UNIVERSITY
OF
JOHANNESBURG

Department of Finance and Investment Management

Advanced Diploma in Property Valuation and Management / Bridging Programme in Finance

Business Mathematics

S3BPIQ1/BPIF001

LAST ASSESSMENT OPPORTUNITY

November 2016

Time: 2½ hours **Marks: 100**

Assessor: Prof G Els

Moderators: Prof I Botha (UJ)
Dr M Reyers (UP)

INSTRUCTIONS:

- This paper consists of **15** pages (including an annexure).
- Answer ALL questions on computer as instructed by invigilators.
- Silent, non-programmable calculators may be used, unless otherwise instructed.
- Round all calculations to **TWO** decimal places unless instructed otherwise.

This question paper SHOULD be handed in before leaving the examination venue.

1. By solving the inequality $\frac{1}{3}(x-3) > \frac{1}{2}(x+2)$, the answer will be ...

A $x < -10$
B $x < -12$
C $x < -14$
D $x < -15$

(2)

2. The value 108.76 rounded to the nearest whole number is ...

A 106
B 107
C 108
D 109

(1)

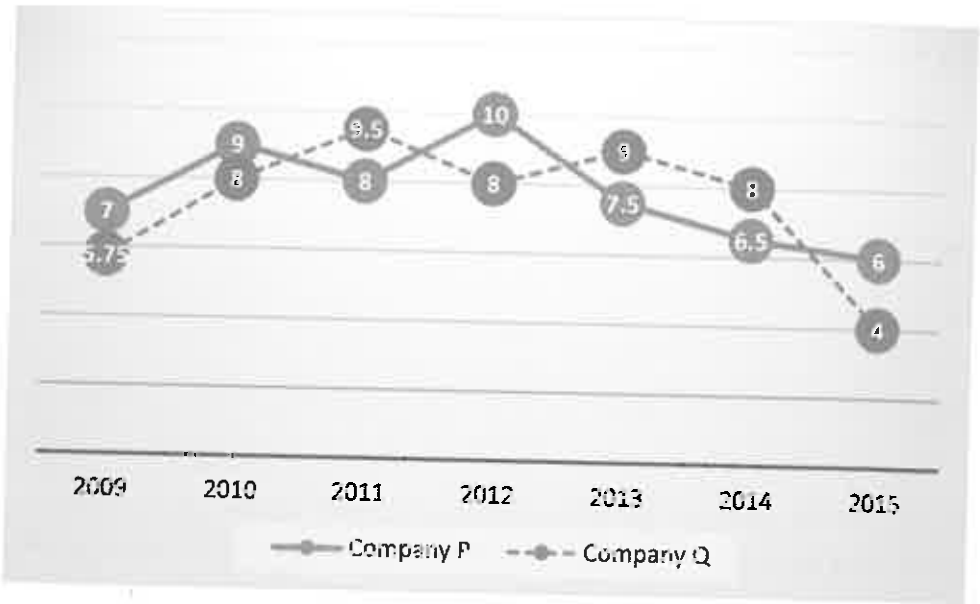
3. The correct value of 0.006472867 up to three significant figures is ...

A 0.00647
B 0.006
C 0.00867
D 0.647

(1)

Refer to the following information and graph and answer questions 4. – 7.:

Two different finance companies declare fixed annual rate of interest on the amounts invested with them by investors. The rate of interest offered by these companies may differ from year to year depending on the variation in the economy of the country and the central bank's rate of interest. The annual rate of interest offered by the two companies (P and Q) over a number of years are shown by the line graph provided below.



4. A sum of R475 000 was invested in Company Q in 2012 for one year. How much more interest would have been earned if the sum was invested in Company P?

A R19 000
B R14 250
C R11 750
D R9 500

(1)

5. If two different amounts are invested in Companies P and Q respectively in 2015 in the ratio 8:9, the amounts received after one year as interest from Companies P and Q are respectively in the ratio ...

A 2 : 3
B 3 : 4
C 4 : 3
D 6 : 7

(1)

6. In 2013, a part of R30 000 was invested in Company P and the rest was invested in Company Q for one year. The total interest received was R2 430. What was the amount invested in Company P?

