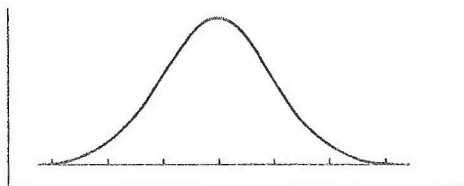
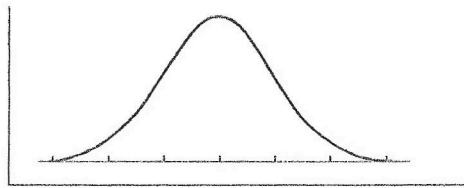


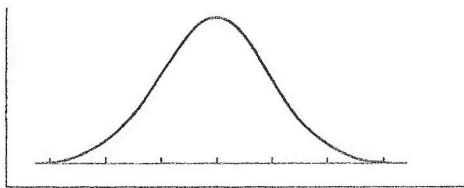
1. For the numbers below, find the percentile rank (percent of individuals scoring below):
  - a)  $-0.47$
  - b)  $2.24$
  
2. For the numbers below, find the percent of cases falling above the  $z$ :
  - a)  $0.24$
  - b)  $-2.07$
  
3. For the numbers below, find the area between the mean and the  $z$ -score:
  - a)  $z = 1.17$
  - b)  $z = -1.37$
  
4. Consider SAT scores for 2009 high school graduates. The scores are approximately normally distributed.
  - a) What is the approximate percent of graduates scoring within one standard deviation of the mean.
  - b) Jeff's  $z$  score is  $-1.75$ . What does that tell you about Jeff's SAT score?  
  
Jeff's score is \_\_\_\_\_ standard deviations \_\_\_\_\_ the mean.
  - c) What percentile rank is Jeff's  $z$  score? What score would someone have to get to be in the top 70%?
  
5. For a normal distribution, find the  $z$ -score that separates the distribution as follows:
  - a) Separate the highest 30% from the rest of the distribution.
  - b) Separate the lowest 40% from the rest of the distribution.
  - c) Separate the highest 75% from the rest of the distribution.



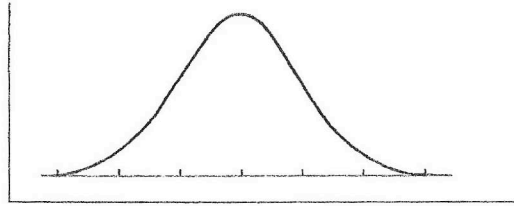
6. A patient recently diagnosed with Alzheimer's disease takes a cognitive abilities test and scores a 45. The mean on this test is 52 and the standard deviation is 5. What is the patient's percentile rank?
7. A fifth grader takes a standardized achievement test (mean = 125, standard deviation = 15) and scores a 148. What is the child's percentile rank?
8. The Welcher Adult Intelligence Test Scale is composed of a number of subtests. On one subtest, the raw scores have a mean of 35 and a standard deviation of 6. Assuming these raw scores form a normal distribution:
- What number represents the 65<sup>th</sup> percentile (what number separates the lower 65% of the distribution)?
  - What number represents the 90<sup>th</sup> percentile?
  - What is the probability of getting a raw score between 28 and 38?
  - What is the probability of getting a raw score between 41 and 44?



9. Scores on the SAT form a normal distribution with  $\mu = 500$  and  $\sigma = 100$ .
- What is the minimum score necessary to be in the top 15% of the SAT distribution?
  - Find the range of values that defines the middle 80% of the distribution of SAT scores. (Find the z-scores then find the range of values)

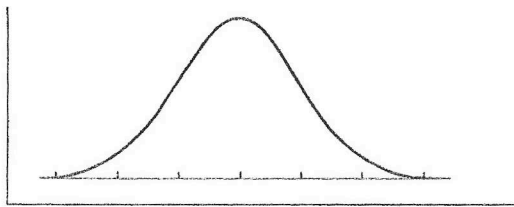


10. Pat and Chris both took a spatial abilities test (mean = 80, std. dev. = 8). Pat scores a 76 and Chris scored a 94. What percent of individuals would score between Pat and Chris?



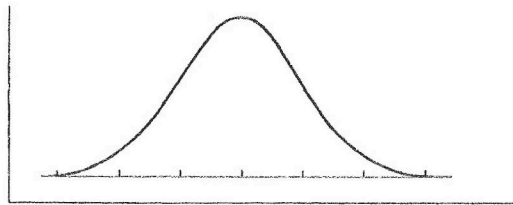
11. IQ scores have a mean of 100 and a standard deviation of 16. Albert Einstein reportedly had an IQ of 160.

- Convert Einstein's IQ score to a z score.
- If we consider "usual IQ scores to be those that convert z scores between -2 and 2, is Einstein's IQ usual or unusual? What is Einstein's percentile rank? Draw the area on the graph.



12. Womens 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 a height of 70 inches and determine whether the height is unusual.
13. Three students take equivalent stress tests. Which is the highest relative score (meaning which has the largest z score value)?
- A score of 144 on a test with a mean of 128 and a standard deviation of 34.
  - A score of 90 on a test with a mean of 86 and a standard deviation of 18.
  - A score of 18 on a test with a mean of 15 and a standard deviation of 5.

