 300	81
82	.052 586	.061 709	.083 893	82
83	.057 501	.066 337	.092 117	83
84	.062 804	.071 169	.101 007	84
85	.068 516	.076 199	.110 600	85
86	.074 661	.081 422	.120 929	86
87	.081 258	.086 827	.132 028	87
88	.088 331	.092 405	.143 929	88
89	.095 902	.098 144	.156 660	89
90	.103 990	.104 031	.170 247	90
91		.110 052	.184 714	91
92			.200 079	92
93			.216 354	93
94			.233 548	94
95			.251 662	95
96			.270 688	96
97			.290 613	97
98			.311 414	98
99			.333 058	99
100			.355 505	100
101			.378 702	101
102			.402 588	102
103			.427 090	103
104			.452 127	104
105			.477 608	105
106			.503 432	106
107			.529 493	107
108			.555 674	108
109			.581 857	109
110			.607 918	110
111			.633 731	111
112			.659 171	112
113			.684 114	113
114			.708 442	114
115			.732 042	115
116			.754 809	116
117			.776 648	117
118			.797 477	118
119			.817 225	119
120			1.000 000	120

AM92

x	$\mu_{[x]}$	$\mu_{[x-1]+1}$	μ_x	x
17	0.000 367		0.000 603	17
18	0.000 367	0.000 488	0.000 597	18
19	0.000 367	0.000 485	0.000 591	19
20	0.000 369	0.000 483	0.000 585	20
21	0.000 370	0.000 482	0.000 580	21
22	0.000 374	0.000 480	0.000 574	22
23	0.000 377	0.000 481	0.000 570	23
24	0.000 380	0.000 481	0.000 568	24
25	0.000 385	0.000 482	0.000 566	25
26	0.000 391	0.000 485	0.000 566	26
27	0.000 400	0.000 489	0.000 568	27
28	0.000 408	0.000 495	0.000 572	28
29	0.000 419	0.000 502	0.000 577	29
30	0.000 430	0.000 512	0.000 585	30
31	0.000 443	0.000 523	0.000 596	31
32	0.000 460	0.000 537	0.000 609	32
33	0.000 479	0.000 555	0.000 626	33
34	0.000 500	0.000 576	0.000 647	34
35	0.000 524	0.000 601	0.000 674	35
36	0.000 551	0.000 630	0.000 706	36
37	0.000 582	0.000 665	0.000 744	37
38	0.000 616	0.000 706	0.000 788	38
39	0.000 656	0.000 754	0.000 840	39
40	0.000 701	0.000 810	0.000 902	40
41	0.000 752	0.000 875	0.000 974	41
42	0.000 808	0.000 950	0.001 057	42
43	0.000 871	0.001 037	0.001 154	43
44	0.000 943	0.001 136	0.001 265	44
45	0.001 023	0.001 250	0.001 394	45
46	0.001 113	0.001 380	0.001 541	46
47	0.001 214	0.001 529	0.001 709	47
48	0.001 326	0.001 698	0.001 902	48
49	0.001 451	0.001 890	0.002 122	49
50	0.001 592	0.002 108	0.002 372	50
51	0.001 750	0.002 354	0.002 656	51
52	0.001 925	0.002 633	0.002 978	52
53	0.002 122	0.002 947	0.003 343	53
54	0.002 342	0.003 300	0.003 756	54
55	0.002 588	0.003 696	0.004 221	55
56	0.002 862	0.004 139	0.004 747	56
57	0.003 170	0.004 636	0.005 340	57
58	0.003 513	0.005 189	0.006 005	58
59	0.003 898	0.005 806	0.006 754	59
60	0.004 327	0.006 493	0.007 593	60
61	0.004 809	0.007 254	0.008 533	61
62	0.005 348	0.008 099	0.009 586	62
63	0.005 949	0.009 032	0.010 763	63
64	0.006 623	0.010 063	0.012 078	64

AM92

x	$\mu_{[x]}$	$\mu_{[x-1]+1}$	μ_x	x
65	0.007 377	0.011 199	0.013 544	65
66	0.008 220	0.012 449	0.015 176	66
67	0.009 162	0.013 821	0.016 993	67
68	0.010 216	0.015 326	0.019 012	68
69	0.011 393	0.016 972	0.021 255	69
70	0.012 709	0.018 771	0.023 741	70
71	0.014 178	0.020 733	0.026 496	71
72	0.015 819	0.022 869	0.029 543	72
73	0.017 648	0.025 190	0.032 912	73
74	0.019 687	0.027 708	0.036 631	74
75	0.021 959	0.030 436	0.040 732	75
76	0.024 487	0.033 385	0.045 251	76
77	0.027 300	0.036 569	0.050 223	77
78	0.030 423	0.040 000	0.055 689	78
79	0.033 892	0.043 691	0.061 689	79
80	0.037 737	0.047 656	0.068 271	80
81	0.041 996	0.051 909	0.075 481	81
82	0.046 709	0.056 462	0.083 372	82
83	0.051 916	0.061 329	0.091 999	83
84	0.057 665	0.066 524	0.101 417	84
85	0.064 000	0.072 061	0.111 691	85
86	0.070 978	0.077 952	0.122 884	86
87	0.078 646	0.084 213	0.135 066	87
88	0.087 067	0.090 853	0.148 309	88
89	0.096 302	0.097 889	0.162 691	89
90	0.106 409	0.105 333	0.178 289	90
91		0.113 198	0.195 190	91
92			0.213 482	92
93			0.233 257	93
94			0.254 610	94
95			0.277 645	95
96			0.302 462	96
97			0.329 170	97
98			0.357 882	98
99			0.388 711	99
100			0.421 777	100
101			0.457 202	101
102			0.495 111	102
103			0.535 631	103
104			0.578 890	104
105			0.625 023	105
106			0.674 162	106
107			0.726 443	107
108			0.782 002	108
109			0.840 973	109
110			0.903 494	110
111			0.969 700	111
112			1.039 723	112
113			1.113 695	113
114			1.191 744	114
115			1.274 000	115
116			1.360 581	116
117			1.451 603	117
118			1.547 178	118
119			1.647 417	119
120			2.000 000	120

AM92

x	$e_{[x]}$	$e_{[x-1]+1}$	e_x	x
17	61.353		61.339	17
18	60.389	60.379	60.376	18
19	59.424	59.414	59.412	19
20	58.458	58.449	58.447	20
21	57.492	57.483	57.481	21
22	56.524	56.516	56.514	22
23	55.556	55.548	55.546	23
24	54.587	54.580	54.578	24
25	53.618	53.611	53.609	25
26	52.648	52.641	52.639	26
27	51.677	51.671	51.669	27
28	50.706	50.700	50.699	28
29	49.735	49.729	49.728	29
30	48.764	48.758	48.757	30
31	47.792	47.787	47.785	31
32	46.821	46.816	46.814	32
33	45.850	45.845	45.843	33
34	44.879	44.874	44.872	34
35	43.909	43.904	43.902	35
36	42.939	42.934	42.932	36
37	41.970	41.965	41.963	37
38	41.003	40.997	40.995	38
39	40.036	40.031	40.029	39
40	39.071	39.066	39.064	40
41	38.108	38.102	38.100	41
42	37.148	37.141	37.139	42
43	36.189	36.182	36.180	43
44	35.234	35.226	35.224	44
45	34.282	34.273	34.271	45
46	33.333	33.323	33.321	46
47	32.388	32.377	32.375	47
48	31.448	31.436	31.433	48
49	30.513	30.499	30.497	49
50	29.583	29.567	29.565	50
51	28.660	28.642	28.639	51
52	27.742	27.722	27.720	52
53	26.833	26.810	26.808	53
54	25.931	25.905	25.903	54
55	25.037	25.009	25.006	55
56	24.153	24.122	24.119	56
57	23.279	23.244	23.240	57
58	22.415	22.376	22.373	58
59	21.563	21.520	21.516	59
60	20.724	20.676	20.670	60
61	19.897	19.844	19.837	61
62	19.084	19.026	19.018	62
63	18.286	18.222	18.212	63
64	17.503	17.433	17.421	64

AM92

x	$e_{[x]}$	$e_{[x-1]+1}$	e_x	x
65	16.736	16.660	16.645	65
66	15.987	15.903	15.886	66
67	15.255	15.164	15.143	67
68	14.541	14.443	14.418	68
69	13.847	13.740	13.711	69
70	13.172	13.057	13.023	70
71	12.517	12.394	12.354	71
72	11.883	11.751	11.704	72
73	11.270	11.129	11.075	73
74	10.679	10.529	10.467	74
75	10.110	9.950	9.879	75
76	9.562	9.393	9.313	76
77	9.037	8.859	8.768	77
78	8.534	8.346	8.244	78
79	8.053	7.856	7.742	79
80	7.594	7.388	7.261	80
81	7.157	6.942	6.802	81
82	6.741	6.518	6.364	82
83	6.347	6.116	5.947	83
84	5.974	5.734	5.550	84
85	5.620	5.374	5.174	85
86	5.287	5.034	4.817	86
87	4.972	4.713	4.480	87
88	4.676	4.412	4.161	88
89	4.397	4.129	3.861	89
90	4.136	3.864	3.578	90
91		3.616	3.312	91
92			3.063	92
93			2.829	93
94			2.610	94
95			2.405	95
96			2.214	96
97			2.035	97
98			1.869	98
99			1.715	99
100			1.571	100
101			1.437	101
102			1.314	102
103			1.199	103
104			1.093	104
105			0.994	105
106			0.904	106
107			0.820	107
108			0.743	108
109			0.672	109
110			0.606	110
111			0.546	111
112			0.491	112
113			0.440	113
114			0.394	114
115			0.352	115
116			0.313	116
117			0.277	117
118			0.240	118
119			0.183	119
120			0.000	120

AM92

4%

x	$D_{[x]}$	$D_{[x-1]+1}$	D_x	x
17	5 132.61		5 133.73	17
18	4 932.28	4 933.09	4 933.32	18
19	4 739.80	4 740.55	4 740.76	19
20	4 554.85	4 555.56	4 555.75	20
21	4 377.15	4 377.80	4 377.98	21
22	4 206.41	4 207.01	4 207.16	22
23	4 042.33	4 042.89	4 043.04	23
24	3 884.66	3 885.19	3 885.32	24
25	3 733.16	3 733.64	3 733.77	25
26	3 587.56	3 588.01	3 588.13	26
27	3 447.63	3 448.06	3 448.17	27
28	3 313.16	3 313.55	3 313.66	28
29	3 183.91	3 184.28	3 184.38	29
30	3 059.68	3 060.03	3 060.13	30
31	2 940.27	2 940.60	2 940.69	31
32	2 825.48	2 825.79	2 825.89	32
33	2 715.13	2 715.43	2 715.52	33
34	2 609.03	2 609.33	2 609.42	34
35	2 507.02	2 507.31	2 507.40	35
36	2 408.92	2 409.20	2 409.30	36
37	2 314.57	2 314.86	2 314.96	37
38	2 223.83	2 224.12	2 224.22	38
39	2 136.53	2 136.83	2 136.93	39
40	2 052.54	2 052.85	2 052.96	40
41	1 971.72	1 972.04	1 972.15	41
42	1 893.92	1 894.27	1 894.37	42
43	1 819.02	1 819.40	1 819.50	43
44	1 746.89	1 747.30	1 747.41	44
45	1 677.42	1 677.86	1 677.97	45
46	1 610.47	1 610.96	1 611.07	46
47	1 545.95	1 546.49	1 546.59	47
48	1 483.73	1 484.32	1 484.43	48
49	1 423.70	1 424.37	1 424.47	49
50	1 365.77	1 366.51	1 366.61	50
51	1 309.83	1 310.65	1 310.75	51
52	1 255.78	1 256.70	1 256.80	52
53	1 203.53	1 204.55	1 204.65	53
54	1 152.98	1 154.11	1 154.22	54
55	1 104.05	1 105.30	1 105.41	55
56	1 056.63	1 058.02	1 058.15	56
57	1 010.66	1 012.19	1 012.34	57
58	966.04	967.73	967.90	58
59	922.70	924.57	924.76	59
60	880.56	882.61	882.85	60
61	839.55	841.80	842.08	61
62	799.59	802.06	802.40	62
63	760.62	763.33	763.74	63
64	722.59	725.54	726.03	64

