

# Normal and Binomial Distributions



# Problem Set 2/Exam Tips:

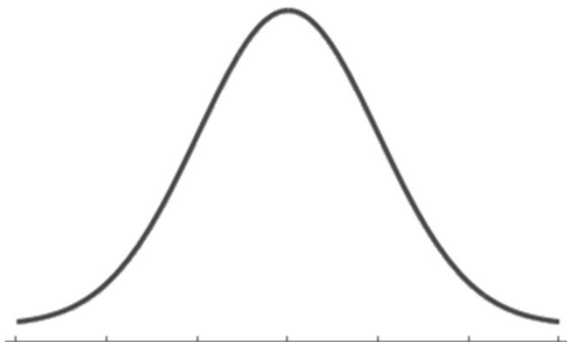


- If you're using a **binomial distribution**, make sure you show that all four binomial distribution conditions are met.
- If you're using a **normal approximation of the binomial distribution**, make sure you show that the SF conditions are met.

# Question:

A Standard Normal Curve is drawn in Z-tables (pg. 428-429 in book).

What should the x-axis look like in these drawings?



Normal probability table



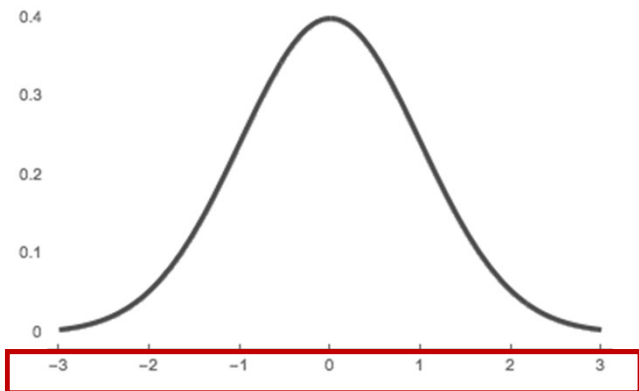
Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8706	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

\*For Z ≥ 3.0, the probability is greater than or equal to 0.9988.

# Question:

A Standard Normal Curve is drawn in Z-tables (pg. 428-429 in book).

What should the x-axis look like in these drawings?



Normal probability table

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

\*For Z ≥ 3.0, the probability is greater than or equal to 0.9998.

**Answer:**

Standard Normal Curve:

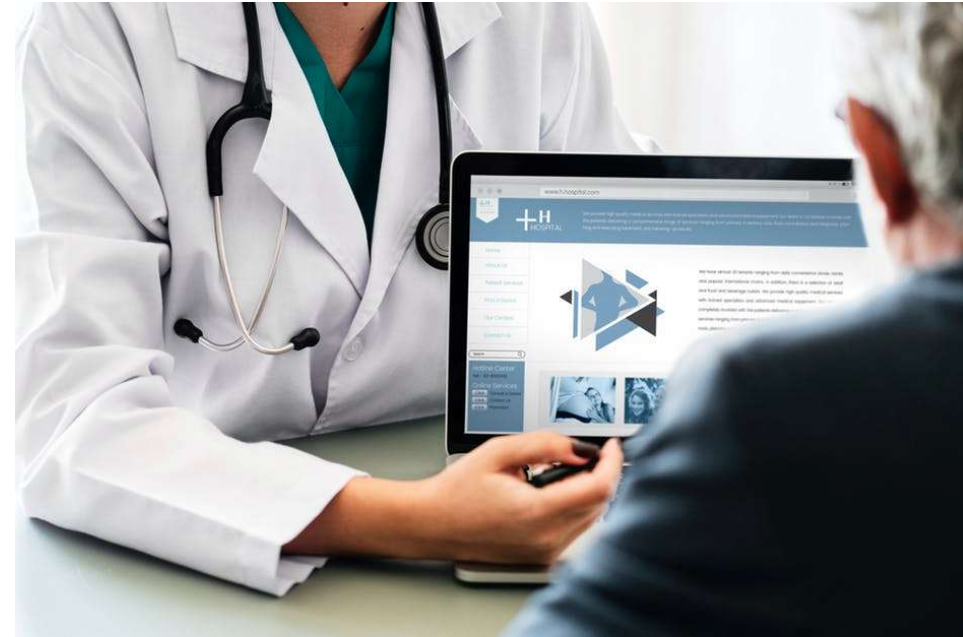
$Z \sim N(\mu = 0, \sigma = 1)$



- Centered at 0.
- 99.7% of data is between  $x=-3$  and  $x=3$

# Getting to know you!

- 13% want to be a doctor
- 12% want to be a lawyer
- 3% want to be a politician
- 3% want to be a writer/journalist
- 2% want to be a teacher/professor



**Question: What is the probability that an adult female is 5'8"?**



**Question: What is the probability that an adult female is 5'8"?**

**Answer: 0**



# Content questions? Ask on Piazza!

- Overview
- Announcements
- Syllabus
- Calendar
- Email
- Drop Box
- Resources
- Assignments
- Gradebook
- Statistics
- Site Info
- Tests & Quizzes
- Piazza
- Help

