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# NUMERACY & STATISTICS

Friday 10<sup>th</sup> June 2022

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## Time allowed

Three hours

## Instructions

- Ensure that you pay particular attention to words in **bold**.
- Write the question number next to each answer in your answer booklet.
- You are **not** required to rewrite the question in your answer booklet.
- Show all your workings.

## Information

- Different questions may carry a different number of marks.
- Marks for each question are shown in [ ].
- Questions start on page 4.

## Advice

- Read each question carefully before you start to answer it.
- Use the full time permitted and check all your answers.

## Materials

- Notes or books are **not** permitted.
- Non-programmable calculators are permitted.



ICM

## FORMULA SHEET

### Quadratic Formula

For a quadratic equation in the form  $ax^2 + bx + c = 0$ :

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

### Normal Distribution

The z score for a normal distribution:

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

**STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.**

**Table of the standard normal distribution values ( $z \leq 0$ )**

<b>z</b>	<b>0.00</b>	<b>0.01</b>	<b>0.02</b>	<b>0.03</b>	<b>0.04</b>	<b>0.05</b>	<b>0.06</b>	<b>0.07</b>	<b>0.08</b>	<b>0.09</b>
-0.0	0.50000	0.49601	0.49202	0.48803	0.48405	0.48006	0.47608	0.47210	0.46812	0.46414
-0.1	0.46017	0.45621	0.45224	0.44828	0.44433	0.44038	0.43644	0.43251	0.42858	0.42466
-0.2	0.42074	0.41683	0.41294	0.40905	0.40517	0.40129	0.39743	0.39358	0.38974	0.38591
-0.3	0.38209	0.37828	0.37448	0.37070	0.36693	0.36317	0.35942	0.35569	0.35197	0.34827
-0.4	0.34458	0.34090	0.33724	0.33360	0.32997	0.32636	0.32276	0.31918	0.31561	0.31207
-0.5	0.30854	0.30503	0.30153	0.29806	0.29460	0.29116	0.28774	0.28434	0.28096	0.27760
-0.6	0.27425	0.27093	0.26763	0.26435	0.26109	0.25785	0.25463	0.25143	0.24825	0.24510
-0.7	0.24196	0.23885	0.23576	0.23270	0.22965	0.22663	0.22363	0.22065	0.21770	0.21476
-0.8	0.21186	0.20897	0.20611	0.20327	0.20045	0.19766	0.19489	0.19215	0.18943	0.18673
-0.9	0.18406	0.18141	0.17879	0.17619	0.17361	0.17106	0.16853	0.16602	0.16354	0.16109
-1.0	0.15866	0.15625	0.15386	0.15151	0.14917	0.14686	0.14457	0.14231	0.14007	0.13786
-1.1	0.13567	0.13350	0.13136	0.12924	0.12714	0.12507	0.12302	0.12100	0.11900	0.11702
-1.2	0.11507	0.11314	0.11123	0.10935	0.10749	0.10565	0.10384	0.10204	0.10027	0.09853
-1.3	0.09680	0.09510	0.09342	0.09176	0.09012	0.08851	0.08692	0.08534	0.08379	0.08226
-1.4	0.08076	0.07927	0.07780	0.07636	0.07493	0.07353	0.07215	0.07078	0.06944	0.06811
-1.5	0.06681	0.06552	0.06426	0.06301	0.06178	0.06057	0.05938	0.05821	0.05705	0.05592
-1.6	0.05480	0.05370	0.05262	0.05155	0.05050	0.04947	0.04846	0.04746	0.04648	0.04551
-1.7	0.04457	0.04363	0.04272	0.04182	0.04093	0.04006	0.03920	0.03836	0.03754	0.03673
-1.8	0.03593	0.03515	0.03438	0.03363	0.03288	0.03216	0.03144	0.03074	0.03005	0.02938
-1.9	0.02872	0.02807	0.02743	0.02680	0.02619	0.02559	0.02500	0.02442	0.02385	0.02330
-2.0	0.02275	0.02222	0.02169	0.02118	0.02068	0.02018	0.01970	0.01923	0.01876	0.01831
-2.1	0.01786	0.01743	0.01700	0.01659	0.01618	0.01578	0.01539	0.01500	0.01463	0.01426
-2.2	0.01390	0.01355	0.01321	0.01287	0.01255	0.01222	0.01191	0.01160	0.01130	0.01101
-2.3	0.01072	0.01044	0.01017	0.00990	0.00964	0.00939	0.00914	0.00889	0.00866	0.00842
-2.4	0.00820	0.00798	0.00776	0.00755	0.00734	0.00714	0.00695	0.00676	0.00657	0.00639
-2.5	0.00621	0.00604	0.00587	0.00570	0.00554	0.00539	0.00523	0.00509	0.00494	0.00480
-2.6	0.00466	0.00453	0.00440	0.00427	0.00415	0.00403	0.00391	0.00379	0.00368	0.00357
-2.7	0.00347	0.00336	0.00326	0.00317	0.00307	0.00298	0.00289	0.00280	0.00272	0.00264
-2.8	0.00256	0.00248	0.00240	0.00233	0.00226	0.00219	0.00212	0.00205	0.00199	0.00193
-2.9	0.00187	0.00181	0.00175	0.00170	0.00164	0.00159	0.00154	0.00149	0.00144	0.00140
-3.0	0.00135	0.00131	0.00126	0.00122	0.00118	0.00114	0.00111	0.00107	0.00104	0.00100
-3.1	0.00097	0.00094	0.00090	0.00087	0.00085	0.00082	0.00079	0.00076	0.00074	0.00071
-3.2	0.00069	0.00066	0.00064	0.00062	0.00060	0.00058	0.00056	0.00054	0.00052	0.00050
-3.3	0.00048	0.00047	0.00045	0.00043	0.00042	0.00040	0.00039	0.00038	0.00036	0.00035
-3.4	0.00034	0.00033	0.00031	0.00030	0.00029	0.00028	0.00027	0.00026	0.00025	0.00024
-3.5	0.00023	0.00022	0.00022	0.00021	0.00020	0.00019	0.00019	0.00018	0.00017	0.00017



