If your z-score is 2, what percent of data is below your score?

34%   34%
2.5%   13.5%   13.5%   2.5%

X̄-3σ   X̄-2σ   X̄-1σ   X̄   X̄+1σ   X̄+2σ   X̄+3σ

97.5%
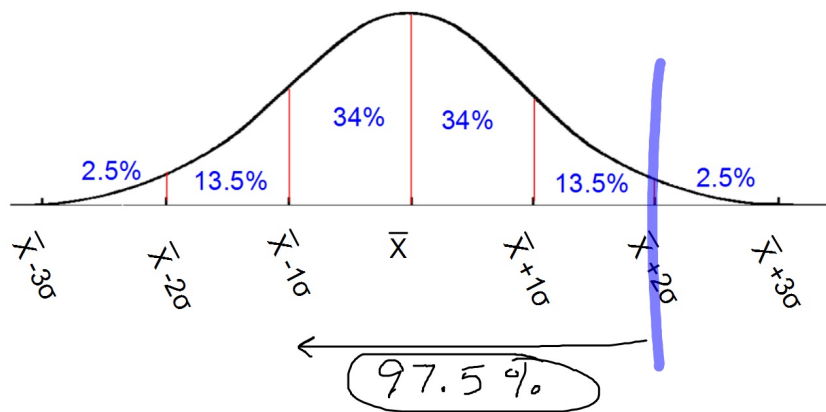
If your z-score is -1, what percent of data is below your score?

34%   34%
2.5%   13.5%   13.5%   2.5%

X̄-3σ   X̄-2σ   X̄-1σ   X̄   X̄+1σ   X̄+2σ   X̄+3σ

16%
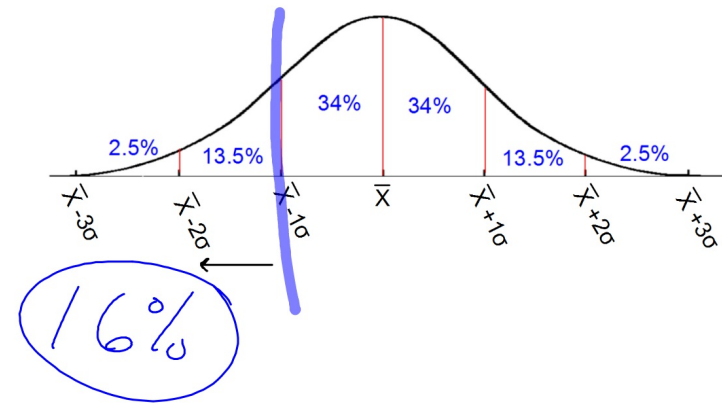
If your z-score is 1.75, what percent of data is below your score?

2.5%   13.5%   34%   34%   13.5%   2.5%

$\overline{X}_{-3\sigma}$ $\overline{X}_{-2\sigma}$ $\overline{X}_{-1\sigma}$ $\overline{X}$ $\overline{X}_{+1\sigma}$ $\overline{X}_{+2\sigma}$ $\overline{X}_{+3\sigma}$
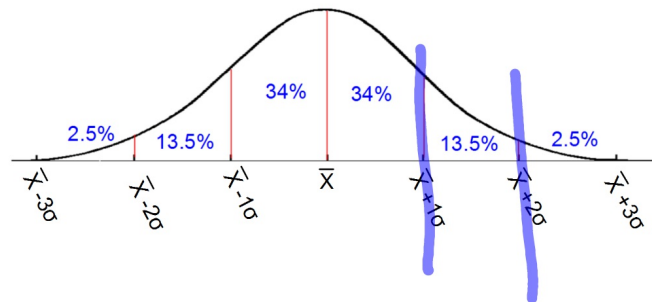
z=1.75 is between 1 and 2 standard deviations above the mean.

84% of the data is below z=1 and 97.5% of the data is below z=2. Therefore, between 84% and 97.5% of the data is below z=1.75.

Using the 68-95-100 rule on a Normal Distribution can only answer questions dealing with integer z-scores (integer values of standard deviations from the mean).

You can use a Normal Distribution Table to find % values that aren't integer z-scores.
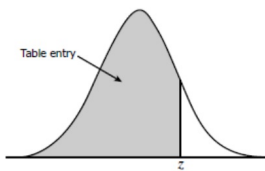
Standard Normal Probabilities

Table entry for z is the area under the standard normal curve to the left of z.

