

Final Exam
DMATH-I: MATH-I
Fall 2025

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. Taofeek Olanrewaju Alade
Exam Date: 23/12/2025
Program: DO

	40
	10

Student Information			
Name:	<input type="text"/>	ID:	<input type="text"/>
Signature:	<input type="text"/>		

Invigilator		
Initials:	<input type="text"/>	<input type="checkbox"/> Student ID checked
Time received:	<input type="text"/>	

Question 1**[6 marks]**

A deck officer records the weekly working hours of crew members on a vessel and presents the data in the grouped form below:

Crew Working Hours (class boundaries)	Frequency
39.5 – 44.5	7
44.5 – 49.5	9
49.5 – 54.5	5
54.5 – 59.5	12
59.5 – 64.5	4

Using this grouped frequency distribution, determine the following

- The estimated **median** and (3 marks)
- The estimated **mode** of the crew's weekly working hours. (3 marks)

Question 2**[6 marks]**

A naval architect models a ship's waterline section using the curve:

$$y = 6x^2 - 2x, 0 \leq x \leq 3$$

Use the Simpson's rule with **6** strips to estimate the total area of this section. Round your answer to two decimal places.

Question 3**[5 marks]**

A helicopter leaves base P and flies 100 km on a bearing of 210° to point Q . From Q , it heads directly to point R . Point R lies 140 km from P on a bearing of 140° .

- (a) Determine the distance QR . (3 marks)
- (b) Calculate the bearing of R from Q . (2 marks)

Question 4**[7 marks]**

As a Deck Officer planning an ocean passage, you are analyzing a great-circle route on a spherical Earth model. The route forms a spherical triangle ABC connecting three key waypoints on the globe. The distances between the waypoints are as follows: $BC = 90^\circ$, $AB = 60^\circ$, and the angle at $A = 100^\circ$.

Sketch the spherical triangle and calculate: (1 mark)

- a. The distance AC . (2 marks)
- b. The angle at B . (2 marks)
- c. The angle C . (2 marks)

Question 5**[8 marks]**

A. As a deck officer on a US training vessel, you are completing a report on the professional development of teachers who participate in the ship's education outreach program. According to national statistics, the average annual salary of teachers in the US is \$45,650, with a standard deviation of \$5,500. Teacher salaries are assumed to follow a normal distribution. For a randomly selected teacher's salary record, determine the probability that the teacher earns

- i. Between \$35,000 and \$42,000 per year. (3 marks)
- ii. More than \$38,000 per year. (2 marks)

- B. A deck officer records the ages of auxiliary machinery on board ships. The average age is 16.4 years, and the ages are normally distributed. It is known that 30% of the machinery is older than 21.4 years. Determine the standard deviation of the machinery ages. (3 marks)

Question 6**[8 marks]**

a. A wave sensor on a training vessel records the motion of the ship as:

$$6 \sin 2t - \cos 2t$$

Express the motion in the standard wave form $A \cos(\omega t + \alpha)$, where $\alpha \geq 0$. (5 marks)

b. Show that

$$\sin 3A = 3 \sin A \cos^2 A - \sin^3 A$$

(3 marks)

Trigonometrical identities

$$\sin(A + B) = \sin A \cos B + \sin B \cos A$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\sin(A - B) = \sin A \cos B - \sin B \cos A$$

$$\cos(A - B) = \cos A \cos B + \sin A \sin B$$

$$\cos^2 A + \sin^2 A = 1$$

Law of Cosine Rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cos B$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$

Law of Sine Rule

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

Napier's Rules

Sine middle part = Product cosines of opposite parts

Sine middle part = Product of tangents of adjacent parts

Simpson Rule

$$\text{Area} = \frac{h}{3} [y_0 + 4(y_1 + y_3 + \cdots + y_{n-1}) + 2(y_2 + y_4 + \cdots + y_{n-2}) + y_n]$$

Median

$$L_m + \frac{\left(\frac{n}{2} - c_f\right)}{f} w$$

Mode

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

TABLE E The Standard Normal Distribution										
Cumulative Standard Normal Distribution										
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-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

For z values less than -3.49, use 0.0001.

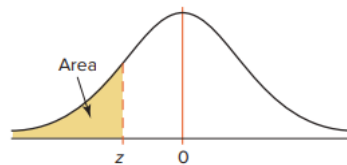


TABLE E (continued)										
Cumulative Standard Normal Distribution										
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.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

For z values greater than 3.49, use 0.9999.

Source: Elementary Statistics- A step by step approach- tenth edition-Allan G. Bluman

MLO & Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
3, 4	2,5	Application	12	--
5	3	Application, Analysis	8	--
6	1	Remembering	8	--
1	4	Evaluating	6	--
2	3	Analysing	6	--

References:

1. Anthony Croft, R. D. and Davison, M. H., 2015. Mathematics for Engineers. 4th edition. Harlow: Pearson Education Limited.
2. Earl, G. E., Robinson, D. M., and Ward, J., 2007. Munro's Mathematics for Deck Officers. 5th edition. Glasgow: Brown, Son & Ferguson, Ltd.