AM92

4%

x	$D_{[x]}$	$D_{[x-1]+1}$	D_x	x
65	685.44	688.64	689.23	65
66	649.11	652.57	653.28	66
67	613.56	617.30	618.14	67
68	578.75	582.78	583.77	68
69	544.65	548.97	550.14	69
70	511.25	515.87	517.23	70
71	478.53	483.43	485.01	71
72	446.48	451.68	453.48	72
73	415.12	420.59	422.64	73
74	384.46	390.20	392.51	74
75	354.54	360.52	363.11	75
76	325.40	331.60	334.46	76
77	297.09	303.48	306.62	77
78	269.69	276.21	279.63	78
79	243.27	249.89	253.56	79
80	217.91	224.57	228.48	80
81	193.71	200.35	204.47	81
82	170.75	177.31	181.60	82
83	149.14	155.55	159.97	83
84	128.97	135.16	139.65	84
85	110.30	116.22	120.71	85
86	93.22	98.79	103.23	86
87	77.76	82.94	87.26	87
88	63.95	68.69	72.83	88
89	51.78	56.06	59.95	89
90	41.24	45.02	48.61	90
91		35.53	38.78	91
92			30.40	92
93			23.38	93
94			17.62	94
95			12.99	95
96			9.34	96
97			6.55	97
98			4.47	98
99			2.96	99
100			1.90	100
101			1.18	101
102			.70	102
103			.40	103
104			.22	104
105			.12	105
106			.06	106
107			.03	107
108			.01	108
109			.01	109
110			.00	110

AM92

4%

x	$N_{[x]}$	$N_{[x-1]+1}$	N_x	x
17	119 958.58		119 959.94	17
18	114 824.96	114 825.98	114 826.20	18
19	109 891.73	109 892.68	109 892.88	19
20	105 151.06	105 151.94	105 152.13	20
21	100 595.40	100 596.21	100 596.38	21
22	96 217.50	96 218.25	96 218.40	22
23	92 010.40	92 011.10	92 011.24	23
24	87 967.43	87 968.07	87 968.21	24
25	84 082.16	84 082.76	84 082.88	25
26	80 348.43	80 349.00	80 349.12	26
27	76 760.35	76 760.88	76 760.99	27
28	73 312.22	73 312.71	73 312.82	28
29	69 998.60	69 999.06	69 999.16	29
30	66 814.23	66 814.68	66 814.78	30
31	63 754.13	63 754.56	63 754.65	31
32	60 813.46	60 813.87	60 813.96	32
33	57 987.58	57 987.98	57 988.07	33
34	55 272.07	55 272.45	55 272.55	34
35	52 662.65	52 663.03	52 663.13	35
36	50 155.24	50 155.63	50 155.73	36
37	47 745.94	47 746.33	47 746.43	37
38	45 430.98	45 431.37	45 431.47	38
39	43 206.74	43 207.15	43 207.25	39
40	41 069.80	41 070.21	41 070.31	40
41	39 016.82	39 017.25	39 017.36	41
42	37 044.65	37 045.10	37 045.21	42
43	35 150.25	35 150.73	35 150.84	43
44	33 330.72	33 331.23	33 331.34	44
45	31 583.27	31 583.82	31 583.93	45
46	29 905.26	29 905.86	29 905.96	46
47	28 294.14	28 294.79	28 294.89	47
48	26 747.50	26 748.20	26 748.30	48
49	25 263.01	25 263.77	25 263.87	49
50	23 838.46	23 839.30	23 839.41	50
51	22 471.77	22 472.69	22 472.79	51
52	21 160.92	21 161.94	21 162.04	52
53	19 904.01	19 905.14	19 905.24	53
54	18 699.23	18 700.48	18 700.59	54
55	17 544.87	17 546.25	17 546.37	55
56	16 439.29	16 440.82	16 440.95	56
57	15 380.96	15 382.66	15 382.81	57
58	14 368.41	14 370.30	14 370.47	58
59	13 400.27	13 402.37	13 402.57	59
60	12 475.24	12 477.57	12 477.80	60
61	11 592.08	11 594.68	11 594.96	61
62	10 749.66	10 752.54	10 752.88	62
63	9 946.87	9 950.07	9 950.48	63
64	9 182.71	9 186.25	9 186.74	64

AM92

4%

x	$N_{[x]}$	$N_{[x-1]+1}$	N_x	x
65	8 456.21	8 460.12	8 460.71	65
66	7 766.46	7 770.77	7 771.48	66
67	7 112.62	7 117.36	7 118.20	67
68	6 493.86	6 499.06	6 500.06	68
69	5 909.43	5 915.12	5 916.29	69
70	5 358.59	5 364.78	5 366.14	70
71	4 840.63	4 847.34	4 848.92	71
72	4 354.86	4 362.10	4 363.91	72
73	3 900.59	3 908.38	3 910.43	73
74	3 477.14	3 485.47	3 487.78	74
75	3 083.84	3 092.69	3 095.27	75
76	2 719.96	2 729.30	2 732.16	76
77	2 384.76	2 394.56	2 397.70	77
78	2 077.47	2 087.67	2 091.08	78
79	1 797.25	1 807.78	1 811.45	79
80	1 543.20	1 553.98	1 557.89	80
81	1 314.35	1 325.29	1 329.41	81
82	1 109.67	1 120.65	1 124.94	82
83	928.03	938.92	943.34	83
84	768.19	778.88	783.37	84
85	628.87	639.22	643.72	85
86	508.67	518.57	523.01	86
87	406.14	415.45	419.77	87
88	319.75	328.38	332.51	88
89	247.93	255.80	259.69	89
90	189.12	196.15	199.74	90
91		147.88	151.13	91
92			112.35	92
93			81.95	93
94			58.56	94
95			40.94	95
96			27.95	96
97			18.61	97
98			12.06	98
99			7.59	99
100			4.63	100
101			2.73	101
102			1.55	102
103			.85	103
104			.45	104
105			.23	105
106			.11	106
107			.05	107
108			.02	108
109			.01	109
110			.00	110

AM92

4%

x	$S_{[x]}$	$S_{[x-1]+1}$	S_x	x
17	2 398 085.62		2 398 087.20	17
18	2 278 125.81	2 278 127.03	2 278 127.26	18
19	2 163 299.72	2 163 300.85	2 163 301.06	19
20	2 053 406.94	2 053 407.99	2 053 408.17	20
21	1 948 254.91	1 948 255.88	1 948 256.05	21
22	1 847 658.63	1 847 659.51	1 847 659.67	22
23	1 751 440.30	1 751 441.12	1 751 441.27	23
24	1 659 429.12	1 659 429.89	1 659 430.03	24
25	1 571 460.98	1 571 461.70	1 571 461.82	25
26	1 487 378.14	1 487 378.82	1 487 378.94	26
27	1 407 029.07	1 407 029.71	1 407 029.82	27
28	1 330 268.14	1 330 268.73	1 330 268.83	28
29	1 256 955.35	1 256 955.92	1 256 956.02	29
30	1 186 956.21	1 186 956.76	1 186 956.85	30
31	1 120 141.46	1 120 141.98	1 120 142.07	31
32	1 056 386.83	1 056 387.32	1 056 387.42	32
33	995 572.87	995 573.36	995 573.46	33
34	937 584.81	937 585.29	937 585.38	34
35	882 312.25	882 312.74	882 312.84	35
36	829 649.12	829 649.61	829 649.71	36
37	779 493.40	779 493.88	779 493.98	37
38	731 746.96	731 747.45	731 747.56	38
39	686 315.48	686 315.99	686 316.09	39
40	643 108.22	643 108.74	643 108.84	40
41	602 037.89	602 038.43	602 038.53	41
42	563 020.51	563 021.07	563 021.17	42
43	525 975.27	525 975.86	525 975.96	43
44	490 824.40	490 825.02	490 825.13	44
45	457 493.03	457 493.69	457 493.79	45
46	425 909.06	425 909.76	425 909.86	46
47	396 003.05	396 003.80	396 003.90	47
48	367 708.11	367 708.91	367 709.01	48
49	340 959.74	340 960.61	340 960.71	49
50	315 695.79	315 696.73	315 696.84	50
51	291 856.30	291 857.33	291 857.43	51
52	269 383.41	269 384.53	269 384.64	52
53	248 221.26	248 222.49	248 222.60	53
54	228 315.88	228 317.24	228 317.35	54
55	209 615.14	209 616.65	209 616.77	55
56	192 068.59	192 070.27	192 070.40	56
57	175 627.43	175 629.30	175 629.44	57
58	160 244.38	160 246.47	160 246.64	58
59	145 873.64	145 875.97	145 876.17	59
60	132 470.75	132 473.37	132 473.60	60
61	119 992.59	119 995.52	119 995.80	61
62	108 397.21	108 400.50	108 400.84	62
63	97 643.87	97 647.55	97 647.96	63
64	87 692.86	87 696.99	87 697.49	64

AM92

x	$S_{[x]}$	$S_{[x-1]+1}$	S_x	x
65	78 505.54	78 510.15	78 510.74	65
66	70 044.17	70 049.32	70 050.03	66
67	62 271.97	62 277.71	62 278.55	67
68	55 152.99	55 159.35	55 160.35	68
69	48 652.08	48 659.12	48 660.29	69
70	42 734.88	42 742.64	42 744.01	70
71	37 367.77	37 376.29	37 377.86	71
72	32 517.84	32 527.14	32 528.95	72
73	28 152.89	28 162.99	28 165.04	73
74	24 241.39	24 252.30	24 254.61	74
75	20 752.53	20 764.24	20 766.83	75
76	17 656.21	17 668.69	17 671.56	76
77	14 923.03	14 936.25	14 939.39	77
78	12 524.40	12 538.27	12 541.69	78
79	10 432.48	10 446.93	10 450.60	79
80	8 620.33	8 635.24	8 639.15	80
81	7 061.91	7 077.14	7 081.26	81
82	5 732.17	5 747.56	5 751.85	82
83	4 607.11	4 622.49	4 626.91	83
84	3 663.90	3 679.09	3 683.57	84
85	2 880.92	2 895.71	2 900.21	85
86	2 237.83	2 252.05	2 256.49	86
87	1 715.71	1 729.16	1 733.48	87
88	1 297.05	1 309.57	1 313.71	88
89	965.85	977.30	981.19	89
90	707.63	717.91	721.51	90
91		518.51	521.76	91
92			370.63	92
93			258.28	93
94			176.34	94
95			117.78	95
96			76.84	96
97			48.88	97
98			30.28	98
99			18.22	99
100			10.63	100
101			6.00	101
102			3.27	102
103			1.72	103
104			.87	104
105			.42	105
106			.19	106
107			.09	107
108			.04	108
109			.01	109
110			.01	110

4%

AM92

4%

x	$C_{[x]}$	$C_{[x-1]+1}$	C_x	x
17	2.11		2.96	17
18	2.02	2.60	2.82	18
19	1.94	2.48	2.68	19
20	1.86	2.37	2.55	20
21	1.79	2.26	2.43	21
22	1.73	2.16	2.31	22
23	1.67	2.08	2.21	23
24	1.61	1.99	2.12	24
25	1.56	1.91	2.03	25
26	1.52	1.85	1.96	26
27	1.48	1.78	1.89	27
28	1.45	1.73	1.83	28
29	1.42	1.68	1.78	29
30	1.40	1.64	1.74	30
31	1.39	1.61	1.70	31
32	1.38	1.59	1.68	32
33	1.38	1.57	1.66	33
34	1.38	1.57	1.66	34
35	1.39	1.57	1.66	35
36	1.41	1.58	1.68	36
37	1.43	1.61	1.70	37
38	1.46	1.64	1.74	38
39	1.51	1.69	1.79	39
40	1.56	1.75	1.85	40
41	1.61	1.82	1.92	41
42	1.68	1.91	2.01	42
43	1.75	2.01	2.11	43
44	1.84	2.13	2.23	44
45	1.94	2.26	2.36	45
46	2.04	2.41	2.51	46
47	2.16	2.58	2.68	47
48	2.29	2.77	2.87	48
49	2.43	2.97	3.07	49
50	2.59	3.20	3.30	50
51	2.76	3.44	3.54	51
52	2.94	3.71	3.81	52
53	3.13	4.00	4.10	53
54	3.34	4.31	4.41	54
55	3.56	4.64	4.75	55
56	3.80	4.99	5.11	56
57	4.05	5.36	5.50	57
58	4.32	5.75	5.91	58
59	4.60	6.16	6.35	59
60	4.89	6.59	6.81	60
61	5.19	7.03	7.29	61
62	5.51	7.48	7.80	62
63	5.83	7.94	8.33	63
64	6.16	8.40	8.88	64