$z = 1.75$

→ 95.99% below

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

Find the % of data below the following z-scores.

1. $z = 1.39$

.09

.8997	.9015
1.3 .9162	.9177
.9306	.9319

91.77%

2. $z = 2.07$

.07

.9750	.9756	.9761
2.0 .9803	.9808	.9812
.9846	.9850	.9854
.9881	.9884	.9887

98.08%

Find the % of data above the following z-scores.

3. z = 1.16

4. z = 2.38

to find percent of data above a z-score you use the table to find % below and subtract it from 100.

.8531	.8554	.8577
.8749	.8770	.8790
.8944	.8962	.8980

$z = 1.16$

87.70% below

.9884	.9887	.9890
.9911	.9913	.9916
.9932	.9934	.9936

$z = 2.38$

99.13% below

$$100 - 87.70$$

$$\boxed{12.30\%}$$

12.30% of the data is above a z-score of 1.16

$$100 - 99.13$$

$$0.87\%$$

0.87% of the data is above a z-score of 2.38

Find the % of data below the following z-scores.
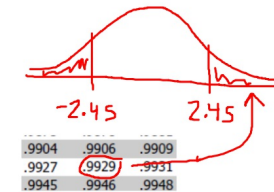
5. z = -1.81

6. z = -2.45

because of the symmetry in a Normal Distribution, the % of data below a negative z-score is the same as the % of data above a positive z-score.
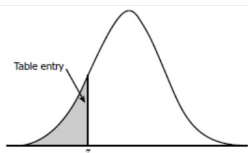
-1.81   1.81

1.7	.9554	.9564
1.8	.9641	.9649
1.9	.9713	.9719
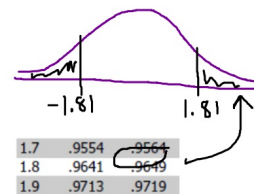
3.51%

96.49% is below z=1.81 thus 3.51% is above 1.81 and this will be the same as percent of data below -1.81

-2.45   2.45

.9904	.9906	.9909
.9927	.9929	.9931
.9945	.9946	.9948

0.71%

99.29% is below z=2.45 thus 0.71% is above 2.45 and this will be the same as percent of data below -2.45

You can also find % of data below a negative z-score by using this table.

Table entry for z is the area under the standard normal curve to the left of z.

Below z = -1.81

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

3.51%

The mean score on the ACT is 18 with a standard deviation of 6.

2. If your ACT score was 27 you did better than what % of those who took the test?

$$Z = \frac{27 - 18}{6} = 1.5$$

1.4	.9192	.9207
1.5	.9332	.9345
1.6	.9452	.9463

93.32% of the data is below

3. You did better than what % if you score was 20?

$$Z = \frac{20 - 18}{6} = 0.33$$

0.2	.5793	.5832	.5871	.5910
0.3	.6179	.6217	.6255	.6293
0.4	.6554	.6591	.6628	.6664

62.93% of the data is below

Students who score in the top 10% of an achievement test qualify for a scholarship.

The test had a mean of 86 and a standard deviation of 7.

	.08	.09
	.5319	.5359
	.5714	.5753
	.6103	.6141
	.6480	.6517

1. If you had a score of 88 you did better than what % of those who took the test?

$$Z = \frac{88 - 86}{7} = 0.29 \longrightarrow 61.41\%$$

	.08	.09
0.6	.7257	.7291
0.7	.7580	.7611
0.8	.7881	.7910

2. If you had a score of 91 what % of those who took the test did better than you?

$$Z = \frac{91 - 86}{7} = 0.71 \longrightarrow$$

76.11% is below

Thus, 100-76.11 = 23.89% is above.

3. You need to get at least what score to qualify for the scholarship? to be in the top 10% there must be 90% below you. Find the value in the table as close to 0.9000 you can get and turn it in to the z-score:

	.08	.09
	.8810	.8830
	.8997	.9015
	.9162	.9177

this is a z-score of 1.28

Use the z-score formula to find the value of x:

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

$$\frac{x - 86}{7} = 1.28$$

you need at least a 95 to qualify.

$$x \approx 95$$