14. Adult female Dalmatians have a mean weight of 50 lbs and a standard deviation of 3.3 lbs. Assume the weights are normally distributed.
- Find the percentile rank of an adult female Dalmatian who weighs 60 lbs.
  - Find the weight of an adult female Dalmatian whose weight is 1.75 standard deviations above the mean weight.
  - Find the weight of an adult female Dalmatian whose weight is 2.5 standard deviations below the mean weight.
15. A pharmaceutical company wants to test a new cholesterol drug. The average cholesterol of the target population is 200 mg and they have a standard deviation of 25 mg. The company wished to test a sample of people who fall between 1.5 and 3 z-scores above the mean. Into what range must a candidate's cholesterol level be in order for the candidate to be included in the study?



1. For the numbers below, find the percentile rank (percent of individuals scoring below):

a) -0.47     .31918     31.9%

b) 2.24     .98745     98.7%

2. For the numbers below, find the percent of cases falling above the z:

a) 0.24     .59483     59.5%

b) -2.07     .01923     1.9%

3. For the numbers below, find the area between the mean and the z-score:

a)  $z = 1.17$      .879     87.9%

b)  $z = -1.37$      .09534     8.5%

4. Consider SAT scores for 2009 high school graduates. The scores are approximately normally distributed.

a) What is the approximate percent of graduates scoring within one standard deviation of the mean.

68%

b) Jeff's z score is -1.75. What does that tell you about Jeff's SAT score?

Jeff's score is 1.75 standard deviations below the mean.

c) What percentile rank is Jeff's z score? What score would someone have to get to be in the top 70%?

0.04006  
4%

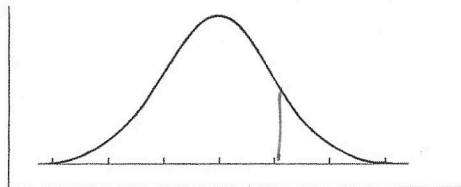
-.52

5. For a normal distribution, find the z-score that separates the distribution as follows:

a) Separate the highest 30% from the rest of the distribution.     .1     0.93

b) Separate the lowest 40% from the rest of the distribution.     .4     -0.25

c) Separate the highest 75% from the rest of the distribution.     .25     -1.96



6. A patient recently diagnosed with Alzheimer's disease takes a cognitive abilities test and scores a 45. The mean on this test is 52 and the standard deviation is 5. What is the patient's percentile rank?

$$\frac{45-52}{5} = -1.4$$

.08076 **8.1%**

7. A fifth grader takes a standardized achievement test (mean = 125, standard deviation = 15) and scores a 148. What is the child's percentile rank?

$$\frac{148-125}{15} = 1.53$$

**93.7%**

8. The Welcher Adult Intelligence Test Scale is composed of a number of subtests. On one subtest, the raw scores have a mean of 35 and a standard deviation of 6. Assuming these raw scores form a normal distribution:

- a) What number represents the 65<sup>th</sup> percentile (what number separates the lower 65% of the distribution)?

$$z = .39 \quad .39 = \frac{x-35}{6}$$

- b) What number represents the 90<sup>th</sup> percentile?

$$z = 1.29 \quad 1.29 = \frac{x-35}{6}$$

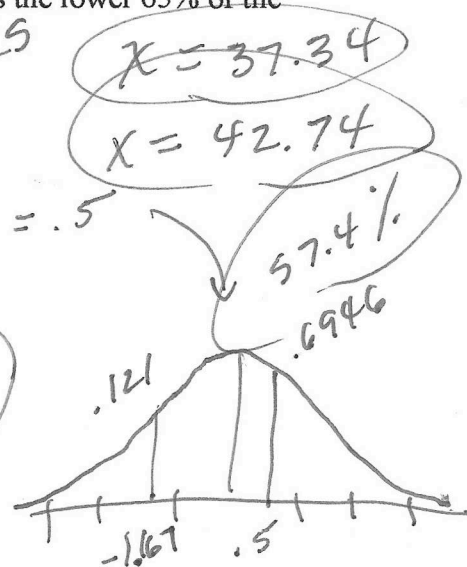
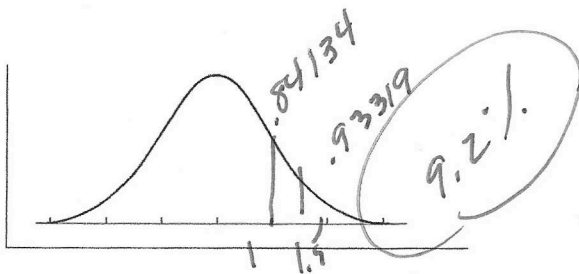
- c) What is the probability of getting a raw score between 28 and 38?

$$z = \frac{28-35}{6} = -1.1667 \quad z = \frac{38-35}{6} = .5$$

- d) What is the probability of getting a raw score between 41 and 44?

$$z = \frac{41-35}{6} = 1$$

$$z = \frac{44-35}{6} = 1.5$$



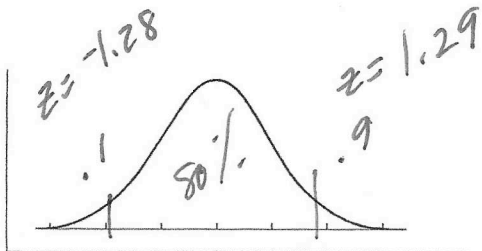
9. Scores on the SAT form a normal distribution with  $\mu = 500$  and  $\sigma = 100$ .