A R9 000
B R11 000
C R12 000
D R18 000

(1)

7. An investor invested a sum of R120 000 in Company P in 2011. The total amount received after one year was re-invested in the same company for one more year. The total appreciation received by the investor on his investment was ...

A R22 560
B R21 600
C R24 220
D R29 620

(1)

8. Simplifying expression: $\frac{9(a-b)}{27(a-b)^2}$

A $\frac{1}{3(b-a)}$
B $\frac{1}{3(a-b)}$
C $\frac{a-b}{3}$
D $3a-b$

(2)

9. The salaries of A, B and C are in the ratio 1:2:3. The monthly sum of the salaries of B and C is R60 000. By what percentage is the salary of C more than that of A?

A 100
B 300
C 200
D 600

(1)

10. Determine the value of the unknown in the following: $\sqrt{x^2} = 110$. **(1)**

11. Howard borrowed 20% of what he needed to buy a new soccer ball. If he borrowed R25, what does the soccer ball costs? **(1)**

12. A pair of shoes has a marked price of R135,50. The mark-up percentage was 30%. Calculate the cost price. **(1)**

13. Which TWO of the following presents 148% as a common fraction in simplified form?

A $\frac{100}{148}$
B $\frac{37}{25}$
C $1\frac{12}{25}$
D 1.48

(2)

14. Convert 1,256 cm to millimetres. **(1)**

15. Convert 150 minutes to hours. **(1)**

16. For which quadratic equation is the axis of symmetry $x = 3$?

A $y = -x^2 + 3x + 5$
B $y = x^2 + 6x + 3$
C $y = -x^2 + 6x + 2$
D $y = x^2 + x + 3$

(2)

17. Which of the following are considered measures of association?

A Mean and variance
B Variance and correlation
C Covariance and correlation
D Covariance and variance

(1)

18. For a boxplot, the vertical line inside the box indicates the location of the ...

A mean.
B median.
C minimum value.
D maximum value.

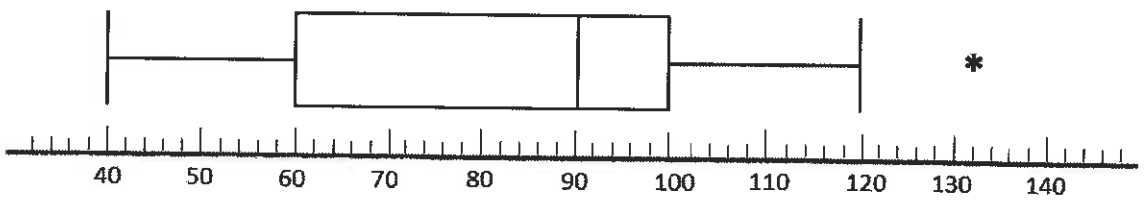
(1)

19. For a 'more than' ogive graph, the *x*-axis represents ...

A upper limits of class-intervals.
B mid-values of class-intervals.
C lower limits of class-intervals.
D frequency.

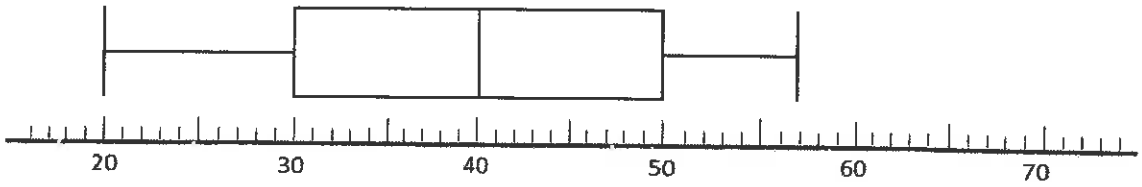
(1)

20. As part of a focus group, participants were asked to record how much time they spent listening to the radio on a weekly basis. The following box-and-whisker plot shows the results.



What is the value of the outlier? **(2)**

21. The Department of Transport collects data concerning waiting times for patrons to renew motor vehicle licenses. The following box-and-whisker plot shows the results.



