7. 15% of passengers on the bus each morning own their own car. If 74 people are on the bus, what is the probability that:

a) more than 12 people own their own car?

discrete ✓

$n=74 \quad p=.15 \quad q=.85$

$r>12$ $+.5$

$x>11.5$

$z>\frac{11.5-11.1}{3.07}$

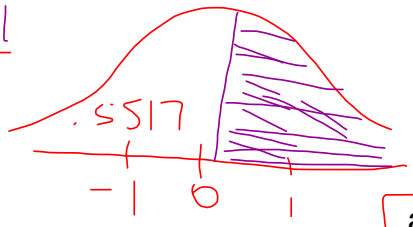
$z>.13$

$np>5 \quad 74(.15)=11.1$ ✓

$nq>5 \quad 74(.85)=62$ ✓

$\mu=np=11.1$

$\sigma=\sqrt{npq}=\sqrt{74(.15)(.85)}=3.07$



$1-.5517$

$.4483$

answer: 44.83%

b) between 6-10 people own their own car?

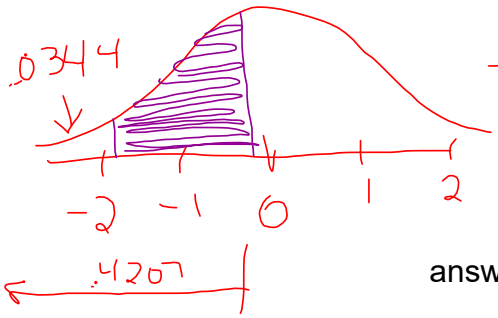
$6<r<10$

$-.5 \quad +.5$

$5.5<X<10.5$

$\frac{5.5-11.1}{3.07}<z<\frac{10.5-11.1}{3.07}$

$-1.82<z<-.20$



$.4207$

$-.0344$

$.3863$

38.63%

answer: 38.63%

c) less than 12 people own their own car?

$r<12$ $+.5$

$X<12.5$

$z<\frac{12.5-11.1}{3.07}$

$z<.46$

$.6772$

67.72%

answer: ~~67.62%~~

4. The visibility standard index (VSI) is a measure of Denver air pollution that is reported each day in the *Rocky Mountain News*. The index ranges from 0 (excellent air) to 200 (very bad air). During winter months, when air pollution is higher, the index has a mean of about 90 (rated as fair) with a standard deviation of approximately 30. Suppose that for 15 days the following VSI measures were reported each day.

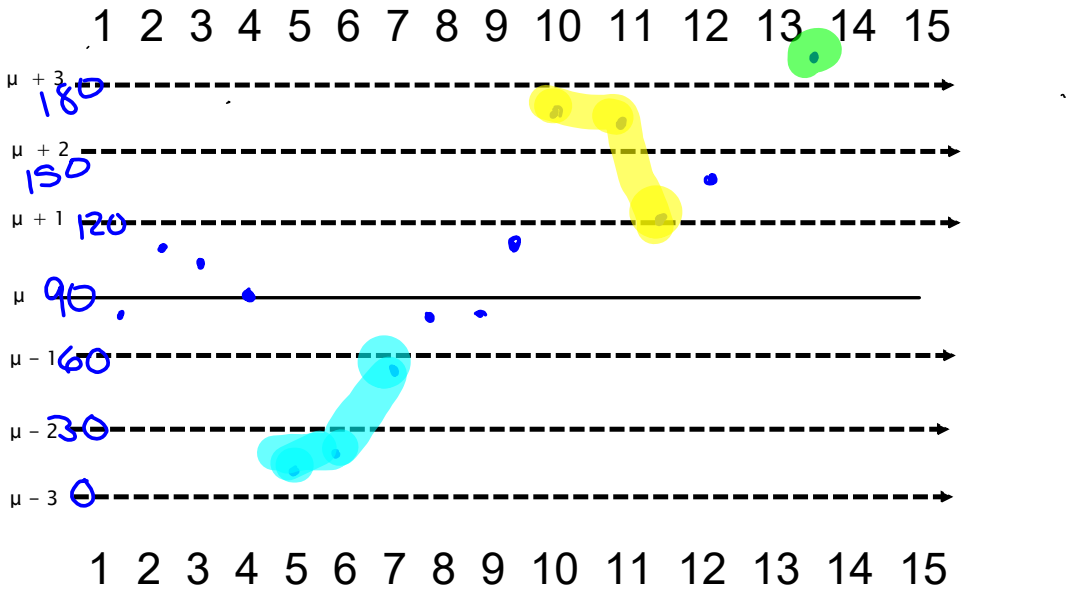
Day	1	2	3	4	5	6	7	8	9
VSI	80	115	100	90	15	10	53	75	80

Day	10	11	12	13	14	15
VSI	110	165	160	120	140	195

(a) Make a control chart for the above data.