AM92

4%

x	$C_{[x]}$	$C_{[x-1]+1}$	C_x	x
65	6.50	8.87	9.44	65
66	6.84	9.33	10.01	66
67	7.18	9.78	10.59	67
68	7.51	10.22	11.18	68
69	7.84	10.63	11.76	69
70	8.15	11.02	12.33	70
71	8.44	11.36	12.87	71
72	8.71	11.66	13.39	72
73	8.95	11.90	13.88	73
74	9.15	12.08	14.31	74
75	9.30	12.19	14.68	75
76	9.41	12.23	14.98	76
77	9.45	12.17	15.19	77
78	9.43	12.03	15.31	78
79	9.35	11.79	15.33	79
80	9.18	11.46	15.23	80
81	8.95	11.04	15.00	81
82	8.63	10.52	14.65	82
83	8.25	9.92	14.17	83
84	7.79	9.25	13.56	84
85	7.27	8.52	12.84	85
86	6.69	7.73	12.00	86
87	6.08	6.92	11.08	87
88	5.43	6.10	10.08	88
89	4.78	5.29	9.03	89
90	4.12	4.50	7.96	90
91		3.76	6.89	91
92			5.85	92
93			4.86	93
94			3.96	94
95			3.14	95
96			2.43	96
97			1.83	97
98			1.34	98
99			.95	99
100			.65	100
101			.43	101
102			.27	102
103			.17	103
104			.10	104
105			.05	105
106			.03	106
107			.01	107
108			.01	108
109			.00	109
110			.00	110

AM92

4%

x	$M_{[x]}$	$M_{[x-1]+1}$	M_x	x
17	518.82		519.89	17
18	515.93	516.71	516.93	18
19	513.19	513.91	514.11	19
20	510.58	511.25	511.43	20
21	508.09	508.72	508.88	21
22	505.73	506.31	506.46	22
23	503.47	504.01	504.14	23
24	501.30	501.80	501.93	24
25	499.23	499.69	499.81	25
26	497.23	497.67	497.78	26
27	495.31	495.72	495.82	27
28	493.46	493.83	493.93	28
29	491.66	492.01	492.10	29
30	489.90	490.23	490.33	30
31	488.19	488.50	488.59	31
32	486.50	486.80	486.89	32
33	484.84	485.12	485.21	33
34	483.18	483.46	483.55	34
35	481.53	481.80	481.90	35
36	479.87	480.14	480.24	36
37	478.19	478.46	478.56	37
38	476.48	476.76	476.86	38
39	474.74	475.02	475.12	39
40	472.94	473.23	473.33	40
41	471.07	471.38	471.48	41
42	469.12	469.46	469.56	42
43	467.09	467.44	467.55	43
44	464.94	465.33	465.43	44
45	462.68	463.10	463.20	45
46	460.27	460.74	460.84	46
47	457.71	458.23	458.33	47
48	454.98	455.55	455.65	48
49	452.05	452.68	452.78	49
50	448.91	449.61	449.71	50
51	445.53	446.32	446.42	51
52	441.90	442.78	442.88	52
53	437.99	438.96	439.07	53
54	433.78	434.86	434.97	54
55	429.24	430.44	430.55	55
56	424.35	425.68	425.80	56
57	419.08	420.55	420.69	57
58	413.41	415.03	415.19	58
59	407.30	409.09	409.28	59
60	400.74	402.71	402.93	60
61	393.70	395.85	396.12	61
62	386.14	388.50	388.83	62
63	378.05	380.63	381.02	63
64	369.41	372.22	372.69	64

AM92

4%

x	$M_{[x]}$	$M_{[x-1]+1}$	M_x	x
65	360.20	363.25	363.82	65
66	350.40	353.70	354.38	66
67	339.99	343.56	344.37	67
68	328.98	332.81	333.77	68
69	317.37	321.47	322.59	69
70	305.15	309.53	310.84	70
71	292.35	297.00	298.51	71
72	278.98	283.90	285.64	72
73	265.09	270.27	272.24	73
74	250.72	256.14	258.37	74
75	235.93	241.57	244.06	75
76	220.78	226.63	229.38	76
77	205.37	211.38	214.40	77
78	189.79	195.92	199.20	78
79	174.14	180.36	183.89	79
80	158.56	164.80	168.56	80
81	143.16	149.37	153.34	81
82	128.07	134.21	138.34	82
83	113.45	119.44	123.69	83
84	99.42	105.20	109.52	84
85	86.12	91.63	95.96	85
86	73.65	78.85	83.12	86
87	62.14	66.96	71.11	87
88	51.65	56.06	60.04	88
89	42.25	46.22	49.96	89
90	33.97	37.47	40.93	90
91		29.84	32.97	91
92			26.08	92
93			20.23	93
94			15.37	94
95			11.41	95
96			8.27	96
97			5.84	97
98			4.01	98
99			2.67	99
100			1.72	100
101			1.07	101
102			.64	102
103			.37	103
104			.21	104
105			.11	105
106			.05	106
107			.03	107
108			.01	108
109			.01	109
110			.00	110

AM92

4%

x	$R_{[x]}$	$R_{[x-1]+1}$	R_x	x
17	27 724.52		27 725.81	17
18	27 204.73	27 205.71	27 205.92	18
19	26 687.90	26 688.80	26 689.00	19
20	26 173.87	26 174.71	26 174.89	20
21	25 662.51	25 663.29	25 663.45	21
22	25 153.71	25 154.42	25 154.57	22
23	24 647.32	24 647.98	24 648.11	23
24	24 143.23	24 143.85	24 143.97	24
25	23 641.35	23 641.93	23 642.04	25
26	23 141.58	23 142.12	23 142.23	26
27	22 643.84	22 644.35	22 644.45	27
28	22 148.06	22 148.53	22 148.63	28
29	21 654.16	21 654.60	21 654.70	29
30	21 162.07	21 162.50	21 162.60	30
31	20 671.77	20 672.17	20 672.27	31
32	20 183.20	20 183.59	20 183.68	32
33	19 696.32	19 696.70	19 696.79	33
34	19 211.11	19 211.48	19 211.57	34
35	18 727.56	18 727.93	18 728.02	35
36	18 245.66	18 246.03	18 246.12	36
37	17 765.43	17 765.79	17 765.89	37
38	17 286.86	17 287.23	17 287.33	38
39	16 809.99	16 810.38	16 810.47	39
40	16 334.87	16 335.26	16 335.36	40
41	15 861.52	15 861.93	15 862.03	41
42	15 390.01	15 390.45	15 390.55	42
43	14 920.43	14 920.89	14 920.99	43
44	14 452.85	14 453.35	14 453.45	44
45	13 987.39	13 987.91	13 988.01	45
46	13 524.14	13 524.71	13 524.81	46
47	13 063.26	13 063.87	13 063.97	47
48	12 604.88	12 605.55	12 605.65	48
49	12 149.17	12 149.90	12 150.00	49
50	11 696.32	11 697.12	11 697.22	50
51	11 246.53	11 247.41	11 247.51	51
52	10 800.02	10 800.99	10 801.09	52
53	10 357.04	10 358.12	10 358.22	53
54	9 917.85	9 919.05	9 919.15	54
55	9 482.75	9 484.07	9 484.19	55
56	9 052.04	9 053.51	9 053.63	56
57	8 626.06	8 627.69	8 627.83	57
58	8 205.17	8 206.98	8 207.14	58
59	7 789.75	7 791.76	7 791.95	59
60	7 380.21	7 382.44	7 382.67	60
61	6 976.98	6 979.47	6 979.73	61
62	6 580.53	6 583.29	6 583.61	62
63	6 191.34	6 194.39	6 194.79	63
64	5 809.91	5 813.29	5 813.76	64

AM92

4%

x	$R_{[x]}$	$R_{[x-1]+1}$	R_x	x
65	5 436.77	5 440.50	5 441.07	65
66	5 072.46	5 076.57	5 077.25	66
67	4 717.54	4 722.06	4 722.87	67
68	4 372.60	4 377.55	4 378.51	68
69	4 038.20	4 043.61	4 044.74	69
70	3 714.94	3 720.83	3 722.14	70
71	3 403.41	3 409.79	3 411.31	71
72	3 104.17	3 111.06	3 112.79	72
73	2 817.78	2 825.19	2 827.16	73
74	2 544.78	2 552.69	2 554.91	74
75	2 285.66	2 294.06	2 296.55	75
76	2 040.87	2 049.74	2 052.49	76
77	1 810.80	1 820.09	1 823.11	77
78	1 595.76	1 605.43	1 608.71	78
79	1 396.00	1 405.97	1 409.51	79
80	1 211.64	1 221.85	1 225.62	80
81	1 042.74	1 053.09	1 057.05	81
82	889.21	899.59	903.72	82
83	750.83	761.13	765.38	83
84	627.27	637.38	641.69	84
85	518.06	527.85	532.17	85
86	422.60	431.95	436.22	86
87	340.15	348.95	353.10	87
88	269.86	278.01	281.99	88
89	210.79	218.21	221.95	89
90	161.90	168.54	171.99	90
91		127.94	131.06	91
92			98.09	92
93			72.01	93
94			51.78	94
95			36.41	95
96			25.00	96
97			16.73	97
98			10.89	98
99			6.89	99
100			4.22	100
101			2.50	101
102			1.43	102
103			.79	103
104			.41	104
105			.21	105
106			.10	106
107			.05	107
108			.02	108
109			.01	109
110			.00	110