What percentage of people waits between 40 and 50 minutes to renew their motor vehicle license?

A 25%
B 50%
C 75%
D 100%

(2)

Refer to the following information and answer questions 22. – 29.:

In a survey conducted at a local High School in Soweto, learners were asked the time (to the nearest minute) that they usually take to travel to school each day. The responses to this question are shown in the table below:

Time taken (minutes)	Number of learners	% of learners
0 to less than 10	195	15,6
10 to less than 20	340	27,2
20 to less than 30	185	**(A)**
30 to less than 40	280	22,4
40 to less than 50	90	7,2
50 to less than 60	30	2,4
60 to less than 70	75	6,0
70 to less than 80	**(B)**	4,4

22. Calculate the missing value of **(A)** correct to 1 d.p. **(1)**

23. Calculate the missing value of **(B)**. **(2)**

24. What percentage (correct to the nearest whole number) of the learners take 40 minutes or more to travel to school? **(2)**

One of the learners in the school decided to make use of this data and tried to determine the median time taken to travel to school each day using this formula:

$$\text{Median} = C\left(\frac{625 - D}{E}\right) + F$$

Provide the missing values depicted by the letters **(C)** – **(F)**.

25. **(C) = ...** **(1)**

26. **(D) = ...** **(1)**

27. **(E) = ...** **(1)**

28. **(F) = ...** **(1)**

29. After calculating the median value, the learner found it to be closest to ... minutes.

A 20
B 22
C 24
D 26

(2)

30. What does the length of a Box-Whisker (box) plot tell you about the data set?

A How many quartiles the box plot has
B How many data points are in the data set
C How close or far apart the data is grouped
D How many times a certain data value occurs

(2)

31. Evan baked 5 chocolate-chip biscuits. Some biscuits ended up with more chocolate chips than others:

6 chocolate chips	7 chocolate chips
9 chocolate chips	3 chocolate chips
1 chocolate chip	

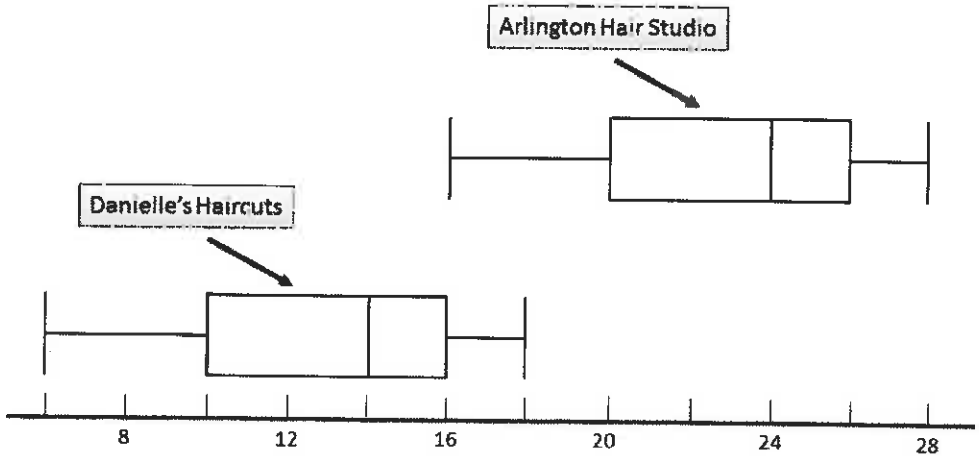
What is the standard deviation of the numbers of chocolate chips, correct to 1 d.p.?

A 2.8
B 2.9
C 8.1
D 8.16

(2)

Refer to the following information and answer questions 32. & 33.:

Bianca wanted to work as a stylist at a popular salon. Before applying she spent a few days tracking how many clients each salon had per day. The following box-and-whisker plot shows the results.



32. Which salon has a lower maximum value?

A Danielle's Haircuts
B Arlington Hair Studio

(1)

33. The inter quartile range for Arlington Hair Studio is ... **(2)**

34. In a recent raffle, tickets (numbered 1 to 20) were mixed up and then a ticket was drawn at random. What is the probability that the ticket drawn had a number which is a multiple of 3 or 5?