(b) Determine whether the process is in statistical control. If it is not, specify which out-of-control signals are present.

nswer



r

This is statistically out of control.
First - the 15th data point is beyond the 3rd standard dev.
Second - the 4th, 5th, and 6th (or 5th, 6th, 7th) data points are consecutive points on same side of the mean with at least 2 beyond the second standard deviation..
Third - the 11th, 12th, and 13th data points are consecutive points on same side of the mean with at least 2 beyond the second standard deviation..

11. Kelsie has a deli business. The time to prepare lunches is approximately normally distributed with a mean of 15 minutes and a standard deviation of 3 minutes.

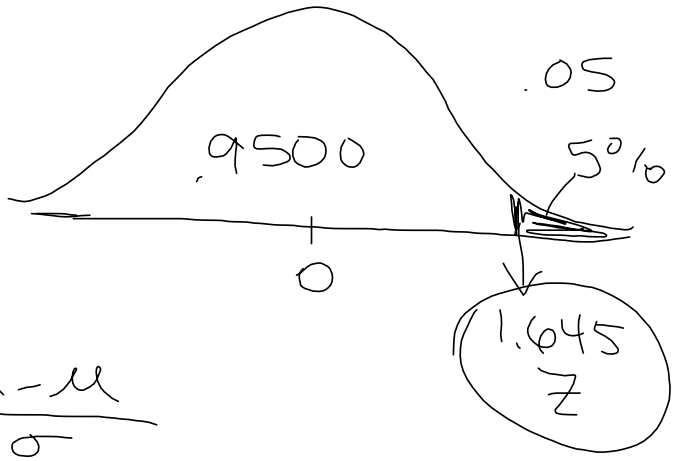
a) Suppose that Kelsie advertised "If it takes more than 15 minutes to get your lunch, you get it free". What percent of her lunches will she have to give away free?

Answer:

b) How long a time should Kelsie allow if she wants to give away no more than 5% of the lunches?

hint:

answer:



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

$$(3)\ 1.645 = \frac{X - 15}{3} \quad (3)$$

$$4.935 = X - 15$$

$$+15 \quad +15$$

$$19.935 = X$$

Areas of a Standard Normal Distribution continued

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 1.000 to approximate the area.

.9500 is between these two numbers

So our answer is between 1.64 and 1.65 = 1.645

1. Which statement is *not* an important property of a normal curve?

A) The transition points between cupping upward and downward occur above $\mu + \sigma$ and $\mu - \sigma$.

B) Approximately 99.7% of the data values will be within four standard deviations on each side of the mean.

answer:

B 99.7% of the data values will be within THREE standard deviations on each side of the mean

C) The curve approaches the horizontal axis but never touches or crosses it.

D) The curve is bell-shaped with the highest point over the mean μ.

E) It is symmetrical about a vertical line through μ.

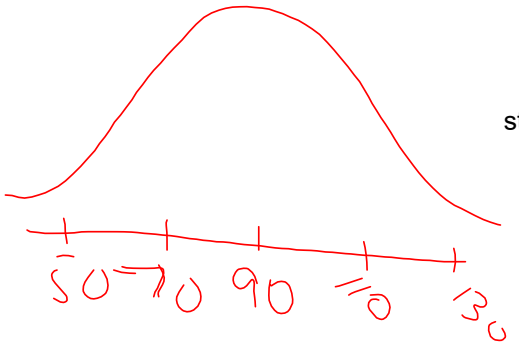
2. The running times of feature movies have a mound-shaped distribution with mean $\mu = 90$ minutes and standard deviation $\sigma = 20$ minutes.

(a) Use the empirical rule to find an interval centered about the mean in which 68% of the data will fall.

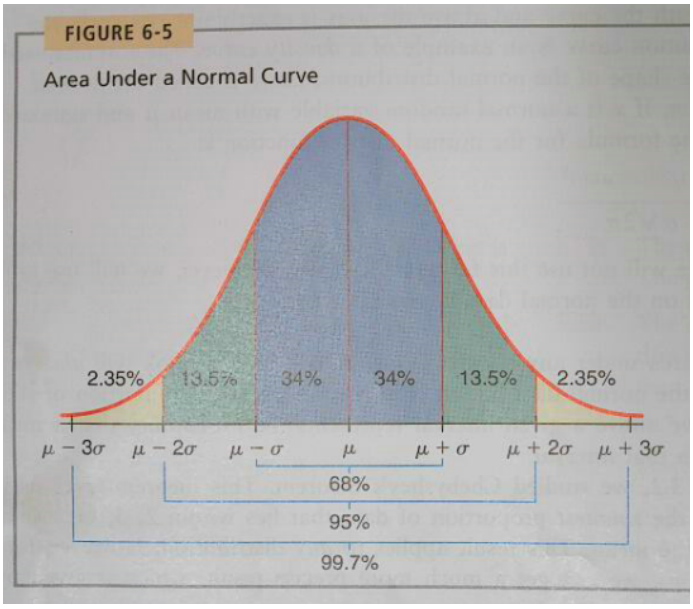
(b) Estimate a range of values centered about the mean in which about 95% of the data will fall.

