

WARM-UP: (Normal Distribution and Z scores)

The following are a set of practice problems.

Conversion of Variables:

1. Each year thousands of high-school students take either the SAT or ACT, standardized tests used in the college admission process. Combined SAT Math and Verbal scores go as high as 1600, while the maximum ACT composite is 36. Different scales are used so the comparisons are different. $SAT = (40)(ACT) + 150$

An admissions officer reported the following statistics about the ACT scores of 2355 students who applied to her college one year. Find the summaries of equivalent SAT scores.

ACT Lowest score=19 SAT Lowest score= _____

Mean=27 Mean= _____

Standard deviation=3 Standard deviation= _____

3rd Quartile= 30 3rd Quartile= _____

Median= 28 Median= _____

IQR= 6 IQR= _____

2. A high school senior uses the Internet to get information on February temperatures in the town where he'll be going to college. The website gives information in degree Celsius.

Conversion formula: $^{\circ}F = (9/5)^{\circ}C + 32$

Determine the Fahrenheit equivalents for the summary information below:

Max Temp= 11 $^{\circ}$ C Max Temp= _____

Range = 33 $^{\circ}$ C Range= _____

Mean= 1 $^{\circ}$ C Mean= _____

Standard Deviation = 7 $^{\circ}$ C SD = _____

Median = 2 $^{\circ}$ C Median = _____

IQR= 16 $^{\circ}$ C IQR = _____

Z-Scores and standardization:

3. Nicole's score on the Stats midterm was 80 points. The class average was 75 and the SD was 5 points. What was her z-score?

Ans: _____

4. Cars currently sold in the US have an average of 135 horsepower with an SD of 40 horsepower. What is the z-score for a car with 195 horsepower?

Ans: _____

5. The average score on a Stats midterm was 75 points with an SD of 5 points. If Gregor's z-score is -2, how many points did he score?

Ans: _____

6. People with z-scores greater than 2.5 on an IQ test are considered as geniuses. If IQ tests have a score of a mean of 100 and SD of 16 points. What is the cut off score for a genius to prove himself as one?

Ans: _____

7. A town's January high temperatures average 36°F with an SD of 10°F, while in July the mean high is 74°F and SD is 8°F. In which month is it more unusual to have a day with a high temp of 55°F? Why?

Ans: _____

8. Anna scored 83 on both her French and Spanish final. Megan scored 77 on French and 95 on her Spanish final. Overall student scores on the French exam had a mean of 81 and SD of 5, while Spanish exam mean was 74 and SD was 15.

- a) To qualify for honors a major must maintain at least an 85 average for all language courses taken. Which student qualifies?

Ans: _____

- b) Which student's overall score is better?

Ans: _____

- c) Would there be a difference if all the Spanish exam marks were increased by 5 marks? Ans a) and b) again?

Ans: _____

Normal Models:

9. What percent of a standard normal model is found in each region? Draw a picture.

a) $z > 1.5$ Ans: _____

b) $z < 2.25$ Ans: _____

c) $-1 < z < 1.15$ Ans: _____

d) $|z| > 0.5$ Ans: _____

10. In a standard Normal Model what values of Z cuts off the region described. Draw a picture.

a) The highest 20%

Ans: _____

b) The highest 75%

Ans: _____

c) The lowest 3%

Ans: _____

d) The middle 90%

Ans: _____

e) The middle 50%

Ans: _____

11. Based on the $IQ \sim N(100,16)$ scores, what percent of people's IQs would you expect to be:

a) Over 80? Ans: _____

b) Under 90? Ans: _____

c) Between 112 and 132? Ans: _____

d) Cut off value of highest 5%? Ans: _____

e) Cut off value of lowest 30%? Ans: _____

f) Cut off value of middle 80%? Ans: _____

g) What is the IQR of the IQs? Ans: _____

h) What IQ represents the 98th percentile? Ans: _____

12. Find the missing parameter?

a) $\mu=88$, 2% below 50; $\sigma =$ _____

b) $\mu=0.64$, 12% below 0.7; $\sigma=$ _____

c) $\sigma=0.5$, 90% above 10; $\mu=$ _____

d) $\sigma=15.6$, 10% below 11.2; $\mu=$ _____

Miscellaneous:

13. While only 5% of babies have learned to walk by the age of 10 months, 75 % are walking by 13 months of age. If the age at which babies develop the ability to walk can be described by a Normal model find mean and standard deviation?

14. Wild life biologists believe that the weights of adult trout can be described by a normal model. They collected data from fishermen, finding that 22% of the trout caught were thrown back because they were below 2-lbs minimum and only 6 % weighed over 5 lbs. What are the parameters? (mean and SD)
15. Based on a long term investigation, researchers have suggested that the acidity (pH) of rainfall in the Shenandoah mountains can be described by the normal model $N(4.9,0.6)$. The lower the pH, the more acidic the rain. What is the pH level for the most acidic 20% of all storms and that of the least acidic 5%?
16. Avoiding an accident when driving can depend on reaction time. That time measured from the moment the driver first sees the danger until he or she gets his foot on the brake pedal is thought to follow a Normal model with mean 1.5 seconds and SD of 0.18 seconds. What is the reaction time of the slowest one third ($1/3$) of all drivers. Give the 68-95-99.7 Rule.