AM92

4%

x	$\ddot{a}_{[x]}$	$A_{[x]}$	${}^2A_{[x]}$	$\ddot{a}_x$	A_x	${}^2A_x$	x
17	23.372	0.101 08	0.016 96	23.367	0.101 27	0.017 16	17
18	23.280	0.104 60	0.017 78	23.276	0.104 78	0.017 97	18
19	23.185	0.108 27	0.018 67	23.180	0.108 44	0.018 85	19
20	23.086	0.112 10	0.019 64	23.081	0.112 26	0.019 82	20
21	22.982	0.116 08	0.020 70	22.978	0.116 24	0.020 86	21
22	22.874	0.120 23	0.021 84	22.870	0.120 38	0.022 00	22
23	22.762	0.124 55	0.023 08	22.758	0.124 69	0.023 24	23
24	22.645	0.129 05	0.024 43	22.641	0.129 19	0.024 58	24
25	22.523	0.133 73	0.025 89	22.520	0.133 86	0.026 03	25
26	22.396	0.138 60	0.027 47	22.393	0.138 73	0.027 61	26
27	22.265	0.143 67	0.029 17	22.261	0.143 79	0.029 31	27
28	22.128	0.148 94	0.031 02	22.124	0.149 06	0.031 15	28
29	21.985	0.154 42	0.033 01	21.982	0.154 54	0.033 14	29
30	21.837	0.160 11	0.035 15	21.834	0.160 23	0.035 28	30
31	21.683	0.166 03	0.037 47	21.680	0.166 15	0.037 59	31
32	21.523	0.172 18	0.039 96	21.520	0.172 30	0.040 08	32
33	21.357	0.178 57	0.042 64	21.354	0.178 68	0.042 76	33
34	21.185	0.185 20	0.045 52	21.182	0.185 31	0.045 65	34
35	21.006	0.192 07	0.048 61	21.003	0.192 19	0.048 74	35
36	20.821	0.199 21	0.051 93	20.818	0.199 33	0.052 07	36
37	20.628	0.206 60	0.055 49	20.625	0.206 72	0.055 63	37
38	20.429	0.214 26	0.059 30	20.426	0.214 39	0.059 45	38
39	20.223	0.222 20	0.063 38	20.219	0.222 34	0.063 54	39
40	20.009	0.230 41	0.067 75	20.005	0.230 56	0.067 92	40
41	19.788	0.238 91	0.072 41	19.784	0.239 07	0.072 59	41
42	19.560	0.247 70	0.077 38	19.555	0.247 87	0.077 58	42
43	19.324	0.256 78	0.082 67	19.319	0.256 96	0.082 89	43
44	19.080	0.266 15	0.088 32	19.075	0.266 36	0.088 56	44
45	18.829	0.275 83	0.094 31	18.823	0.276 05	0.094 58	45
46	18.569	0.285 80	0.100 68	18.563	0.286 05	0.100 98	46
47	18.302	0.296 07	0.107 44	18.295	0.296 35	0.107 78	47
48	18.027	0.306 64	0.114 60	18.019	0.306 95	0.114 98	48
49	17.745	0.317 52	0.122 17	17.736	0.317 86	0.122 60	49
50	17.454	0.328 68	0.130 17	17.444	0.329 07	0.130 65	50
51	17.156	0.340 14	0.138 61	17.145	0.340 58	0.139 15	51
52	16.851	0.351 89	0.147 49	16.838	0.352 38	0.148 11	52
53	16.538	0.363 92	0.156 84	16.524	0.364 48	0.157 55	53
54	16.218	0.376 23	0.166 65	16.202	0.376 85	0.167 45	54
55	15.891	0.388 79	0.176 93	15.873	0.389 50	0.177 85	55
56	15.558	0.401 61	0.187 69	15.537	0.402 40	0.188 74	56
57	15.219	0.414 66	0.198 93	15.195	0.415 56	0.200 12	57
58	14.874	0.427 94	0.210 64	14.847	0.428 96	0.212 00	58
59	14.523	0.441 43	0.222 82	14.493	0.442 58	0.224 37	59
60	14.167	0.455 10	0.235 47	14.134	0.456 40	0.237 23	60
61	13.808	0.468 94	0.248 57	13.769	0.470 41	0.250 58	61
62	13.444	0.482 92	0.262 11	13.401	0.484 58	0.264 40	62
63	13.077	0.497 03	0.276 08	13.029	0.498 90	0.278 68	63
64	12.708	0.511 23	0.290 46	12.653	0.513 33	0.293 40	64

Note. ${}^2A_{[x]} = A_{[x]}$ at 8.16% and ${}^2A_x = A_x$ at 8.16%.

AMS92

4%

x	$\ddot{a}_{[x]}$	$A_{[x]}$	$^2A_{[x]}$	$\ddot{a}_x$	A_x	^2A_x	x
65	12.337	0.525 50	0.305 22	12.276	0.527 86	0.308 55	65
66	11.965	0.539 81	0.320 33	11.896	0.542 46	0.324 10	66
67	11.592	0.554 14	0.335 78	11.515	0.557 10	0.340 03	67
68	11.221	0.568 44	0.351 51	11.135	0.571 75	0.356 30	68
69	10.850	0.582 70	0.367 51	10.754	0.586 38	0.372 89	69
70	10.481	0.596 87	0.383 72	10.375	0.600 97	0.389 75	70
71	10.116	0.610 93	0.400 12	9.998	0.615 48	0.406 86	71
72	9.754	0.624 85	0.416 65	9.623	0.629 88	0.424 16	72
73	9.396	0.638 60	0.433 27	9.252	0.644 14	0.441 62	73
74	9.044	0.652 14	0.449 93	8.886	0.658 24	0.459 19	74
75	8.698	0.665 45	0.466 59	8.524	0.672 14	0.476 83	75
76	8.359	0.678 51	0.483 20	8.169	0.685 81	0.494 48	76
77	8.027	0.691 27	0.499 71	7.820	0.699 24	0.512 10	77
78	7.703	0.703 73	0.516 09	7.478	0.712 38	0.529 65	78
79	7.388	0.715 85	0.532 27	7.144	0.725 23	0.547 07	79
80	7.082	0.727 62	0.548 22	6.818	0.737 75	0.564 32	80
81	6.785	0.739 03	0.563 90	6.502	0.749 93	0.581 36	81
82	6.499	0.750 05	0.579 27	6.194	0.761 75	0.598 14	82
83	6.222	0.760 68	0.594 30	5.897	0.773 19	0.614 61	83
84	5.957	0.770 90	0.608 95	5.610	0.784 25	0.630 75	84
85	5.701	0.780 72	0.623 20	5.333	0.794 90	0.646 52	85
86	5.457	0.790 12	0.637 01	5.066	0.805 14	0.661 88	86
87	5.223	0.799 11	0.650 38	4.811	0.814 98	0.676 80	87
88	5.000	0.807 69	0.663 29	4.566	0.824 39	0.691 27	88
89	4.788	0.815 85	0.675 73	4.332	0.833 38	0.705 25	89
90	4.586	0.823 62	0.687 68	4.109	0.841 96	0.718 74	90
91				3.897	0.850 12	0.731 72	91
92				3.695	0.857 87	0.744 17	92
93				3.504	0.865 22	0.756 09	93
94				3.323	0.872 18	0.767 48	94
95				3.153	0.878 75	0.778 34	95
96				2.992	0.884 94	0.788 67	96
97				2.840	0.890 77	0.798 47	97
98				2.698	0.896 25	0.807 76	98
99				2.564	0.901 39	0.816 54	99
100				2.439	0.906 21	0.824 83	100
101				2.321	0.910 71	0.832 63	101
102				2.212	0.914 92	0.839 97	102
103				2.110	0.918 85	0.846 86	103
104				2.015	0.922 51	0.853 31	104
105				1.926	0.925 91	0.859 34	105
106				1.844	0.929 07	0.864 98	106
107				1.768	0.932 01	0.870 23	107
108				1.697	0.934 72	0.875 12	108
109				1.632	0.937 24	0.879 66	109
110				1.571	0.939 56	0.883 87	110
111				1.516	0.941 70	0.887 77	111
112				1.464	0.943 67	0.891 37	112
113				1.417	0.945 49	0.894 69	113
114				1.374	0.947 15	0.897 75	114
115				1.334	0.948 68	0.900 56	115
116				1.298	0.950 08	0.903 15	116
117				1.264	0.951 39	0.905 57	117
118				1.229	0.952 73	0.908 04	118
119				1.176	0.954 78	0.911 81	119
120				1.000	0.961 54	0.924 56	120

Note. $^2A_{[x]} = A_{[x]}$ at 8.16% and $^2A_x = A_x$ at 8.16%.

AM92

4%

x	$(I\ddot{a})_{[x]}$	$(IA)_{[x]}$	$(I\ddot{a})_x$	$(IA)_x$	x
17	467.226	5.401 64	467.124	5.400 71	17
18	461.881	5.515 65	461.784	5.514 73	18
19	456.412	5.630 60	456.320	5.629 69	19
20	450.817	5.746 37	450.729	5.745 47	20
21	445.097	5.862 84	445.013	5.861 95	21
22	439.249	5.979 86	439.170	5.978 99	22
23	433.275	6.097 30	433.200	6.096 44	23
24	427.174	6.215 01	427.102	6.214 15	24
25	420.947	6.332 80	420.878	6.331 95	25
26	414.593	6.450 51	414.528	6.449 67	26
27	408.114	6.567 94	408.051	6.567 10	27
28	401.510	6.684 88	401.450	6.684 05	28
29	394.783	6.801 12	394.726	6.800 29	29
30	387.935	6.916 44	387.878	6.915 59	30
31	380.966	7.030 57	380.911	7.029 72	31
32	373.879	7.143 28	373.825	7.142 42	32
33	366.676	7.254 28	366.623	7.253 40	33
34	359.361	7.363 31	359.308	7.362 39	34
35	351.937	7.470 05	351.883	7.469 09	35
36	344.407	7.574 21	344.353	7.573 20	36
37	336.776	7.675 46	336.720	7.674 38	37
38	329.048	7.773 46	328.991	7.772 31	38
39	321.228	7.867 88	321.169	7.866 63	39
40	313.323	7.958 35	313.260	7.956 99	40
41	305.337	8.044 52	305.271	8.043 03	41
42	297.278	8.126 02	297.207	8.124 35	42
43	289.153	8.202 46	289.077	8.200 60	43
44	280.970	8.273 47	280.888	8.271 37	44
45	272.737	8.338 65	272.647	8.336 28	45
46	264.462	8.397 62	264.365	8.394 93	46
47	256.156	8.450 01	256.049	8.446 95	47
48	247.828	8.495 42	247.711	8.491 93	48
49	239.488	8.533 51	239.360	8.529 50	49
50	231.149	8.563 90	231.007	8.559 29	50
51	222.820	8.586 24	222.664	8.580 95	51
52	214.514	8.600 22	214.342	8.594 12	52
53	206.244	8.605 54	206.053	8.598 51	53
54	198.022	8.601 90	197.811	8.593 81	54
55	189.861	8.589 08	189.627	8.579 76	55
56	181.774	8.566 87	181.516	8.556 11	56
57	173.775	8.535 08	173.489	8.522 68	57
58	165.878	8.493 60	165.561	8.479 31	58
59	158.094	8.442 34	157.744	8.425 88	59
60	150.440	8.381 28	150.053	8.362 34	60
61	142.926	8.310 44	142.499	8.288 67	61
62	135.566	8.229 90	135.096	8.204 91	62
63	128.373	8.139 81	127.856	8.111 17	63
64	121.359	8.040 36	120.790	8.007 60	64

AM92

4%

x	$(I\ddot{a})_{[x]}$	$(IA)_{[x]}$	$(I\ddot{a})_x$	$(IA)_x$	x
65	114.533	7.931 82	113.911	7.894 42	65
66	107.909	7.814 53	107.228	7.771 92	66
67	101.494	7.688 86	100.751	7.640 43	67
68	95.297	7.555 27	94.489	7.500 35	68
69	89.327	7.414 26	88.450	7.352 15	69
70	83.589	7.266 40	82.641	7.196 35	70
71	78.089	7.112 29	77.067	7.033 51	71
72	72.832	6.952 57	71.732	6.864 24	72
73	67.819	6.787 95	66.640	6.689 22	73
74	63.053	6.619 14	61.793	6.509 13	74
75	58.534	6.446 87	57.192	6.324 70	75
76	54.260	6.271 92	52.836	6.136 69	76
77	50.230	6.095 04	48.723	5.945 86	77
78	46.440	5.916 97	44.851	5.752 98	78
79	42.885	5.738 48	41.215	5.558 83	79
80	39.559	5.560 29	37.811	5.364 17	80
81	36.457	5.383 08	34.633	5.169 76	81
82	33.570	5.207 53	31.673	4.976 31	82
83	30.890	5.034 26	28.924	4.784 53	83
84	28.410	4.863 82	26.378	4.595 08	84
85	26.118	4.696 75	24.025	4.408 56	85
86	24.007	4.533 50	21.858	4.225 55	86
87	22.065	4.374 48	19.866	4.046 57	87
88	20.283	4.220 03	18.039	3.872 08	88
89	18.651	4.070 43	16.368	3.702 50	89
90	17.159	3.925 89	14.843	3.538 17	90
91			13.453	3.379 39	91
92			12.191	3.226 40	92
93			11.045	3.079 39	93
94			10.007	2.938 48	94
95			9.070	2.803 78	95
96			8.223	2.675 30	96
97			7.460	2.553 06	97
98			6.774	2.437 01	98
99			6.156	2.327 08	99
100			5.602	2.223 16	100
101			5.104	2.125 12	101
102			4.659	2.032 81	102
103			4.259	1.946 07	103
104			3.902	1.864 71	104
105			3.582	1.788 53	105
106			3.295	1.717 34	106
107			3.039	1.650 92	107
108			2.811	1.589 07	108
109			2.606	1.531 58	109
110			2.424	1.478 23	110
111			2.261	1.428 82	111
112			2.115	1.383 15	112
113			1.985	1.341 02	113
114			1.869	1.302 22	114
115			1.765	1.266 54	115
116			1.672	1.233 70	116
117			1.584	1.202 99	117
118			1.492	1.171 57	118
119			1.351	1.123 76	119
120			1.000	0.961 54	120