Table of the standard normal distribution values ( $z \geq 0$ )

<b>z</b>	<b>0.00</b>	<b>0.01</b>	<b>0.02</b>	<b>0.03</b>	<b>0.04</b>	<b>0.05</b>	<b>0.06</b>	<b>0.07</b>	<b>0.08</b>	<b>0.09</b>
<b>0.0</b>	0.50000	0.50399	0.50798	0.51197	0.51595	0.51994	0.52392	0.52790	0.53188	0.53586
<b>0.1</b>	0.53983	0.54380	0.54776	0.55172	0.55567	0.55962	0.56356	0.56749	0.57142	0.57535
<b>0.2</b>	0.57926	0.58317	0.58706	0.59095	0.59483	0.59871	0.60257	0.60642	0.61026	0.61409
<b>0.3</b>	0.61791	0.62172	0.62552	0.62930	0.63307	0.63683	0.64058	0.64431	0.64803	0.65173
<b>0.4</b>	0.65542	0.65910	0.66276	0.66640	0.67003	0.67364	0.67724	0.68082	0.68439	0.68793
<b>0.5</b>	0.69146	0.69497	0.69847	0.70194	0.70540	0.70884	0.71226	0.71566	0.71904	0.72240
<b>0.6</b>	0.72575	0.72907	0.73237	0.73565	0.73891	0.74215	0.74537	0.74857	0.75175	0.75490
<b>0.7</b>	0.75804	0.76115	0.76424	0.76730	0.77035	0.77337	0.77637	0.77935	0.78230	0.78524
<b>0.8</b>	0.78814	0.79103	0.79389	0.79673	0.79955	0.80234	0.80511	0.80785	0.81057	0.81327
<b>0.9</b>	0.81594	0.81859	0.82121	0.82381	0.82639	0.82894	0.83147	0.83398	0.83646	0.83891
<b>1.0</b>	0.84134	0.84375	0.84614	0.84849	0.85083	0.85314	0.85543	0.85769	0.85993	0.86214
<b>1.1</b>	0.86433	0.86650	0.86864	0.87076	0.87286	0.87493	0.87698	0.87900	0.88100	0.88298
<b>1.2</b>	0.88493	0.88686	0.88877	0.89065	0.89251	0.89435	0.89617	0.89796	0.89973	0.90147
<b>1.3</b>	0.90320	0.90490	0.90658	0.90824	0.90988	0.91149	0.91308	0.91466	0.91621	0.91774
<b>1.4</b>	0.91924	0.92073	0.92220	0.92364	0.92507	0.92647	0.92785	0.92922	0.93056	0.93189
<b>1.5</b>	0.93319	0.93448	0.93574	0.93699	0.93822	0.93943	0.94062	0.94179	0.94295	0.94408
<b>1.6</b>	0.94520	0.94630	0.94738	0.94845	0.94950	0.95053	0.95154	0.95254	0.95352	0.95449
<b>1.7</b>	0.95543	0.95637	0.95728	0.95818	0.95907	0.95994	0.96080	0.96164	0.96246	0.96327
<b>1.8</b>	0.96407	0.96485	0.96562	0.96638	0.96712	0.96784	0.96856	0.96926	0.96995	0.97062
