Inspiring Greatness

ISD

INDEPENDENCE SCHOOL DISTRICT

Math Virtual Learning

Probability and Statistics

April 23, 2020

Probability and Statistics
Lesson: April 23, 2020

Objective/Learning Target:

Students will be able to convert z-scores into percentages for a set of data

Let's Get Started!

Women's heights have a mean of 63.6 in. and a standard deviation of 2.5 inches. Find the z score corresponding to a woman with the following heights.

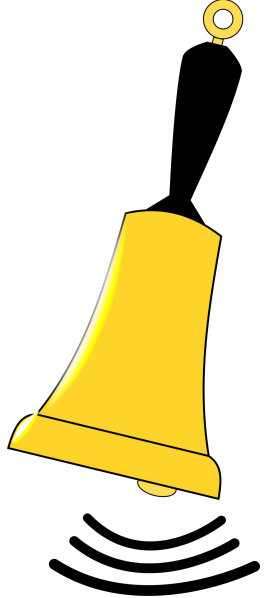
A. Height = 67"

B. Height = 72"

C. Height = 44"

D. What height would be 2 standard deviations below the mean?

E. What height has a z-score of 2.5 (Hint: Work Backwards with the Formula)



Let's Get Started!

Women's heights have a mean of 63.6 in. and a standard deviation of 2.5 inches. Find the z score corresponding to a woman with the following heights.

A. Height = 67" $\frac{67 - 63.6}{2.5} = 1.36$

B. Height = 72" $\frac{72 - 63.6}{2.5} = 3.36$

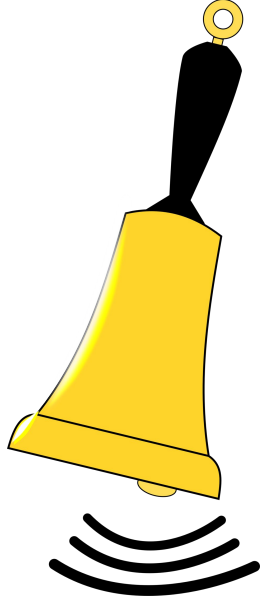
C. Height = 58" $\frac{58 - 63.6}{2.5} = -2.24$

D. What height would be 2 standard deviations below the mean? **58.6 inches**

E. What height has a z-score of 2.5 (Hint: Work Backwards with the Formula)

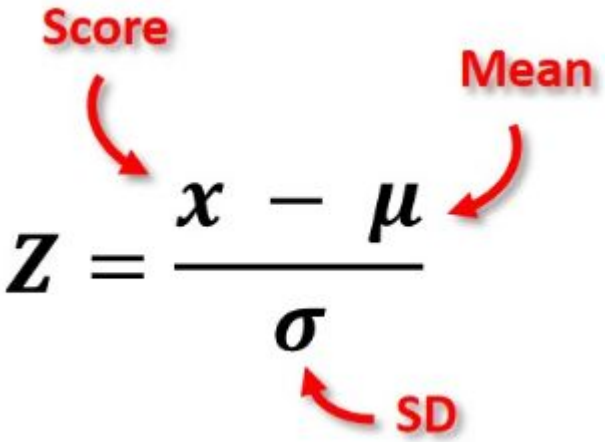
$2.5 = \frac{x - 63.6}{2.5}$ **-----> 6.25 = x - 63.6 (multiply both sides by 2.5)**

-----> x = 69.85 in. (add 63.6 to both sides)

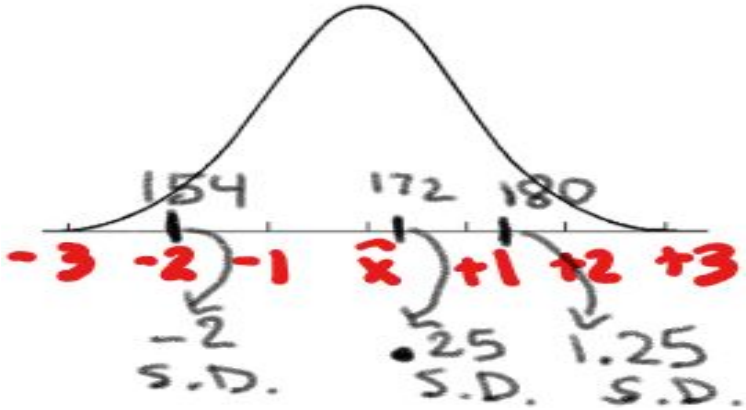


What we already know...

Now that we know how to calculate a Z-Score using the formula



AND we know how to put that answer onto the graph:



Z-Score to Percent...

Now we can answer questions about percentages using a Z-Score to Percent Chart

You will want to open or print this chart for referencing during this lesson

Z-Score to Percent Chart

The first thing you will notice is that there are 2 charts. One has negative values and the other has positive values.

When your Z-Score is above the Mean you will use the positive chart

When your Z-Score is below the Man you will use the negative chart

Let's start with the first example from the Bell Ringer...

Women's heights have a mean of 63.6 in. and a standard deviation of 2.5 inches. Find the z score corresponding to a woman with the following heights.

A. Height = 67" $\frac{67 - 63.6}{2.5} = 1.36$

We want to know what percent of the women surveyed have a height of 67" or less

(We know that it will be more than 50% because the Z-Score (1.36) is on the right side of the mean since it is a positive Z-Score.)

To find the exact %, take your Z-Score (1.36) and look it up on the Z-Score to Percent Chart that I told you to open or print from Slide 6

Here it is again for you: Z-Score to Percent Chart

Watch this short video on how to read/use the chart to find your percentage answer:

Reading a Z-Score to Percent Chart

Let's start with the first example from the Bell Ringer...