A $\frac{1}{2}$
B $\frac{2}{5}$
C $\frac{8}{15}$
D $\frac{9}{20}$

(2)

35. In a box, there are 8 red, 7 blue and 6 green balls. One ball is picked up randomly. What is the probability that it is neither red nor green?

A $\frac{1}{3}$
B $\frac{3}{4}$
C $\frac{7}{19}$
D $\frac{8}{21}$
E $\frac{9}{21}$

(2)

36. Three unbiased coins are tossed. What is the probability of getting at most two heads?

A $\frac{3}{4}$
B $\frac{1}{4}$
C $\frac{3}{8}$
D $\frac{7}{8}$

(2)

37. In a lottery (drawn at random), there are 10 prizes and 25 blanks. What is the probability of getting a prize?

A $\frac{1}{10}$
B $\frac{2}{5}$
C $\frac{2}{7}$
D $\frac{5}{7}$

(2)

38. If you flip a fair coin 10 times, which ONE of the following is true?

A The number of heads will equal the number of tails.
B The probability of all heads is greater than the probability of all tails.
C The probability of HHHHHHHHHH = the probability of HTHTHTHTHT.
D The probability of HHHHHHHHHH < the probability of HTHTHTHTHT.

(1)

Refer to the following information and answer questions 39. – 41.:

A survey of 120 business executives revealed the following results:

- 80 read the Financial Times
- 60 read the Economist
- 40 read both the Financial Times and the Economist

39. If an executive is picked at random, find the probability that he or she reads both the Financial Times and the Economist.

A 0.333
B 0.833
C 0.166
D 0.500

(2)

40. If an executive is picked at random find the probability that he or she reads either the Financial Times or the Economist.

A 0.333
B 0.833
C 0.166
D 0.500

(2)

41. If an executive is selected at random what is the probability that they read either the Financial Times or the Economist but not both

A 0.333
B 0.833
C 0.166
D 0.500

(2)

42. $P(Z < -1.983)$, where Z is a standard normal random variable is closest to ...

A 0.0237
B 0.9763
C 0.4763
D 0.0559

(2)

43. If Z is a standard normal random variable, and $P(Z > c) = 0.65$, then the value of c is closest to ...

A −0.2578
B 0.2578
C −0.3853
D 0.3853

(2)

44. Find the z-score that corresponds to a cumulative area of 0.4761. **(2)**

45. The cost of treatment per patient for a certain medical condition was modelled by an insurance company as a normal random variable with mean R7 750 and standard deviation R1 500. What is the probability that the treatment cost of a patient is less than R10 000, based on this model?

A .5000
B .3531
C .8531
D .9332

(2)

46. The diameters of steel disks produced in a plant are normally distributed with a mean of 2.5 cm and standard deviation of .02 cm. The probability that a disk picked at random has a diameter greater than 2.54 cm is about ...

A .5080
B .2000
C .4772
D .0228

(2)

47. If the slope of the regression line is calculated to be 2.5 and the intercept 16, then the value of Y when X is 4 is ...

A 2,5.
B 66,5.
C 26.
D 16.

(2)

48. If Spearman's coefficient of rank correlation is equal to one, then ...

A the rankings of the two variables partially agree.
B the rankings of the two variables totally agree.
C all the 'total variation' is 'explained' by the regression line.
D the rankings of the two variables is totally different.

(1)

Refer to the following information and answer questions 49. – 51.:

A medical researcher was trying to predict the weight of a new-born given some information about its mother and prenatal care.

- WT is the birth weight
- MWT is the mothers weight before getting pregnant
- WTGN is how much weight the mother gained during pregnancy
- SMK is how many cigarettes a day the mother smoked during pregnancy
- PRN is how far into the pregnancy the mother was when she began receiving prenatal care.

Use this matrix to answer the following question.

