الجامعة الوطنية
National University
Science & Technology للعلوم والتكنولوجيا
كلية عمان البحرية الدولية
International Maritime College Oman

Final Exam
DMATH-I: MATH 1
Fall 2024

Points of attention:

- For each question, the maximum earned points are specified in the question.
- Write clearly! Answers that are not readable are not marked and don't earn marks!
- All answers should be written in English using **blue or black pens** only.
- Use the pencil only for diagrams and graphs.
- Show all the calculation steps in the given space.
- When finished, submit the question paper, together with the answer scripts and the signed cover page to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

Exam Duration: 2 hours
Instructor's Name: Dr. Rokhsaneh Yousef Zehi
Exam Date: 12/01/2025
Program: DO

	40
	10

Student Information

Name: | ID:

Signature:

Question 1 **[5 marks]**

Express $\mathbf{5\cos 3t + 2\sin 3t}$ in the form of $\boldsymbol{A\cos(\omega t + \alpha)}$ $\boldsymbol{\alpha \geq 0}$ and then state the following values for the wave.

a) Amplitude
b) Angular frequency
c) Time displacement

Question 2 **[8 marks]**

The following table represents the number of hours spent in a workshop during different shifts over a week. Estimate the **standard deviation** of the data.

Hours spent (Class intervals)	Frequency
$0.5 - 3.5$	6
$3.5 - 6.5$	8
$6.5 - 9.5$	4
$9.5 - 12.5$	3
$12.5 - 15.5$	4

Question 3 **[6 marks]**

A Deck officer is navigating a ship using a spherical triangle (ABC) to calculate the route. In this spherical triangle $B = 90°,\ C = 35^{\circ}45',$ and $AC = 49^{\circ}51'$. Determine A and AB.

Question 4 **[5 marks]**

The average number of gallons of gasoline used to complete a trip from Pittsburgh to Atlanta City is 15, with a standard deviation of 3 gallons. If this trip is taken, determine the probability of using the following amounts of gasoline:

a) Between 14 and 22 gallons. (3 marks)

b) More than 19.5 gallons. (2 marks)

Question 5 **[7 marks]**

A ship travels for $50\ km$ from point O on a bearing of $110°$ to get to position A. Then it changes its bearing to $210°$ and sails for $35\ km$ to get to position B.

a) Determine the distance of the ship from its starting position (OB). (3 marks)

b) Determine the bearing the ship must take to go directly back to its starting position. (4 marks)

Question 6 **[5 marks]**

Given the following data set,

14, 16, 27, 18, 13, 19, 38, 15, 20

a) Determine the first quartile (Q_1), third quartile (Q_3) and interquartile range (IQR). (2.5 marks)

b) Determine if there are any outliers in this data set. (2.5 marks)

Question 7 **[4 marks]**

The following table shows the sailing speeds of a boat during different trips across a river. State the **modal class** for this data set and estimate the **Mode** for the data.

Class boundaries	Frequency
$8 - 10$	6
$10 - 12$	9
$12 - 14$	10
$14 - 16$	13
$16 - 18$	8

Rough work

Formula sheet

No **Formula**

1) **Cosine Rule:**

$$a^2 = b^2 + c^2 - 2bc\ cosA$$

$$b^2 = a^2 + c^2 - 2ac\ cosB$$

$$c^2 = a^2 + b^2 - 2ab\ cosC$$

2) $\sin^2 x + \cos^2 x = 1$

3) $\sin(a + b) = \sin a \cos b + \sin b \cos a$

$\sin(a - b) = \sin a \cos b - \sin b \cos a$

$\cos(a + b) = \cos a \cos b - \sin a \sin b$

$\cos(a - b) = \cos a \cos b + \sin a \sin b$

4) **Sine Rule:**

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

5) **Spherical Trigonometry**

Sine middle part = Product of cosines of opposite parts.

Sine middle parts = Products of tangents of adjacent part.

$$\cos A = \frac{\cos a - \cos b \cos c}{\sin b \sin c}$$

6) **Descriptive statistics**

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

$$\mu = \frac{\sum fx}{n}$$

$$\sigma^2 = \frac{\sum (x - \mu)^2}{n}$$

$$\sigma^2 = \frac{\sum f(x-\mu)^2}{n}$$

$$Mode = L_m + \frac{(f_m - f_{m-1})}{(f_m - f_{m-1}) + (f_m - f_{m+1})} \times w$$

$$Median = \frac{\left(n/2\right) - cf}{f}(w) + L_m$$

7) Normal distribution

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

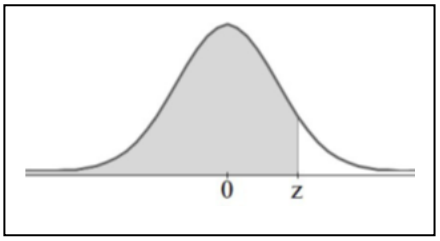
8) Binomial distribution

$$\mu = n \cdot p \qquad \sigma = \sqrt{n \cdot p \cdot q}$$

9)

Binomial	Normal
1) $P(x = a)$	$P(a - 0.5 < x < a + 0.5)$
2) $P(x \geq a)$	$P(x > a - 0.5)$
3) $P(x > a)$	$P(x > a + 0.5)$
4) $P(x \leq a)$	$P(x < a + 0.5)$
5) $P(x < a)$	$P(x < a - 0.5)$

Standard Normal (*Z*) Distribution

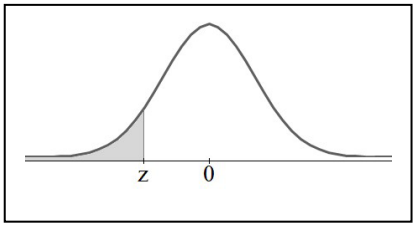


Cumulative Area from the LEFT

Positive *z* scores

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998
3.50	and above .9999									

Standard Normal (*Z*) Distribution



Cumulative Area from the LEFT

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.50	and lower	.0001								
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

MLO and Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	1,4	Application, Analysis	5	
2	5	Application, Analysis	8	
3	1,4	Application	6	
4	5	Application	5	
5	2,3,5	Application, Analysis	7	
6	5	Understanding, Application	5	
7	5	Understanding, Application	4	

References:

- Anthony Croft, R. D. and Davison, M. H., 2015. Mathematics for Engineers. 4th edition. Harlow: Pearson Education Limited.
- Bluman, A. G., 2014. Elementary Statistics: A Step-by-Step Approach. 9th edition. New York: McGraw-Hill Education.
- Earl, G. E., Robinson, D. M., and Ward, J., 2007. Munro's Mathematics for Deck Officers. 5th edition. Glasgow: Brown, Son & Ferguson, Ltd.