AM92

4%

x	$\ddot{a}_{[x]:\overline{n}\rvert}$	$A_{[x]:\overline{n}\rvert}$	$n = 60 - x$	$\ddot{a}_{x:\overline{n}\rvert}$	$A_{x:\overline{n}\rvert}$	x
17	20.941	0.194 59	43	20.936	0.194 75	17
18	20.750	0.201 90	42	20.746	0.202 06	18
19	20.552	0.209 53	41	20.548	0.209 68	19
20	20.346	0.217 46	40	20.342	0.217 60	20
21	20.131	0.225 72	39	20.128	0.225 86	21
22	19.908	0.234 32	38	19.904	0.234 45	22
23	19.675	0.243 27	37	19.672	0.243 40	23
24	19.433	0.252 59	36	19.430	0.252 71	24
25	19.181	0.262 28	35	19.178	0.262 40	25
26	18.918	0.272 37	34	18.916	0.272 48	26
27	18.645	0.282 87	33	18.643	0.282 97	27
28	18.361	0.293 79	32	18.359	0.293 89	28
29	18.066	0.305 15	31	18.064	0.305 25	29
30	17.759	0.316 97	30	17.756	0.317 06	30
31	17.439	0.329 26	29	17.437	0.329 35	31
32	17.107	0.342 04	28	17.105	0.342 12	32
33	16.762	0.355 33	27	16.759	0.355 41	33
34	16.402	0.369 14	26	16.400	0.369 23	34
35	16.029	0.383 50	25	16.027	0.383 59	35
36	15.641	0.398 43	24	15.639	0.398 52	36
37	15.237	0.413 95	23	15.235	0.414 03	37
38	14.818	0.430 07	22	14.816	0.430 16	38
39	14.383	0.446 82	21	14.380	0.446 92	39
40	13.930	0.464 23	20	13.927	0.464 33	40
41	13.460	0.482 31	19	13.457	0.482 42	41
42	12.971	0.501 10	18	12.969	0.501 21	42
43	12.464	0.520 61	17	12.461	0.520 73	43
44	11.937	0.540 88	16	11.934	0.541 00	44
45	11.390	0.561 93	15	11.386	0.562 06	45
46	10.821	0.583 80	14	10.818	0.583 93	46
47	10.231	0.606 51	13	10.227	0.606 65	47
48	9.617	0.630 10	12	9.613	0.630 25	48
49	8.980	0.654 61	11	8.976	0.654 77	49
50	8.318	0.680 07	10	8.314	0.680 24	50
51	7.630	0.706 54	9	7.625	0.706 72	51
52	6.914	0.734 06	8	6.910	0.734 24	52
53	6.170	0.762 68	7	6.166	0.762 86	53
54	5.396	0.792 46	6	5.391	0.792 64	54
55	4.590	0.823 48	5	4.585	0.823 65	55
56	3.749	0.855 80	4	3.745	0.855 95	56
57	2.873	0.889 52	3	2.870	0.889 63	57
58	1.957	0.924 73	2	1.955	0.924 79	58
59	1.000	0.961 54	1	1.000	0.961 54	59

AM92

x	$\ddot{a}_{[x]:\overline{n}\rvert}$	$A_{[x]:\overline{n}\rvert}$	$n = 65 - x$	$\ddot{a}_{x:\overline{n}\rvert}$	$A_{x:\overline{n}\rvert}$	x	**4%**
17	21.723	0.164 48	48	21.719	0.164 66	17	
18	21.565	0.170 58	47	21.561	0.170 74	18	
19	21.400	0.176 93	46	21.396	0.177 09	19	
20	21.228	0.183 54	45	21.224	0.183 69	20	
21	21.049	0.190 42	44	21.045	0.190 57	21	
22	20.863	0.197 59	43	20.859	0.197 73	22	
23	20.669	0.205 05	42	20.665	0.205 18	23	
24	20.467	0.212 81	41	20.464	0.212 94	24	
25	20.257	0.220 90	40	20.254	0.221 02	25	
26	20.038	0.229 31	39	20.035	0.229 42	26	
27	19.811	0.238 05	38	19.808	0.238 17	27	
28	19.574	0.247 16	37	19.571	0.247 26	28	
29	19.328	0.256 62	36	19.325	0.256 73	29	
30	19.072	0.266 47	35	19.069	0.266 57	30	
31	18.806	0.276 71	34	18.803	0.276 81	31	
32	18.529	0.287 35	33	18.526	0.287 45	32	
33	18.241	0.298 42	32	18.239	0.298 52	33	
34	17.942	0.309 92	31	17.940	0.310 02	34	
35	17.631	0.321 87	30	17.629	0.321 97	35	
36	17.308	0.334 29	29	17.306	0.334 39	36	
37	16.973	0.347 19	28	16.970	0.347 29	37	
38	16.625	0.360 59	27	16.622	0.360 70	38	
39	16.263	0.374 51	26	16.260	0.374 62	39	
40	15.887	0.388 96	25	15.884	0.389 07	40	
41	15.497	0.403 95	24	15.494	0.404 07	41	
42	15.092	0.419 52	23	15.089	0.419 65	42	
43	14.672	0.435 67	22	14.669	0.435 81	43	
44	14.237	0.452 43	21	14.233	0.452 58	44	
45	13.785	0.469 82	20	13.780	0.469 98	45	
46	13.316	0.487 86	19	13.311	0.488 03	46	
47	12.829	0.506 56	18	12.824	0.506 75	47	
48	12.325	0.525 96	17	12.320	0.526 17	48	
49	11.802	0.546 08	16	11.796	0.546 30	49	
50	11.259	0.566 95	15	11.253	0.567 19	50	
51	10.697	0.588 58	14	10.690	0.588 84	51	
52	10.113	0.611 02	13	10.106	0.611 30	52	
53	9.508	0.634 30	12	9.500	0.634 60	53	
54	8.880	0.658 46	11	8.872	0.658 78	54	
55	8.228	0.683 54	10	8.219	0.683 88	55	
56	7.551	0.709 58	9	7.542	0.709 93	56	
57	6.847	0.736 64	8	6.838	0.737 01	57	
58	6.115	0.764 79	7	6.106	0.765 16	58	
59	5.353	0.794 10	6	5.344	0.794 46	59	
60	4.559	0.824 65	5	4.550	0.824 99	60	
61	3.730	0.856 54	4	3.722	0.856 85	61	
62	2.863	0.889 90	3	2.857	0.890 13	62	
63	1.954	0.924 85	2	1.951	0.924 98	63	
64	1.000	0.961 54	1	1.000	0.961 54	64	

AM92

6%

x	$\ddot{a}_{[x]}$	$A_{[x]}$	$^2A_{[x]}$	$\ddot{a}_x$	A_x	^2A_x	x
17	16.977	0.039 02	0.006 11	16.974	0.039 21	0.006 30	17
18	16.946	0.040 80	0.006 30	16.943	0.040 99	0.006 48	18
19	16.912	0.042 70	0.006 52	16.909	0.042 88	0.006 69	19
20	16.877	0.044 72	0.006 77	16.874	0.044 89	0.006 93	20
21	16.839	0.046 86	0.007 05	16.836	0.047 03	0.007 21	21
22	16.798	0.049 14	0.007 38	16.796	0.049 30	0.007 53	22
23	16.756	0.051 57	0.007 75	16.753	0.051 72	0.007 90	23
24	16.710	0.054 14	0.008 16	16.708	0.054 28	0.008 31	24
25	16.662	0.056 86	0.008 63	16.660	0.057 01	0.008 77	25
26	16.611	0.059 76	0.009 16	16.609	0.059 90	0.009 30	26
27	16.557	0.062 82	0.009 75	16.554	0.062 96	0.009 88	27
28	16.499	0.066 07	0.010 41	16.497	0.066 20	0.010 54	28
29	16.439	0.069 51	0.011 15	16.436	0.069 64	0.011 28	29
30	16.374	0.073 16	0.011 97	16.372	0.073 28	0.012 10	30
31	16.306	0.077 01	0.012 89	16.304	0.077 14	0.013 01	31
32	16.234	0.081 09	0.013 90	16.232	0.081 21	0.014 03	32
33	16.158	0.085 40	0.015 03	16.156	0.085 52	0.015 15	33
34	16.078	0.089 95	0.016 27	16.075	0.090 07	0.016 40	34
35	15.993	0.094 75	0.017 65	15.990	0.094 88	0.017 78	35
36	15.903	0.099 82	0.019 16	15.901	0.099 95	0.019 30	36
37	15.809	0.105 16	0.020 84	15.806	0.105 30	0.020 98	37
38	15.709	0.110 79	0.022 67	15.707	0.110 94	0.022 82	38
39	15.605	0.116 72	0.024 69	15.602	0.116 88	0.024 85	39
40	15.494	0.122 96	0.026 90	15.491	0.123 13	0.027 07	40
41	15.378	0.129 52	0.029 33	15.375	0.129 70	0.029 51	41
42	15.257	0.136 41	0.031 98	15.253	0.136 60	0.032 18	42
43	15.129	0.143 65	0.034 87	15.125	0.143 85	0.035 09	43
44	14.995	0.151 23	0.038 02	14.991	0.151 46	0.038 26	44
45	14.855	0.159 18	0.041 45	14.850	0.159 43	0.041 72	45
46	14.708	0.167 50	0.045 17	14.703	0.167 78	0.045 48	46
47	14.554	0.176 19	0.049 21	14.548	0.176 51	0.049 56	47
48	14.393	0.185 28	0.053 59	14.387	0.185 63	0.053 98	48
49	14.226	0.194 76	0.058 32	14.219	0.195 16	0.058 76	49
50	14.051	0.204 63	0.063 42	14.044	0.205 08	0.063 92	50
51	13.870	0.214 91	0.068 92	13.861	0.215 42	0.069 49	51
52	13.681	0.225 60	0.074 83	13.671	0.226 17	0.075 48	52
53	13.485	0.236 69	0.081 18	13.474	0.237 34	0.081 92	53
54	13.282	0.248 18	0.087 97	13.269	0.248 92	0.088 82	54
55	13.072	0.260 08	0.095 24	13.057	0.260 92	0.096 21	55
56	12.855	0.272 37	0.102 98	12.838	0.273 33	0.104 09	56
57	12.631	0.285 06	0.111 23	12.612	0.286 14	0.112 50	57
58	12.400	0.298 12	0.119 98	12.378	0.299 35	0.121 44	58
59	12.163	0.311 55	0.129 26	12.138	0.312 94	0.130 93	59
60	11.919	0.325 33	0.139 07	11.891	0.326 92	0.140 98	60
61	11.670	0.339 45	0.149 41	11.638	0.341 25	0.151 60	61
62	11.415	0.353 88	0.160 29	11.379	0.355 92	0.162 80	62
63	11.155	0.368 61	0.171 71	11.114	0.370 91	0.174 57	63
64	10.890	0.383 60	0.183 66	10.844	0.386 20	0.186 92	64

Note. $^2A_{[x]} = A_{[x]}$ at 12.36% and $^2A_x = A_x$ at 12.36%.