	WT	MWT	SMK	WTGN	PRN
WT	1.000				
MWT	0.674	1.000			
SMK	-0.962	-0.947	1.000		
WTGN	0.239	0.258	-0.442	1.000	
PRN	-0.173	-0.214	0.002	0.211	1.000

49. According to the matrix, what is the correlation between smoking and weight gain?

A -.962
B -.947
C -.442
D .211

(1)

50. Which of the variables is likely to be the SINGLE best predictor of WT?

A MWT
B WTGN
C SMK
D PRN

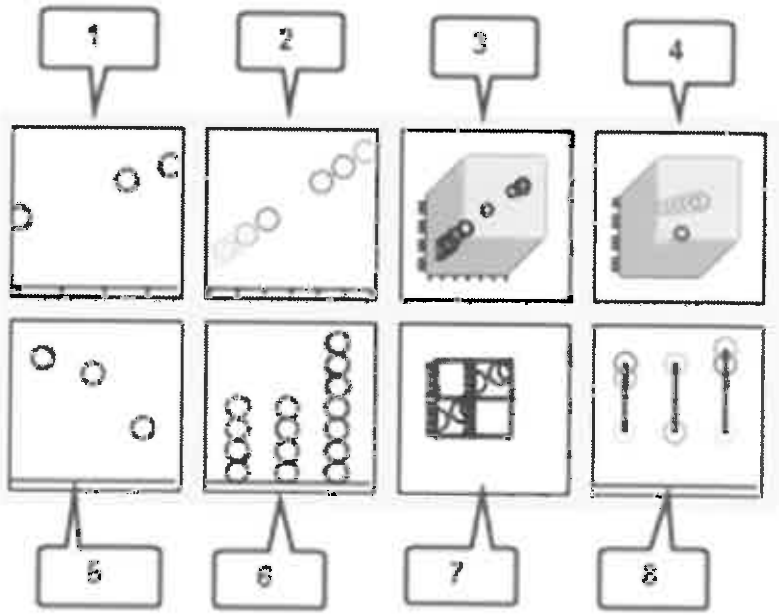
(1)

51. What is the coefficient of determination for the relationship between smoking and mothers' weight?

A .947
B -.947
C .897
D -.897

(1)

52. With reference to the figure below, a scatterplot is selected by clicking the picture labelled with ...



A figure 7.
B figure 4.
C figure 3.
D figure 1. **(1)**

Refer to the following information and answer questions 53. – 57.:

During monitoring of a rejuvenation project in one of the KwaZulu-Natal wetlands, an ecologist collected data from an area of the wetland that had been restored in a previous year. In order to assess whether a correlation existed between the two plant species she studied or whether they were growing independently of one another, she wanted to calculate Spearman's Correlation Coefficient.

Wetland quadrant	% cover of Plant Species A	Ranking of A	% cover of Plant Species B	Ranking of B
1	5		0	
2	40	**(A)**	0	
3	50		5	
4	5		0	
5	10		0	
6	25		0	
7	0	**(B)**	1	**(C)**
8	4		0	
9	0		0	
10	0		1	**(D)**
11	10		6	
12	2		0.5	

Refer to the above table, and determine the values of **(A)** – **(D)** correct to 1 d.p.

53. (A) = ... **(1)**

54. (B) = ... **(1)**

55. (C) = ... **(1)**

56. (D) = ... **(1)**

57. If $\sum d^2 = 264{,}5$, then R = ... (correct to 3 d.p.). **(2)**

Refer to the following information and answer questions 58. – 61.:

Dairy Queen (Pty) Ltd, a highly seasonal business, has reported quarterly net profit figures for 2011 – 2015.

Period	Net profit (R mil)	8 point moving total	8 point moving average	*Proportion of trend (sales ÷ trend)*
1	4.374			
2	8.227			
3	10.185	55.874	6.984	0.6857
4	5.135	56.353	7.044	1.3718
5	4.406	57.151	7.144	1.6214
6	8.674	57.846	7.231	0.8336
7	10.536	58.332	7.292	0.6921
8	5.479	58.527	**(P)**	1.3353
9	4.548	58.721	7.340	1.6139
10	8.727	59.319	7.415	0.8496
11	10.677	59.842	7.480	0.7006
12	5.936	60.441	7.555	1.2728
13	4.614	61.944	7.743	1.6782
14	9.260	63.361	**(Q)**	0.8553
15	11.647	64.104	8.013	0.6880
16	6.383	64.988	8.124	1.2727
17	4.910	65.676	8.210	**(R)**
18	9.848	66.105	8.263	**(S)**
19	11.747			
20	6.712			

Refer to the above table, and determine the values of **(P)** – **(S)** correct to 3 d.p.