Women's heights have a mean of 63.6 in. and a standard deviation of 2.5 inches. Find the z score corresponding to a woman with the following heights.

A. Height = 67"

$$\frac{67 - 63.6}{2.5} = 1.36$$

We want to know what percent of the women surveyed have a height of 67" or less

From the chart we get .9131 or 91.31%

*****Keep in mind that the chart AlWAYS gives you the % on the left or the % LOWER than your data point. This is very important to remember when using this chart!**

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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

Let's do Example 2 from the Bell Ringer...

Women's heights have a mean of 63.6 in. and a standard deviation of 2.5 inches. Find the z score corresponding to a woman with the following heights.

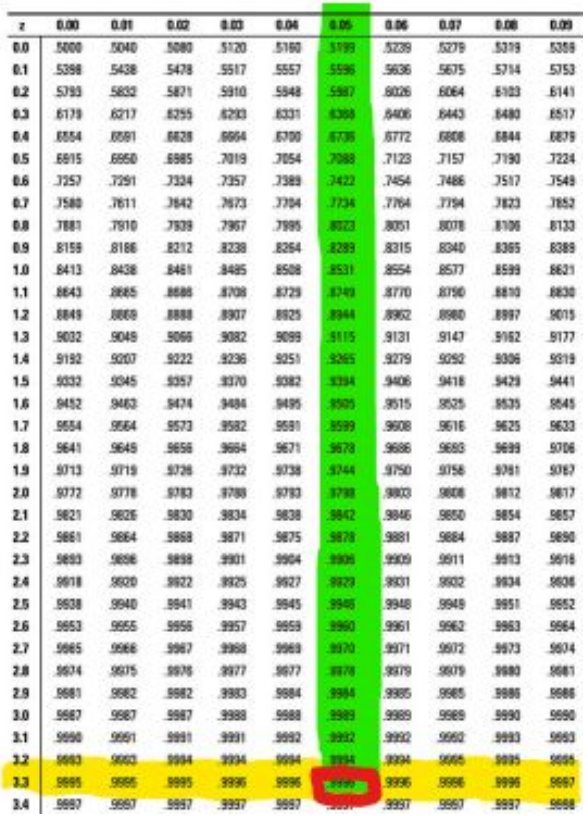
B. Height = 72" $\frac{72 - 63.6}{2.5} = 3.36$

Find the % of women shorter than 72"

From the chart, we get .9996 or 99.96% (so almost everyone is shorter than 72 in.)

So what % of the women are taller than 72"

100% - 99.96% (shorter) = .04% (taller)



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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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
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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

Now let's combine Part A and Part B for a new question:

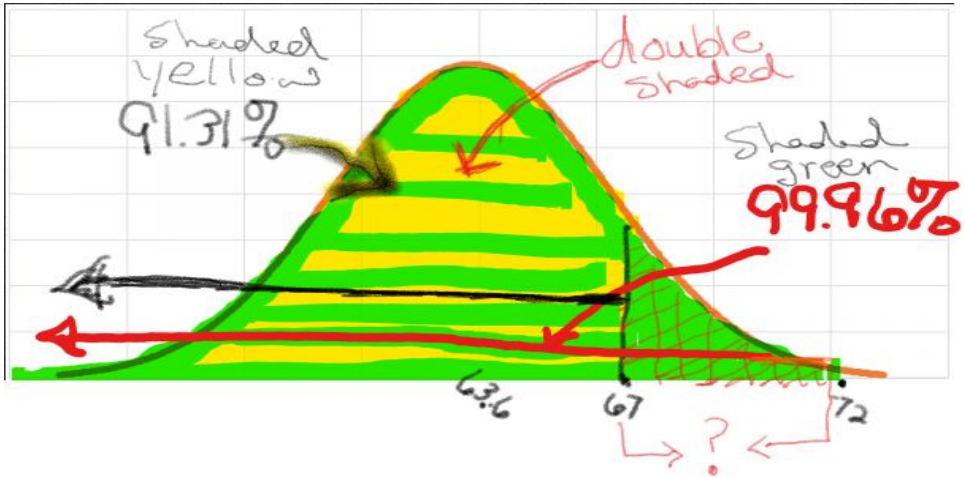
Women's heights have a mean of 63.6 in. and a standard deviation of 2.5 inches. Find the z score corresponding to a woman with the following heights.

A. Height = 67" $\frac{67 - 63.6}{2.5} = 1.36$ 91.31% shorter

B. Height = 72" $\frac{72 - 63.6}{2.5} = 3.36$ 99.96% shorter

What % of women are BETWEEN 67" and 72"?

8.65% ---------->



We only care about the % between 67 and 72, so we need to subtract the double shaded area (%).

99.96% - 91.31% = 8.65%

Your turn...

Women's heights have a mean of 63.6 in. and a standard deviation of 2.5 inches. Find the z score corresponding to a woman with the following height.

C. Height = 58"

1. What % of women are shorter than 58"
2. What % of women are taller than 58"
3. What % of women are between 58" and 67"

Your turn...

Women's heights have a mean of 63.6 in. and a standard deviation of 2.5 inches. Find the z score corresponding to a woman with the following heights.

C. Height = 58" **Z-Score = -2.24 (Remember to use the negative side of the chart)**

1. What % of women are shorter than 58" **.0125 (from chart) = 1.25%**
2. What % of women are taller than 58" **100% - 1.25% = 98.75%**
3. What % of women are between 58" and 67"

91.31% -	**1.25% =**	**90.06%**
67" %	**58" %**	**% Between 58 and 67**