AM92

6%

x	$\ddot{a}_{[x]}$	$A_{[x]}$	${}^2A_{[x]}$	$\ddot{a}_x$	A_x	${}^2A_x$	x
65	10.621	0.398 83	0.196 14	10.569	0.401 77	0.199 85	65
66	10.348	0.414 27	0.209 13	10.289	0.417 58	0.213 35	66
67	10.072	0.429 88	0.222 62	10.006	0.433 61	0.227 40	67
68	9.794	0.445 64	0.236 58	9.720	0.449 82	0.242 00	68
69	9.513	0.461 50	0.251 00	9.431	0.466 17	0.257 12	69
70	9.232	0.477 43	0.265 83	9.140	0.482 65	0.272 74	70
71	8.950	0.493 38	0.281 06	8.848	0.499 19	0.288 82	71
72	8.669	0.509 33	0.296 64	8.555	0.515 78	0.305 34	72
73	8.388	0.525 21	0.312 54	8.262	0.532 36	0.322 26	73
74	8.109	0.541 01	0.328 70	7.969	0.548 90	0.339 55	74
75	7.832	0.556 67	0.345 09	7.679	0.565 35	0.357 14	75
76	7.559	0.572 15	0.361 64	7.390	0.581 69	0.375 01	76
77	7.289	0.587 42	0.378 33	7.105	0.597 86	0.393 09	77
78	7.024	0.602 44	0.395 08	6.822	0.613 83	0.411 33	78
79	6.763	0.617 17	0.411 86	6.544	0.629 56	0.429 69	79
80	6.509	0.631 59	0.428 60	6.271	0.645 01	0.448 11	80
81	6.260	0.645 66	0.445 25	6.004	0.660 16	0.466 52	81
82	6.018	0.659 35	0.461 77	5.742	0.674 97	0.484 88	82
83	5.783	0.672 65	0.478 11	5.487	0.689 42	0.503 13	83
84	5.556	0.685 53	0.494 22	5.239	0.703 46	0.521 21	84
85	5.336	0.697 97	0.510 05	4.998	0.717 10	0.539 07	85
86	5.124	0.709 97	0.525 57	4.765	0.730 29	0.556 67	86
87	4.920	0.721 50	0.540 75	4.540	0.743 04	0.573 96	87
88	4.724	0.732 58	0.555 55	4.323	0.755 31	0.590 88	88
89	4.537	0.743 18	0.569 94	4.114	0.767 11	0.607 41	89
90	4.358	0.753 32	0.583 90	3.914	0.778 43	0.623 50	90
91				3.723	0.789 25	0.639 13	91
92				3.541	0.799 59	0.654 26	92
93				3.367	0.809 44	0.668 88	93
94				3.201	0.818 80	0.682 96	94
95				3.044	0.827 69	0.696 49	95
96				2.896	0.836 10	0.709 46	96
97				2.755	0.844 06	0.721 87	97
98				2.622	0.851 56	0.733 70	98
99				2.498	0.858 63	0.744 96	99
100				2.380	0.865 27	0.755 65	100
101				2.270	0.871 51	0.765 79	101
102				2.167	0.877 36	0.775 37	102
103				2.070	0.882 83	0.784 42	103
104				1.980	0.887 94	0.792 93	104
105				1.895	0.892 71	0.800 94	105
106				1.817	0.897 15	0.808 45	106
107				1.744	0.901 28	0.815 48	107
108				1.676	0.905 11	0.822 05	108
109				1.614	0.908 66	0.828 17	109
110				1.556	0.911 95	0.833 87	110
111				1.502	0.914 99	0.839 17	111
112				1.452	0.917 79	0.844 08	112
113				1.407	0.920 37	0.848 61	113
114				1.365	0.922 75	0.852 80	114
115				1.326	0.924 92	0.856 66	115
116				1.291	0.926 93	0.860 22	116
117				1.258	0.928 80	0.863 55	117
118				1.224	0.930 72	0.866 94	118
119				1.172	0.933 64	0.872 10	119
120				1.000	0.943 40	0.890 00	120

Note. ${}^2A_{[x]} = A_{[x]}$ at 12.36% and ${}^2A_x = A_x$ at 12.36%.

AM92

6%

x	$(I\ddot{a})_{[x]}$	$(IA)_{[x]}$	$(I\ddot{a})_x$	$(IA)_x$	x
17	268.142	1.799 55	268.083	1.799 40	17
18	266.392	1.867 08	266.336	1.866 92	18
19	264.567	1.936 81	264.514	1.936 64	19
20	262.666	2.008 74	262.615	2.008 56	20
21	260.687	2.082 89	260.638	2.082 70	21
22	258.626	2.159 25	258.579	2.159 06	22
23	256.482	2.237 82	256.437	2.237 62	23
24	254.253	2.318 58	254.210	2.318 37	24
25	251.936	2.401 51	251.896	2.401 29	25
26	249.531	2.486 57	249.491	2.486 35	26
27	247.034	2.573 73	246.996	2.573 50	27
28	244.444	2.662 93	244.407	2.662 70	28
29	241.759	2.754 10	241.724	2.753 86	29
30	238.978	2.847 18	238.943	2.846 92	30
31	236.099	2.942 06	236.065	2.941 80	31
32	233.120	3.038 64	233.087	3.038 37	32
33	230.041	3.136 81	230.008	3.136 53	33
34	226.861	3.236 43	226.827	3.236 13	34
35	223.579	3.337 35	223.545	3.337 02	35
36	220.194	3.439 40	220.159	3.439 04	36
37	216.706	3.542 39	216.671	3.542 00	37
38	213.116	3.646 13	213.079	3.645 69	38
39	209.424	3.750 37	209.385	3.749 89	39
40	205.630	3.854 89	205.589	3.854 35	40
41	201.736	3.959 42	201.692	3.958 80	41
42	197.744	4.063 68	197.696	4.062 97	42
43	193.654	4.167 36	193.603	4.166 55	43
44	189.471	4.270 14	189.416	4.269 22	44
45	185.197	4.371 70	185.136	4.370 62	45
46	180.834	4.471 66	180.768	4.470 41	46
47	176.388	4.569 65	176.315	4.568 20	47
48	171.863	4.665 29	171.783	4.663 59	48
49	167.264	4.758 18	167.175	4.756 18	49
50	162.597	4.847 89	162.497	4.845 55	50
51	157.867	4.934 00	157.757	4.931 26	51
52	153.082	5.016 09	152.959	5.012 87	52
53	148.249	5.093 72	148.113	5.089 94	53
54	143.376	5.166 47	143.224	5.162 03	54
55	138.472	5.233 89	138.302	5.228 68	55
56	133.545	5.295 58	133.356	5.289 47	56
57	128.605	5.351 13	128.394	5.343 97	57
58	123.662	5.400 16	123.427	5.391 76	58
59	118.726	5.442 29	118.464	5.432 47	59
60	113.808	5.477 20	113.516	5.465 72	60
61	108.918	5.504 57	108.594	5.491 18	61
62	104.067	5.524 16	103.707	5.508 56	62
63	99.267	5.535 74	98.868	5.517 59	63
64	94.528	5.539 13	94.087	5.518 08	64

AM92

6%

x	$(I\ddot{a})_{[x]}$	$(IA)_{[x]}$	$(I\ddot{a})_x$	$(IA)_x$	x
65	89.861	5.534 21	89.374	5.509 85	65
66	85.277	5.520 93	84.740	5.492 80	66
67	80.785	5.499 28	80.196	5.466 88	67
68	76.397	5.469 31	75.752	5.432 09	68
69	72.121	5.431 14	71.416	5.388 51	69
70	67.965	5.384 97	67.198	5.336 28	70
71	63.939	5.331 01	63.105	5.275 60	71
72	60.048	5.269 59	59.146	5.206 73	72
73	56.300	5.201 07	55.326	5.129 99	73
74	52.700	5.125 86	51.652	5.045 77	74
75	49.251	5.044 44	48.128	4.954 52	75
76	45.958	4.957 31	44.758	4.856 72	76
77	42.822	4.865 04	41.545	4.752 91	77
78	39.846	4.768 19	38.491	4.643 69	78
79	37.028	4.667 37	35.596	4.529 64	79
80	34.369	4.563 20	32.860	4.411 42	80
81	31.866	4.456 30	30.283	4.289 68	81
82	29.517	4.347 29	27.861	4.165 09	82
83	27.320	4.236 78	25.594	4.038 31	83
84	25.268	4.125 36	23.475	3.910 00	84
85	23.359	4.013 61	21.503	3.780 82	85
86	21.586	3.902 05	19.671	3.651 39	86
87	19.944	3.791 19	17.974	3.522 31	87
88	18.426	3.681 49	16.406	3.394 16	88
89	17.026	3.573 36	14.962	3.267 46	89
90	15.738	3.467 16	13.634	3.142 70	90
91			12.417	3.020 33	91
92			11.303	2.900 75	92
93			10.287	2.784 31	93
94			9.361	2.671 32	94
95			8.518	2.562 02	95
96			7.754	2.456 63	96
97			7.061	2.355 32	97
98			6.435	2.258 21	98
99			5.869	2.165 37	99
100			5.358	2.076 86	100
101			4.898	1.992 70	101
102			4.483	1.912 86	102
103			4.111	1.837 31	103
104			3.776	1.765 98	104
105			3.475	1.698 78	105
106			3.205	1.635 63	106
107			2.963	1.576 39	107
108			2.746	1.520 96	108
109			2.551	1.469 20	109
110			2.377	1.420 96	110
111			2.221	1.376 11	111
112			2.081	1.334 50	112
113			1.956	1.295 98	113
114			1.845	1.260 40	114
115			1.744	1.227 60	115
116			1.654	1.197 34	116
117			1.570	1.169 04	117
118			1.481	1.140 18	118
119			1.345	1.096 31	119
120			1.000	0.943 40	120

AM92

6%

x	$\ddot{a}_{[x]:\overline{n}\rvert}$	$A_{[x]:\overline{n}\rvert}$	$n = 60 - x$	$\ddot{a}_{x:\overline{n}\rvert}$	$A_{x:\overline{n}\rvert}$	x
17	16.076	0.090 05	43	16.072	0.090 24	17
18	15.990	0.094 93	42	15.986	0.095 11	18
19	15.898	0.100 11	41	15.895	0.100 28	19
20	15.801	0.105 61	40	15.798	0.105 77	20
21	15.698	0.111 45	39	15.695	0.111 60	21
22	15.588	0.117 64	38	15.586	0.117 79	22
23	15.472	0.124 22	37	15.470	0.124 36	23
24	15.349	0.131 19	36	15.347	0.131 33	24
25	15.218	0.138 59	35	15.216	0.138 72	25
26	15.080	0.146 43	34	15.078	0.146 56	26
27	14.933	0.154 75	33	14.931	0.154 87	27
28	14.777	0.163 57	32	14.775	0.163 69	28
29	14.612	0.172 92	31	14.610	0.173 03	29
30	14.437	0.182 83	30	14.435	0.182 94	30
31	14.251	0.193 33	29	14.249	0.193 44	31
32	14.054	0.204 46	28	14.053	0.204 57	32
33	13.846	0.216 26	27	13.844	0.216 36	33
34	13.625	0.228 75	26	13.624	0.228 85	34
35	13.392	0.241 98	25	13.390	0.242 08	35
36	13.144	0.255 99	24	13.142	0.256 09	36
37	12.882	0.270 82	23	12.880	0.270 93	37
38	12.605	0.286 53	22	12.603	0.286 64	38
39	12.311	0.303 16	21	12.309	0.303 27	39
40	12.000	0.320 76	20	11.998	0.320 88	40
41	11.671	0.339 38	19	11.669	0.339 51	41
42	11.323	0.359 10	18	11.320	0.359 23	42
43	10.954	0.379 96	17	10.952	0.380 10	43
44	10.564	0.402 03	16	10.561	0.402 19	44
45	10.151	0.425 39	15	10.149	0.425 56	45
46	9.715	0.450 11	14	9.712	0.450 28	46
47	9.253	0.476 26	13	9.249	0.476 45	47
48	8.764	0.503 94	12	8.760	0.504 15	48
49	8.246	0.533 24	11	8.242	0.533 46	49
50	7.698	0.564 26	10	7.694	0.564 49	50
51	7.118	0.597 11	9	7.114	0.597 35	51
52	6.503	0.631 91	8	6.499	0.632 16	52
53	5.851	0.668 79	7	5.847	0.669 04	53
54	5.160	0.707 91	6	5.156	0.708 15	54
55	4.427	0.749 41	5	4.423	0.749 65	55
56	3.648	0.793 50	4	3.645	0.793 70	56
57	2.820	0.840 36	3	2.817	0.840 52	57
58	1.939	0.890 24	2	1.937	0.890 34	58
59	1.000	0.943 40	1	1.000	0.943 40	59