The screenshot shows the Piazza Q&A interface for a class. The top navigation bar includes "piazza", "STA. 101.001.SP19", "Q & A", "Resources", "Statistics", and "Manage Class". The user "Victoria Ellison" is logged in. The left sidebar shows a list of folders: polls, hw1, hw2, hw3, and hw4. The main content area is for creating a new post. The "Post Type" is set to "Note" (with options for "Question" and "Poll/In-Class Response"). The "Post to" is set to "Entire Class". The "Select Folder(s)" section shows a list of folders: hw1, hw2, hw3, hw4, hw5, hw6, hw7, hw8, hw9, hw10, project, exam, logistics, and other. The "Summary" field contains the text "Flipped Class Tip". The "Details" section shows a rich text editor with a toolbar containing options like Edit, Insert, View, Format, and Table. The text in the editor reads: "Why do you need to look on both sides of a randomization distribution if the alternative hypothesis has "≠" ?".


**Question: What is the probability that the **z-score** of an **observation from a normal distribution** is between -1 and 1?**

Question: What is the probability that the **z-score** of an **observation** from a **normal distribution** is between **-1 and 1**?

Answer:  $P(-1 \leq Z \leq 1) = 0.68$

We CAN use the z-tables to find this probability, because the observation comes from a normal distribution.

Normal probability table



Z	Second decimal place of Z									
	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
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0.4	0.6554	0.6591	0.6628	0.6665	0.6702	0.6738	0.6774	0.6811	0.6847	0.6883
0.5	0.6919	0.6954	0.6989	0.7024	0.7059	0.7093	0.7128	0.7162	0.7196	0.7231
0.6	0.7267	0.7301	0.7334	0.7367	0.7400	0.7432	0.7464	0.7496	0.7527	0.7559
0.7	0.7590	0.7621	0.7652	0.7683	0.7713	0.7743	0.7772	0.7801	0.7830	0.7859
0.8	0.7888	0.7916	0.7944	0.7971	0.7998	0.8025	0.8052	0.8078	0.8104	0.8131
0.9	0.8157	0.8183	0.8209	0.8234	0.8259	0.8284	0.8309	0.8334	0.8358	0.8382
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8769	0.8788	0.8807	0.8826
1.2	0.8844	0.8863	0.8881	0.8899	0.8916	0.8934	0.8951	0.8968	0.8984	0.8999
1.3	0.9015	0.9032	0.9049	0.9065	0.9081	0.9097	0.9112	0.9127	0.9141	0.9156
1.4	0.9171	0.9184	0.9197	0.9211	0.9225	0.9238	0.9251	0.9264	0.9276	0.9289
1.5	0.9302	0.9314	0.9326	0.9338	0.9349	0.9360	0.9371	0.9381	0.9391	0.9401
1.6	0.9411	0.9421	0.9431	0.9441	0.9450	0.9459	0.9468	0.9477	0.9485	0.9493
1.7	0.9502	0.9510	0.9518	0.9526	0.9533	0.9541	0.9548	0.9555	0.9562	0.9569
1.8	0.9576	0.9582	0.9589	0.9596	0.9602	0.9608	0.9614	0.9620	0.9625	0.9631
1.9	0.9636	0.9641	0.9646	0.9651	0.9656	0.9661	0.9666	0.9671	0.9676	0.9681
2.0	0.9686	0.9690	0.9695	0.9699	0.9703	0.9708	0.9712	0.9716	0.9720	0.9724
2.1	0.9728	0.9732	0.9735	0.9738	0.9741	0.9744	0.9747	0.9750	0.9753	0.9756
2.2	0.9759	0.9761	0.9764	0.9767	0.9769	0.9771	0.9773	0.9775	0.9777	0.9779
2.3	0.9781	0.9782	0.9784	0.9785	0.9787	0.9788	0.9789	0.9790	0.9791	0.9792
2.4	0.9793	0.9794	0.9795	0.9796	0.9797	0.9798	0.9799	0.9800	0.9801	0.9802
2.5	0.9803	0.9804	0.9805	0.9806	0.9807	0.9808	0.9809	0.9810	0.9811	0.9812
2.6	0.9813	0.9814	0.9815	0.9816	0.9817	0.9818	0.9819	0.9820	0.9821	0.9822
2.7	0.9823	0.9824	0.9825	0.9826	0.9827	0.9828	0.9829	0.9830	0.9831	0.9832
2.8	0.9833	0.9834	0.9835	0.9836	0.9837	0.9838	0.9839	0.9840	0.9841	0.9842
2.9	0.9843	0.9844	0.9845	0.9846	0.9847	0.9848	0.9849	0.9850	0.9851	0.9852
3.0	0.9853	0.9854	0.9855	0.9856	0.9857	0.9858	0.9859	0.9860	0.9861	0.9862
3.1	0.9863	0.9864	0.9865	0.9866	0.9867	0.9868	0.9869	0.9870	0.9871	0.9872
3.2	0.9873	0.9874	0.9875	0.9876	0.9877	0.9878	0.9879	0.9880	0.9881	0.9882
3.3	0.9883	0.9884	0.9885	0.9886	0.9887	0.9888	0.9889	0.9890	0.9891	0.9892
3.4	0.9893	0.9894	0.9895	0.9896	0.9897	0.9898	0.9899	0.9900	0.9901	0.9902

\*For Z ≥ 3.50, the probability is greater than or equal to 0.9999.