<b>1.9</b>	0.97128	0.97193	0.97257	0.97320	0.97381	0.97441	0.97500	0.97558	0.97615	0.97670
<b>2.0</b>	0.97725	0.97778	0.97831	0.97882	0.97932	0.97982	0.98030	0.98077	0.98124	0.98169
<b>2.1</b>	0.98214	0.98257	0.98300	0.98341	0.98382	0.98422	0.98461	0.98500	0.98537	0.98574
<b>2.2</b>	0.98610	0.98645	0.98679	0.98713	0.98745	0.98778	0.98809	0.98840	0.98870	0.98899
<b>2.3</b>	0.98928	0.98956	0.98983	0.99010	0.99036	0.99061	0.99086	0.99111	0.99134	0.99158
<b>2.4</b>	0.99180	0.99202	0.99224	0.99245	0.99266	0.99286	0.99305	0.99324	0.99343	0.99361
<b>2.5</b>	0.99379	0.99396	0.99413	0.99430	0.99446	0.99461	0.99477	0.99492	0.99506	0.99520
<b>2.6</b>	0.99534	0.99547	0.99560	0.99573	0.99585	0.99598	0.99609	0.99621	0.99632	0.99643
<b>2.7</b>	0.99653	0.99664	0.99674	0.99683	0.99693	0.99702	0.99711	0.99720	0.99728	0.99736
<b>2.8</b>	0.99744	0.99752	0.99760	0.99767	0.99774	0.99781	0.99788	0.99795	0.99801	0.99807
<b>2.9</b>	0.99813	0.99819	0.99825	0.99831	0.99836	0.99841	0.99846	0.99851	0.99856	0.99861
<b>3.0</b>	0.99865	0.99869	0.99874	0.99878	0.99882	0.99886	0.99889	0.99893	0.99896	0.99900
<b>3.1</b>	0.99903	0.99906	0.99910	0.99913	0.99916	0.99918	0.99921	0.99924	0.99926	0.99929
<b>3.2</b>	0.99931	0.99934	0.99936	0.99938	0.99940	0.99942	0.99944	0.99946	0.99948	0.99950
<b>3.3</b>	0.99952	0.99953	0.99955	0.99957	0.99958	0.99960	0.99961	0.99962	0.99964	0.99965
<b>3.4</b>	0.99966	0.99968	0.99969	0.99970	0.99971	0.99972	0.99973	0.99974	0.99975	0.99976
<b>3.5</b>	0.99977	0.99978	0.99978	0.99979	0.99980	0.99981	0.99981	0.99982	0.99983	0.99983

**ANSWER SEVEN QUESTIONS IN TOTAL**  
**ANSWER ALL QUESTIONS FROM SECTION A**  
**ANSWER ANY THREE QUESTIONS FROM SECTION B**

**SECTION A (ANSWER ALL QUESTIONS)**

1. An organisation offers a 9% discount on invoices paid on time and a further discount of  $\frac{1}{30}$  of the original invoice value for early payment within 21 days. Calculate the fraction of the invoice that is deducted for early payment and the percentage this represents.