AM92

6%

x	$\ddot{a}_{[x]:\overline{n}\rceil}$	$A_{[x]:\overline{n}\rceil}$	$n = 65 - x$	$\ddot{a}_{x:\overline{n}\rceil}$	$A_{x:\overline{n}\rceil}$	x
17	16.409	0.071 21	48	16.405	0.071 40	17
18	16.343	0.074 95	47	16.339	0.075 13	18
19	16.272	0.078 92	46	16.269	0.079 09	19
20	16.198	0.083 13	45	16.195	0.083 30	20
21	16.119	0.087 61	44	16.116	0.087 77	21
22	16.035	0.092 36	43	16.032	0.092 51	22
23	15.946	0.097 40	42	15.943	0.097 54	23
24	15.852	0.102 74	41	15.849	0.102 88	24
25	15.751	0.108 42	40	15.749	0.108 55	25
26	15.645	0.114 43	39	15.643	0.114 56	26
27	15.532	0.120 81	38	15.530	0.120 94	27
28	15.413	0.127 58	37	15.411	0.127 70	28
29	15.286	0.134 75	36	15.284	0.134 86	29
30	15.152	0.142 34	35	15.150	0.142 46	30
31	15.010	0.150 39	34	15.008	0.150 50	31
32	14.859	0.158 92	33	14.857	0.159 03	32
33	14.700	0.167 95	32	14.698	0.168 06	33
34	14.531	0.177 51	31	14.529	0.177 62	34
35	14.352	0.187 63	30	14.350	0.187 74	35
36	14.163	0.198 33	29	14.161	0.198 45	36
37	13.963	0.209 67	28	13.960	0.209 79	37
38	13.751	0.221 65	27	13.749	0.221 78	38
39	13.527	0.234 33	26	13.525	0.234 46	39
40	13.290	0.247 74	25	13.288	0.247 87	40
41	13.040	0.261 91	24	13.037	0.262 06	41
42	12.775	0.276 89	23	12.772	0.277 05	42
43	12.495	0.292 72	22	12.492	0.292 89	43
44	12.200	0.309 44	21	12.197	0.309 63	44
45	11.888	0.327 11	20	11.884	0.327 31	45
46	11.558	0.345 78	19	11.554	0.345 99	46
47	11.210	0.365 49	18	11.206	0.365 72	47
48	10.842	0.386 30	17	10.837	0.386 56	48
49	10.454	0.408 28	16	10.449	0.408 57	49
50	10.044	0.431 50	15	10.038	0.431 81	50
51	9.610	0.456 02	14	9.604	0.456 35	51
52	9.153	0.481 91	13	9.146	0.482 28	52
53	8.669	0.509 27	12	8.662	0.509 67	53
54	8.159	0.538 19	11	8.151	0.538 62	54
55	7.618	0.568 77	10	7.610	0.569 22	55
56	7.047	0.601 12	9	7.038	0.601 60	56
57	6.442	0.635 36	8	6.433	0.635 86	57
58	5.801	0.671 65	7	5.792	0.672 16	58
59	5.121	0.710 15	6	5.112	0.710 66	59
60	4.398	0.751 04	5	4.390	0.751 52	60
61	3.630	0.794 54	4	3.622	0.794 97	61
62	2.811	0.840 90	3	2.805	0.841 23	62
63	1.936	0.890 42	2	1.933	0.890 60	63
64	1.000	0.943 40	1	1.000	0.943 40	64

PENSIONER MORTALITY TABLES

PMA92 and PFA92 (Base tables)
and
PMA92C20 and PFA92C20 (Projected tables)

The Base tables are based on the mortality of pensioners insured by UK life offices during the years 1991, 1992, 1993, and 1994. Mortality is measured by amounts of annuities held.

The projected tables are projected to the calendar year 2020.

Full details are given in *C.M.I.R.* **16** and **17**. **PMA92**
PFA92

PROJECTION FORMULAE

The projected mortality rate applicable in a particular calendar year is calculated using the formula:

$$q_x^{Year}\,(projected) = q_x^{Base} \times RF(x,t) \quad \text{where} \quad t = Year - 1992$$

The reduction factor is calculated as: $RF(x,t) = \alpha + (1-\alpha)(1-f)^{t/20}$

The parameters used are:

Age range	α	f
$x < 60$	0.13	0.55
$60 \le x \le 110$	$1 - 0.87\left(\dfrac{110-x}{50}\right)$	$0.55\left(\dfrac{110-x}{50}\right) + 0.29\left(\dfrac{x-60}{50}\right)$
$x > 110$	1	0.29

PMA92Base

x	q_x
50	0.001 315
51	0.001 519
52	0.001 761
53	0.002 045
54	0.002 379
55	0.002 771
56	0.003 228
57	0.003 759
58	0.004 376
59	0.005 090
60	0.005 914
61	0.006 861
62	0.007 947
63	0.009 189
64	0.010 604
65	0.012 211
66	0.014 032
67	0.016 088
68	0.018 402
69	0.020 998
70	0.023 901
71	0.027 137
72	0.030 732
73	0.034 713
74	0.039 105
75	0.043 935
76	0.049 227
77	0.055 006
78	0.061 292
79	0.068 106
80	0.075 464
81	0.083 379
82	0.091 862
83	0.100 917
84	0.110 544
85	0.120 739
86	0.131 492
87	0.142 786
88	0.154 599
89	0.166 903
90	0.179 664
91	0.192 841
92	0.206 389
93	0.220 257
94	0.234 389
95	0.248 727
96	0.263 206
97	0.277 762
98	0.292 327
99	0.306 832
100	0.321 209
101	0.335 389
102	0.349 305
103	0.362 893
104	0.376 091
105	0.388 838

PFA92base

x	q_x
50	0.001 271
51	0.001 456
52	0.001 670
53	0.001 917
54	0.002 200
55	0.002 524
56	0.002 894
57	0.003 317
58	0.003 799
59	0.004 345
60	0.004 965
61	0.005 667
62	0.006 458
63	0.007 350
64	0.008 352
65	0.009 476
66	0.010 734
67	0.012 138
68	0.013 703
69	0.015 442
70	0.017 371
71	0.019 505
72	0.021 861
73	0.024 455
74	0.027 306
75	0.030 432
76	0.033 849
77	0.037 577
78	0.041 632
79	0.046 035
80	0.050 800
81	0.055 946
82	0.061 488
83	0.067 441
84	0.073 817
85	0.080 629
86	0.087 885
87	0.095 594
88	0.103 761
89	0.112 386
90	0.121 470
91	0.131 009
92	0.140 996
93	0.151 420
94	0.162 267
95	0.173 519
96	0.185 155
97	0.197 150
98	0.209 477
99	0.222 103
100	0.234 995
101	0.248 115
102	0.261 424
103	0.274 879
104	0.288 437
105	0.302 054

PMA92C20

x	l_x	d_x	q_x	μ_x	$\mathring{e}_x$	x
50	9 941.923	5.418	0.000 545	0.000 507	34.10	50
51	9 936.504	6.260	0.000 630	0.000 585	33.12	51
52	9 930.244	7.249	0.000 730	0.000 677	32.14	52
53	9 922.995	8.415	0.000 848	0.000 786	31.17	53
54	9 914.580	9.776	0.000 986	0.000 914	30.19	54
55	9 904.805	11.371	0.001 148	0.001 063	29.22	55
56	9 893.434	13.237	0.001 338	0.001 239	28.25	56
57	9 880.196	15.393	0.001 558	0.001 444	27.29	57
58	9 864.803	17.895	0.001 814	0.001 681	26.33	58
59	9 846.908	20.777	0.002 110	0.001 957	25.38	59
60	9 826.131	24.084	0.002 451	0.002 266	24.43	60
61	9 802.048	28.965	0.002 955	0.002 685	23.49	61
62	9 773.083	34.694	0.003 550	0.003 241	22.56	62
63	9 738.388	41.398	0.004 251	0.003 889	21.64	63
64	9 696.990	49.193	0.005 073	0.004 651	20.73	64
65	9 647.797	58.195	0.006 032	0.005 543	19.83	65
66	9 589.602	68.537	0.007 147	0.006 583	18.95	66
67	9 521.065	80.348	0.008 439	0.007 792	18.08	67
68	9 440.717	93.746	0.009 930	0.009 191	17.23	68
69	9 346.970	108.836	0.011 644	0.010 806	16.40	69
70	9 238.134	125.685	0.013 605	0.012 661	15.59	70
71	9 112.449	144.350	0.015 841	0.014 783	14.79	71
72	8 968.099	164.834	0.018 380	0.017 204	14.02	72
73	8 803.265	187.096	0.021 253	0.019 956	13.28	73
74	8 616.170	211.010	0.024 490	0.023 072	12.55	74
75	8 405.160	236.362	0.028 121	0.026 587	11.86	75
76	8 168.798	262.864	0.032 179	0.030 537	11.18	76
77	7 905.934	290.116	0.036 696	0.034 962	10.54	77
78	7 615.818	317.595	0.041 702	0.039 899	9.92	78
79	7 298.223	344.688	0.047 229	0.045 390	9.33	79
80	6 953.536	370.644	0.053 303	0.051 473	8.77	80
81	6 582.891	394.658	0.059 952	0.058 188	8.23	81
82	6 188.234	415.856	0.067 201	0.065 576	7.73	82
83	5 772.378	433.321	0.075 068	0.073 676	7.25	83
84	5 339.057	446.180	0.083 569	0.082 522	6.80	84
85	4 892.878	453.648	0.092 716	0.092 149	6.37	85
86	4 439.230	455.092	0.102 516	0.102 590	5.97	86
87	3 984.138	450.084	0.112 969	0.113 873	5.59	87
88	3 534.054	438.463	0.124 068	0.126 023	5.24	88
89	3 095.591	420.387	0.135 802	0.139 060	4.91	89
90	2 675.203	396.334	0.148 151	0.152 998	4.61	90
91	2 278.869	367.099	0.161 088	0.167 846	4.32	91
92	1 911.771	333.759	0.174 581	0.183 606	4.06	92
93	1 578.012	297.596	0.188 589	0.200 273	3.81	93
94	1 280.416	260.008	0.203 065	0.217 836	3.59	94
95	1 020.409	222.405	0.217 957	0.236 273	3.38	95
96	798.003	186.098	0.233 205	0.255 556	3.18	96
97	611.905	152.209	0.248 746	0.275 647	3.00	97
98	459.696	121.595	0.264 511	0.296 499	2.84	98
99	338.101	94.813	0.280 429	0.318 054	2.68	99
100	243.288	72.117	0.296 425	0.340 247	2.54	100
101	171.171	53.478	0.312 423	0.363 002	2.41	101
102	117.693	38.644	0.328 344	0.386 232	2.29	102
103	79.050	27.202	0.344 113	0.409 842	2.18	103
104	51.848	18.647	0.359 653	0.433 729	2.08	104
105	33.200	12.446	0.374 887	0.457 778	1.99	105