(c) Estimate a range of values centered about the mean in which about 99.7% of the data will fall.

step 1 draw the normal curve for this situation:



step 2 refer to notes or (page 296)

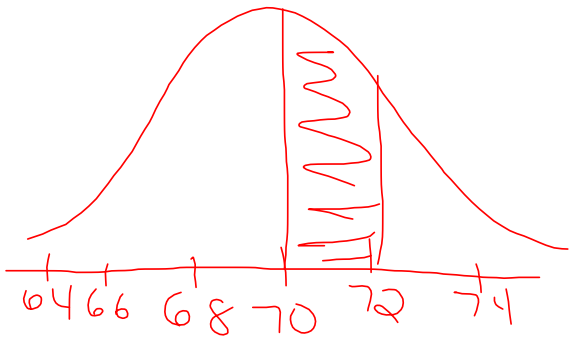


answer: a 70 to 110
b 50 to 130
c 30 to 150

3. A certain brand of battery lasts according to a normal distribution with $\mu = 70$ hr and $\sigma = 2$ hr.

(a) What is the probability that a battery selected at random will last between 70 and 72 hr? 34%

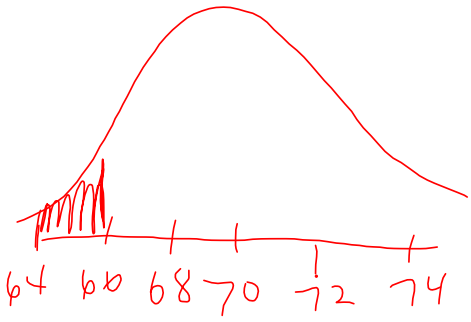
(b) What is the probability that a battery selected at random will last between 64 hr and 66 hr?



$70 < x < 72$

$\frac{70-70}{2} < z < \frac{72-70}{2}$

$0 < z < 1$



2.35

area under normal curv

answers: a) 34% b) 2.35%

5 Raul earned an 86 on his economics midterm and an 87 on his psychology midterm. In the economics class the mean score was 80 with standard deviation 4. In the psychology class the mean score was 79 with standard deviation 6.

(a) Convert each midterm score to a standard z score.

answer

$z_{ec} = \frac{86-80}{4}$

1.5

$z_{psy} = \frac{87-79}{6}$

1.333

(b) On which test did he do better compared to the rest of the class?

answer:

The economics test was better in comparison to the class!

6. Police response time to an emergency call is the difference between the time the call is first received by the dispatcher and the time a patrol car radios that it has arrived at the scene (based on information from the *Denver Post*). Over a long period of time, it has been determined that the police response time has a normal distribution with a mean of 8.4 minutes and a standard deviation of 1.7 minutes. For a randomly received emergency call, what is the probability that

(a) Find the probability is less than 4 minutes

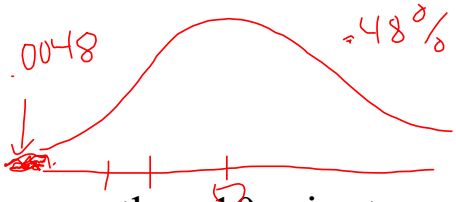
pull z <

ans:

$P(x < 4)$

$z < \frac{4 - 8.4}{1.7}$

$z < -2.59$



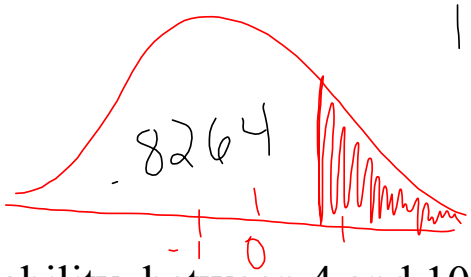
(b) Find the probability is more than 10 minutes