[4 marks]

2. **Salary Case Study**

A commercial auditor is working for a building and construction organisation and receives a basic salary of £48,000 per year and a bonus of 8%, when the company is in profit. The auditor's tax free allowance is £11,500 for the current tax year. The basic rate of tax is 20% up to £33,500 above the tax allowance and 40% from £33,501.

- (a) Calculate:
- (i) The auditor's gross pay for the year referring to the case study, given that the organisation declared a profit for this year.
  - (ii) The amount of tax the auditor pays in this year referring to the case study.
  - (iii) The auditor's net pay for the year referring to the case study.
- (b) The organisation is considering removing the bonus scheme and replacing it with an increase in basic salary of 5%. Analyse whether this is a more suitable option for the auditor, given that the organisation made a loss for the previous two years and may not be in profit next year because of a reduction in contract numbers.

[4 marks]

[5 marks]

[3 marks]

[6 marks]

3. Solve the following simultaneous equations using algebra:

$$6x + 4y = 48$$

$$x + 9y = 63$$

[6 marks]

4. Table 1 shows the number of boats produced by 'Splash' over a six-month period.

**Table 1**

Month	Jan	Feb	Mar	Apr	May	Jun
No. of boats	1,500	1,800	2,300	2,500	2,600	2,700

- (a) Draw a line graph for the data in Table 1.
- (b) Calculate the mean number of boats produced by Splash.
- (c) Draw a cumulative frequency curve for the data in Table 1.

[4 marks]

[2 marks]

[6 marks]



## SECTION B (ANSWER ANY THREE QUESTIONS)

5. When a large retailer sells large quantities of a product, the price per item affects its demand, i.e. a lower unit price will normally result in increased demand. Table 2 shows the level of demand for units at the prices shown:

Table 2

Demand per week (Units)	Price per unit (£)
10,000	0.20
14,000	0.15
20,000	0.10

- (a) Draw a graph of the data in Table 2, plotting the price on the x axis and the demand on the y axis. [5 marks]
- (b) Draw a line to fit the points. [2 marks]
- (c) Write an equation for the line you have drawn in question 5 part (b). [6 marks]
- (d) At £0.05 per unit, the demand was 27,000. Analyse this result. [7 marks]
6. An investment of £29,000 was made to a Cash ISA/tax exempt savings account. The account has an interest rate of 1.8% (AER) per annum.
- (a) Draw a table to show the amount of money in the account at the end of each year, for a ten-year period. [4 marks]
- (b) Draw a curve to show the growth of the investment. [6 marks]
- (c) After three years the interest rate goes up to 2.15%.
- (i) Calculate the amount in the account after four years if no money is withdrawn. [3 marks]
- (ii) Calculate the amount in the account after eight years if no money is withdrawn. [3 marks]
- (d) Calculate the cumulative rate of growth at the end of the ten-year period. [4 marks]

7. The quantities of items produced by a factory during the year ended 31<sup>st</sup> December 2021 and the related costs are shown in Table 3:

**Table 3**

Month	Item production 000s	Factory costs £000s
January	7	45
February	10	59
March	13	75
April	14	80
May	11	65
June	7	46
July	5	35
August	4	30
September	3	25
October	2	20
November	1	15
December	5	35

Assume that costs remained stable throughout the year.

- (a) Draw a scatter diagram plotting the line of best fit referring to the data in Table 3. [8 marks]
- (b) (i) Calculate the expected factory cost if 12,000 items were produced in a particular month. [6 marks]
- (ii) Estimate the organisation's monthly fixed costs. [6 marks]
8. The salaries of the employees at a manufacturing organisation are normally distributed with a mean of £15,000 and a standard deviation of £2,700.
- (a) Calculate the proportion of employees who earn less than £13,000. [5 marks]
- (b) Calculate the proportion of employees who earn between £11,000 and £19,000. [6 marks]
- (c) Analyse the results you calculated in question 8 parts (a) and (b). [9 marks]

**END OF QUESTIONS**