PFA92C20

x	l_x	d_x	q_x	μ_x	$\mathring{e}_x$	x
50	9 952.697	5.245	0.000 527	0.000 492	37.08	50
51	9 947.452	5.998	0.000 603	0.000 563	36.10	51
52	9 941.454	6.879	0.000 692	0.000 645	35.12	52
53	9 934.574	7.898	0.000 795	0.000 741	34.15	53
54	9 926.676	9.053	0.000 912	0.000 851	33.17	54
55	9 917.623	10.374	0.001 046	0.000 976	32.20	55
56	9 907.249	11.879	0.001 199	0.001 120	31.24	56
57	9 895.370	13.606	0.001 375	0.001 284	30.27	57
58	9 881.764	15.564	0.001 575	0.001 472	29.31	58
59	9 866.200	17.769	0.001 801	0.001 685	28.36	59
60	9 848.431	20.268	0.002 058	0.001 918	27.41	60
61	9 828.163	23.991	0.002 441	0.002 236	26.46	61
62	9 804.173	28.285	0.002 885	0.002 655	25.53	62
63	9 775.888	33.248	0.003 401	0.003 135	24.60	63
64	9 742.640	38.932	0.003 996	0.003 691	23.68	64
65	9 703.708	45.423	0.004 681	0.004 332	22.78	65
66	9 658.285	52.802	0.005 467	0.005 069	21.88	66
67	9 605.483	61.158	0.006 367	0.005 914	21.00	67
68	9 544.325	70.580	0.007 395	0.006 882	20.13	68
69	9 473.745	81.124	0.008 563	0.007 986	19.28	69
70	9 392.621	92.874	0.009 888	0.009 240	18.44	70
71	9 299.747	105.887	0.011 386	0.010 663	17.62	71
72	9 193.860	120.210	0.013 075	0.012 272	16.81	72
73	9 073.650	135.860	0.014 973	0.014 086	16.03	73
74	8 937.791	152.836	0.017 100	0.016 126	15.27	74
75	8 784.955	171.113	0.019 478	0.018 414	14.52	75
76	8 613.841	190.598	0.022 127	0.020 974	13.80	76
77	8 423.243	211.162	0.025 069	0.023 829	13.10	77
78	8 212.080	232.615	0.028 326	0.027 004	12.42	78
79	7 979.465	254.729	0.031 923	0.030 527	11.77	79
80	7 724.737	277.179	0.035 882	0.034 425	11.14	80
81	7 447.558	299.593	0.040 227	0.038 728	10.54	81
82	7 147.965	321.523	0.044 981	0.043 464	9.96	82
83	6 826.442	342.455	0.050 166	0.048 664	9.41	83
84	6 483.987	361.832	0.055 804	0.054 357	8.88	84
85	6 122.154	379.053	0.061 915	0.060 576	8.37	85
86	5 743.101	393.506	0.068 518	0.067 349	7.89	86
87	5 349.595	404.595	0.075 631	0.074 708	7.43	87
88	4 945.000	411.770	0.083 270	0.082 686	7.00	88
89	4 533.230	414.537	0.091 444	0.091 308	6.59	89
90	4 118.693	412.545	0.100 164	0.100 604	6.20	90
91	3 706.149	405.590	0.109 437	0.110 601	5.84	91
92	3 300.559	393.644	0.119 266	0.121 325	5.49	92
93	2 906.914	376.882	0.129 650	0.132 801	5.17	93
94	2 530.033	355.677	0.140 582	0.145 048	4.87	94
95	2 174.356	330.617	0.152 053	0.158 084	4.58	95
96	1 843.738	302.467	0.164 051	0.171 926	4.32	96
97	1 541.271	272.119	0.176 555	0.186 586	4.07	97
98	1 269.152	240.562	0.189 545	0.202 071	3.84	98
99	1 028.591	208.795	0.202 991	0.218 386	3.62	99
100	819.796	177.783	0.216 863	0.235 531	3.41	100
101	642.013	148.385	0.231 125	0.253 502	3.22	101
102	493.627	121.303	0.245 737	0.272 288	3.05	102
103	372.325	97.048	0.260 654	0.291 872	2.89	103
104	275.277	75.930	0.275 830	0.312 234	2.73	104
105	199.347	58.053	0.291 217	0.333 348	2.59	105

4%

PMA92C20				PFA92C20		
x	$\ddot{a}_x$	${}^2A_x$		x	$\ddot{a}_x$	${}^2A_x$
50	18.843	0.088 02		50	19.539	0.074 21
51	18.567	0.094 71		51	19.291	0.079 78
52	18.281	0.101 87		52	19.034	0.085 74
53	17.985	0.109 54		53	18.768	0.092 11
54	17.680	0.117 73		54	18.494	0.098 91
55	17.364	0.126 47		55	18.210	0.106 16
56	17.038	0.135 80		56	17.917	0.113 90
57	16.702	0.145 74		57	17.615	0.122 14
58	16.356	0.156 32		58	17.303	0.130 91
59	15.999	0.167 56		59	16.982	0.140 24
60	15.632	0.179 50		60	16.652	0.150 15
61	15.254	0.192 17		61	16.311	0.160 68
62	14.868	0.205 50		62	15.963	0.171 77
63	14.475	0.219 50		63	15.606	0.183 43
64	14.073	0.234 16		64	15.242	0.195 66
65	13.666	0.249 46		65	14.871	0.208 47
66	13.252	0.265 38		66	14.494	0.221 83
67	12.834	0.281 90		67	14.111	0.235 76
68	12.412	0.298 99		68	13.723	0.250 22
69	11.988	0.316 60		69	13.330	0.265 21
70	11.562	0.334 69		70	12.934	0.280 69
71	11.136	0.353 20		71	12.535	0.296 64
72	10.711	0.372 08		72	12.135	0.313 02
73	10.288	0.391 25		73	11.734	0.329 80
74	9.870	0.410 65		74	11.333	0.346 93
75	9.456	0.430 21		75	10.933	0.364 37
76	9.049	0.449 84		76	10.536	0.382 07
77	8.649	0.469 47		77	10.142	0.399 97
78	8.258	0.489 03		78	9.752	0.418 02
79	7.877	0.508 44		79	9.367	0.436 16
80	7.506	0.527 62		80	8.989	0.454 33
81	7.148	0.546 50		81	8.618	0.472 47
82	6.801	0.565 01		82	8.254	0.490 53
83	6.468	0.583 10		83	7.900	0.508 45
84	6.148	0.600 71		84	7.555	0.526 16
85	5.842	0.617 79		85	7.220	0.543 63
86	5.551	0.634 29		86	6.896	0.560 80
87	5.273	0.650 19		87	6.582	0.577 62
88	5.010	0.665 45		88	6.281	0.594 05
89	4.762	0.680 06		89	5.991	0.610 06
90	4.527	0.693 99		90	5.713	0.625 60
91	4.306	0.707 25		91	5.447	0.640 66
92	4.098	0.719 83		92	5.193	0.655 20
93	3.903	0.731 74		93	4.951	0.669 21
94	3.721	0.742 97		94	4.722	0.682 68
95	3.551	0.753 56		95	4.504	0.695 59
96	3.393	0.763 50		96	4.297	0.707 94
97	3.245	0.772 82		97	4.102	0.719 73
98	3.109	0.781 55		98	3.918	0.730 97
99	2.982	0.789 69		99	3.744	0.741 64
100	2.864	0.797 28		100	3.581	0.751 77
101	2.755	0.804 34		101	3.428	0.761 36
102	2.655	0.810 89		102	3.284	0.770 43
103	2.562	0.816 96		103	3.149	0.778 99
104	2.477	0.822 57		104	3.023	0.787 05
105	2.399	0.827 74		105	2.905	0.794 63

Note. ${}^2A_x = A_x$ at 8.16%.

PMA92C20 and PFA92C20

4%

$\ddot{a}_{xy}$ for male (x) and female (y)

Age difference d $(= y - x)$

x \ d	−20	−10	−5	−4	−3	−2	−1	0	+1	+2	+3	+4	+5	+10	+20	x
50	18.746	18.493	18.192	18.110	18.019	17.918	17.808	17.688	17.556	17.413	17.258	17.090	16.909	15.801	12.638	50
51	18.467	18.206	17.894	17.809	17.715	17.612	17.498	17.374	17.238	17.091	16.931	16.758	16.572	15.433	12.232	51
52	18.179	17.908	17.586	17.499	17.402	17.295	17.178	17.050	16.910	16.758	16.594	16.416	16.225	15.057	11.823	52
53	17.881	17.601	17.269	17.178	17.078	16.968	16.848	16.716	16.572	16.415	16.246	16.064	15.867	14.672	11.413	53
54	17.573	17.283	16.941	16.847	16.744	16.631	16.507	16.371	16.223	16.062	15.888	15.701	15.499	14.279	11.004	54
55	17.255	16.955	16.602	16.506	16.400	16.284	16.156	16.016	15.864	15.699	15.521	15.328	15.121	13.880	10.595	55
56	16.926	16.617	16.253	16.155	16.046	15.926	15.795	15.651	15.495	15.326	15.143	14.945	14.733	13.473	10.189	56
57	16.587	16.269	15.894	15.793	15.681	15.558	15.423	15.276	15.116	14.942	14.755	14.553	14.337	13.061	9.786	57
58	16.238	15.910	15.525	15.421	15.306	15.180	15.041	14.891	14.727	14.549	14.357	14.151	13.932	12.644	9.387	58
59	15.879	15.541	15.146	15.039	14.921	14.791	14.650	14.495	14.327	14.145	13.950	13.742	13.520	12.222	8.993	59
60	15.509	15.161	14.756	14.646	14.526	14.393	14.248	14.090	13.918	13.734	13.536	13.325	13.101	11.796	8.605	60
61	15.129	14.772	14.356	14.244	14.121	13.985	13.837	13.675	13.501	13.314	13.114	12.901	12.675	11.368	8.224	61
62	14.740	14.374	13.949	13.834	13.708	13.569	13.418	13.254	13.078	12.888	12.686	12.472	12.245	10.939	7.851	62
63	14.343	13.968	13.533	13.416	13.287	13.145	12.992	12.826	12.648	12.458	12.255	12.039	11.812	10.511	7.487	63
64	13.939	13.555	13.111	12.991	12.859	12.716	12.561	12.394	12.215	12.023	11.819	11.604	11.376	10.085	7.133	64
65	13.529	13.136	12.682	12.560	12.427	12.282	12.126	11.958	11.778	11.586	11.382	11.167	10.940	9.662	6.790	65
66	13.112	12.711	12.248	12.125	11.991	11.845	11.688	11.520	11.339	11.147	10.944	10.729	10.504	9.243	6.457	66
67	12.692	12.282	11.811	11.687	11.552	11.406	11.248	11.080	10.900	10.708	10.506	10.293	10.070	8.830	6.137	67
68	12.267	11.849	11.372	11.247	11.112	10.966	10.808	10.640	10.460	10.270	10.070	9.859	9.639	8.423	5.829	68
69	11.840	11.414	10.933	10.807	10.672	10.526	10.369	10.201	10.023	9.835	9.637	9.429	9.213	8.025	5.533	69
70	11.412	10.978	10.494	10.368	10.233	10.088	9.932	9.766	9.590	9.404	9.209	9.005	8.792	7.636	5.250	70
75	9.295	8.833	8.357	8.238	8.110	7.975	7.831	7.679	7.520	7.355	7.182	7.005	6.822	5.860	4.027	75
80	7.335	6.876	6.441	6.336	6.224	6.107	5.985	5.857	5.725	5.588	5.449	5.306	5.161	4.422	3.108	80
85	5.660	5.235	4.864	4.777	4.687	4.593	4.496	4.396	4.294	4.189	4.084	3.977	3.870	3.340	2.449	85
90	4.339	3.963	3.664	3.597	3.528	3.456	3.384	3.310	3.235	3.160	3.084	3.008	2.933	2.571	1.998	90
95	3.361	3.039	2.808	2.757	2.706	2.654	2.602	2.549	2.496	2.444	2.391	2.339	2.288	2.049	1.708	95
100	2.670	2.400	2.223	2.186	2.149	2.112	2.075	2.038	2.001	1.965	1.930	1.895	1.861	1.708	1.000	100

Exam Permit

Member Number: MAHA00035
Surname: Maharaj
Candidate Number: A213-exa-2020-2-Vir-0001-1NVWF

Dear Ratul Maharaj

This letter serves as your entry permit for the forthcoming examination for which you have been entered. Please check all details (date, venue) to ensure that they are correct. You must bring this permit with you to your exam.

EXAM DETAILS

Start Date:	02 Oct 2020 09:00
End Date:	02 Oct 2020 15:45
Subject:	A213 - Contingencies
Exam Venue:	Virtual
Medium:	Both written and typed sections

IMPORTANT NOTICE:
Please be reminded that the following calculators ONLY are permitted:

Casio FX82 (with/without any suffix)	Sharp ELW535 (with/without any prefix/suffix)
Casio FX83 (with/without any suffix)	Sharp EL531 (with/without any prefix/suffix)
Casio FX85 (with/without any suffix)	Texas Instruments BA II Plus (with/without any suffix)
Hewlett Packard HP12c (with/without any suffix)	Texas Instruments TI-30 (with/without any suffix)

For further information on exam logistics e.g. venue, please click here
For further information on exam policies, please click here
Should you have any queries, please contact the Actuarial Society of South Africa:

Senior Education Administrator
Bobbie Beukes
bbeukes@actuarialsociety.org.za

Head of Administration
Michelle Abrahams
mabrahams@actuarialsociety.org.za

Kind regards,
Actuarial Society of South Africa
http://www.actuarialsociety.org.za