- a) What is the minimum score necessary to be in the top 15% of the SAT distribution?

top 15% .85  $z = 1.04 \quad 1.04 = \frac{x-500}{100}$  **604**

- b) Find the range of values that defines the middle 80% of the distribution of SAT scores. (Find the z-scores then find the range of values)

**Between 372 & 629**



$$1.29 = \frac{x-500}{100}$$

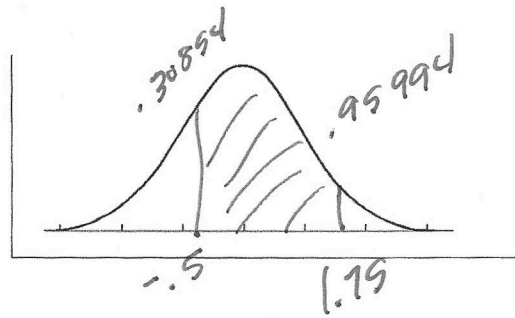
$$x = 629$$

$$-1.28 = \frac{x-500}{100}$$

$$x = 372$$

10. Pat and Chris both took a spatial abilities test (mean = 80, std. dev. = 8). Pat scores a 76 and Chris scored a 94. What percent of individuals would score between Pat and Chris?

Pat  
 $\frac{76 - 80}{8} = -.5$



Chris  
 $\frac{94 - 80}{8} = 1.75$

$.95994 - .30854 = 0.6514$  (65%)

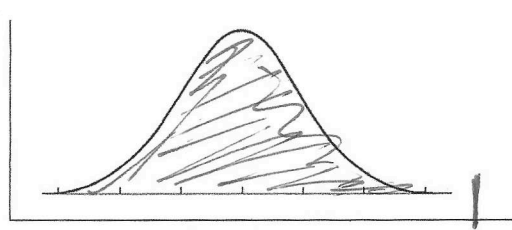
11. IQ scores have a mean of 100 and a standard deviation of 16. Albert Einstein reportedly had an IQ of 160.

- a. Convert Einstein's IQ score to a z score.

$\frac{160 - 100}{16} = 3.75$

- b. If we consider "usual IQ scores to be those that convert z scores between -2 and 2, is Einstein's IQ usual or unusual? What is Einstein's percentile rank? Draw the area on the graph.

unusual



99.99%

12. Womens 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 a height of 70 inches and determine whether the height is unusual.

$\frac{70 - 63.6}{2.5} = 2.56$  yes

13. Three students take equivalent stress tests. Which is the highest relative score (meaning which has the largest z score value)?

C has the highest score

- a. A score of 144 on a test with a mean of 128 and a standard deviation of 34.

$\frac{144 - 128}{34} = .4706$

- b. A score of 90 on a test with a mean of 86 and a standard deviation of 18.

$\frac{90 - 86}{18} = .2222$

- c. A score of 18 on a test with a mean of 15 and a standard deviation of 5.

$\frac{18 - 15}{5} = .6$

14. Adult female Dalmatians have a mean weight of 50 lbs and a standard deviation of 3.3 lbs. Assume the weights are normally distributed.

a) Find the percentile rank of an adult female Dalmatian who weighs 60 lbs.

$$\frac{60-50}{3.3} = 3.03 \quad .99878 \quad 99.88\%$$

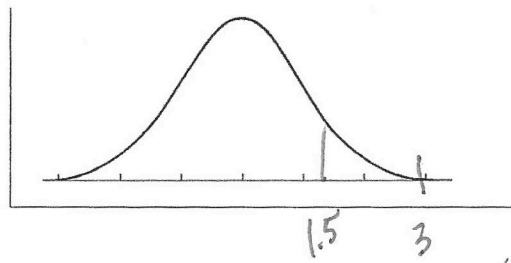
b) Find the weight of an adult female Dalmatian whose weight is 1.75 standard deviations above the mean weight.

$$1.75 = \frac{x-50}{3.3} \quad 55.775 \text{ lbs}$$

c) Find the weight of an adult female Dalmatian whose weight is 2.5 standard deviations below the mean weight.

$$-2.5 = \frac{x-50}{3.3} \quad 41.75 \text{ lbs}$$

15. A pharmaceutical company wants to test a new cholesterol drug. The average cholesterol of the target population is 200 mg and they have a standard deviation of 25 mg. The company wished to test a sample of people who fall between 1.5 and 3 z-scores above the mean. Into what range must a candidate's cholesterol level be in order for the candidate to be included in the study?



$$1.5 = \frac{x-200}{25}$$

$$3 = \frac{x-200}{25}$$

237.5    275

Between  
237.5 and 275