58. (P) = ... **(1)**

59. (Q) = ... **(1)**

60. (R) = ... **(1)**

61. (S) = ... **(1)**

Refer to the following information and answer questions 62. – 67.:

Based on the calculations on the previous page, the summarised seasonal variations can be found in the table below:

	Q1	Q2	Q3	Q4	
2011			0.6857	1.3718	
2012	1.6214	0.8336	**(T)**	1.3353	
2013	1.6139	0.8497	0.7006	1.2728	
2014	1.6782	0.8553	0.6880	**(U)**	
2015	1.6720	0.8391			
	6.5855	3.3777	**(V)**	**(W)**	
Average	1.6464	0.8444	0.6916	1.3132	
Adjustment					
Quarterly variation					4.0000

Refer to the above table, and determine the values of **(T)** – **(W)** correct to 4 d.p.

62. **(T)** = ... **(2)**

63. **(U)** = ... **(2)**

64. **(V)** = ... **(2)**

65. **(W)** = ... **(2)**

66. The average adjustment for **Q2** is ...

A 0.1239
B –0.1239
C 1.6464
D 0.8444

(2)

67. The average adjusted variation for **Q1** is ...

A –0.1239
B 1.5225
C 1.6464
D 0.5855

(2)

68. The difference between the actual value of the time series and the forecasted value is called ...

A residual.
B sum of variation.
C sum of squares of residual.
D All of the above

(1)

FORMULAE AND NORMAL DISTRIBUTION TABLE

$$k = 1 + 3{,}3\log(n)$$

$$w = \frac{max - min}{k}$$

$$M = l + i\left(\frac{\frac{n}{2} - cf}{f}\right)$$

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{\sum fx}{\sum f}$$

$$\bar{x} = \frac{\sum fx_{mid}}{\sum f}$$

$$IQR = Q_3 - Q_1$$

$$\text{SIQR} = \frac{Q_3 - Q_1}{2}$$

$$\text{SD} = \sqrt{\frac{\sum x^2}{n} - \bar{x}^2}$$

$$\text{s} = \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2}$$

$$\text{s} = \sqrt{\frac{\sum fx_{mid}^2}{\sum f} - \bar{x}^2}$$

$$P(\bar{E}) = 1 - P(E)$$

$$P(\text{A or B}) = P(\text{A} \cup \text{B}) = P(\text{A}) + P(\text{B})$$

$$P(\text{A or B}) = P(\text{A} \cup \text{B})$$

$$= P(\text{A}) + P(\text{B}) - P(\text{A and B})$$

$$P(\text{A and B}) = P(\text{A} \cap \text{B}) = P(\text{A}) \times P(\text{B})$$

$$P(\text{A and B}) = P(\text{A} \cap \text{B}) = P(\text{B}) \times P(\text{A}|\text{B})$$

$$z = \frac{x - \mu}{\sigma}$$

$$y = a + bx$$

$$b = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2}$$

$$a = \bar{y} - b\bar{x}$$

$$r = \frac{\sum xy - n\bar{x}\bar{y}}{\sqrt{(\sum x^2 - n\bar{x}^2)(\sum y^2 - n\bar{y}^2)}}$$

$$R = r_{rank} = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$$

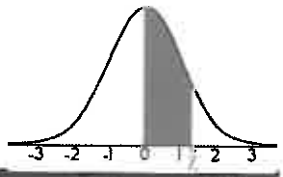
$$Y = T \times S \times C \times I$$

$$Y = T + S + C + I$$

FORMULAE AND NORMAL DISTRIBUTION TABLE

Areas under the normal distribution curve

This table provides the area under normal curve between the mean and the point z standard deviations above the mean. The corresponding area for deviations below the mean can be found by symmetry.



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.091	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.291	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998