pull

$P(x > 10$

$z > \frac{10 - 8.4}{1.7}$

$z > .94$



$1 - .8264$

$.1736$

17.36%

ans: p

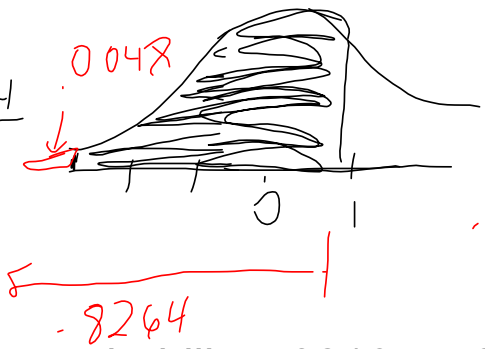
pull z

(c) Find the probability between 4 and 10 minutes

$P(4 < x < 10)$

$\frac{4 - 8.4}{1.7} < z < \frac{10 - 8.4}{1.7}$

$-2.59 < z < .94$



$.8264 - .0048 = .8216$

ans: probability: .8216 or 82.16 %

Areas of a Standard Normal Distribution

(a) Table of Areas to the Left of z

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

8. Tonya and Ryan are both applying for a position as lifeguard. Tonya took the advanced first aid class at the community center. Her score on the comprehensive final exam was 128 points. The final exam scores followed a normal distribution with mean 110 points and standard deviation 20 points. Ryan took an advanced first aid class at the hospital. For the method of testing there, his cumulative score on all exams was 73. The cumulative scores followed a normal distribution with mean 55 and standard deviation 8. There is only one position available as lifeguard and Tonya and Ryan are equally qualified as swimmers.

(a) Both Tonya and Ryan scored 18 points above the mean for their respective tests. Does this mean that they both gave the same performance on the first aid course? Explain your answer.
(b) Calculate the z scores for Tonya and Ryan. On the basis of test results which of them should get the job? Explain your answer.

$z = \frac{128-110}{20}$ $z = \frac{73-55}{8}$

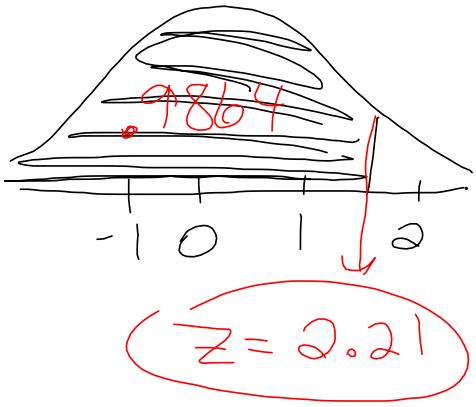
tonya z(tonya) = .9 Ryan z(Ryan) = 2.25

answer Ryan is more qualified, his z score is higher which shows that he out performed more students than Tonya did.

8. What is the z score associated with the area to the left of .9864?

98.64%

answer:



Areas of a Standard Normal Distribution *continued*

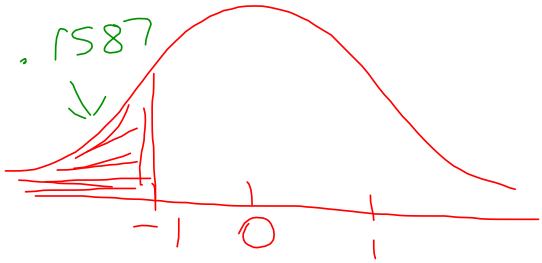
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.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 1.000 to approximate the area.

9. A certain karaoke machine is known to function properly for a mean 5.8 years with a standard deviation of 0.8 year. The machine is sold with a 5-year warranty. What is the probability that the player will break during the warranty period?

$\mu = 5.8$
$\sigma = .8$

15.87%



$x < 5$

$z < \frac{5 - 5.8}{.8}$

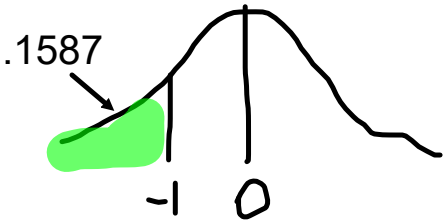
$z < \frac{-.8}{.8}$

$z < -1$

steps: find the probability that x ≤ 5

1. Change 5 to a z-value $\frac{5 - 5.8}{.8} = -1$
2. Draw the standard normal curve and shade le
3. Look up -1 in the z-chart in the book.

pull



answer: .1587 or 15.87% of the time the player will break durir the warranty period.

10. Laura received a z score of 0.95 on a college entrance exam. If the raw scores have a mean of 460 and a standard deviation of 60 points, what is her raw score?

Answer:

$(60)\ .95 = \frac{X - 460}{60}(60)$

$57 = X - 460$

$460 \qquad 460$

$517 = X$

Areas of a Standard Normal Distribution

(a) Table of Areas to the Left of z

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