**Need help?  
Confused about  
something?  
Come stop by  
office hours!**



## Office Hours

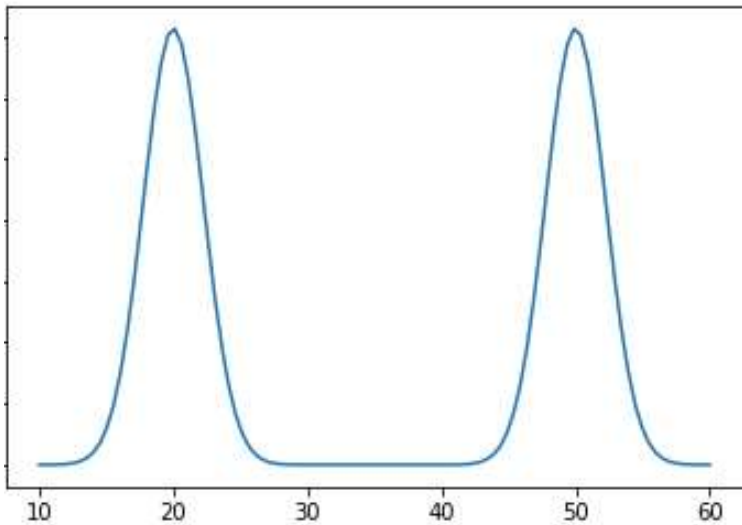
**Instructor Office Hours:** Tuesdays 2:00pm-4:00pm Old Chemistry 208A

### TA Office Hours:

TA	Time	Location
Sibora Seranaj	Monday 9 - 11 am	Old Chem 203B
Austin Jia	Monday 2 - 4pm	Old Chem 203B
Valerie Roberts	Monday 6:30 - 8:30pm	Old Chem 025
Morgan Bird	Monday, 5:00 - 7:00pm	Old Chem 025
Melanie Lai Wai	Tuesday 8:30 - 10:30am	Old Chem 203B
Ed Tam	Tuesday 12pm - 2pm	Old Chem 203B
Samantha Morales	Tuesday 3:30-5:30pm	Old Chem 203B
Brian Jiang	Tuesday 6:00-8:00pm	Old Chem 203B
Rose Graves	Tuesday 7-9pm	Old Chem 203B
Junette Yu	Wednesday 11:00-1:00pm	Old Chem 203B
Eduardo Coronado	Wednesday 5 - 7pm	Old Chem 025
Tess Chandler	Thursday 3-4pm	Old Chem 203B
Mark Sampson	Thursday 6:00-8:00 pm	Old Chem 025
Vanessa Alwan	Friday 8-10am	Old Chem 203B
Tess Chandler	Friday 12-1pm	Old Chem 025
Lavonne Hoang	Friday 2-4 pm	Old Chem 203B
Tessa Johnson	Friday 5:30-7:30 pm	Old Chem 025

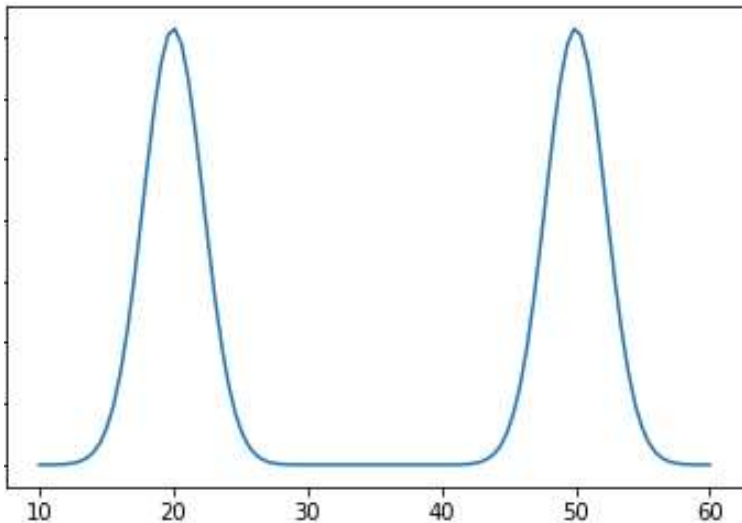
<https://www2.stat.duke.edu/courses/Spring19/sta101.001/officehours.html>

**Question: What is the probability that the **z-score** of an **observation from the distribution below** is between -1 and 1?**



**Question:** What is the probability that the **z-score** of an **observation from the distribution below** is between **-1 and 1**?

**Answer:**  $P(-1 \leq Z \leq 1) = ?$



We're not given enough information!  
We CAN'T use the z-table because the observation doesn't come from a normal distribution.

Normal probability table

The image shows a standard normal probability table (z-table) with a large red 'X' drawn over it. The table lists cumulative probabilities for various z-scores. The title is 'Normal probability table' and the column header is 'Second decimal place of Z'. The table includes a small normal distribution curve icon above the title.