Accelerated Math II Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Z-Scores and Percentile Rank Period\_\_\_\_\_Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sometimes it is necessary to compare individual scores from different sets of data. For example, suppose two students, Kenny from South Park High and Bart from Springfield High, are both applying for a scholarship. Both are taking AP Calculus with 99 other students (in other words, these are good sample sizes). Kenny has an 88 average while Bart has a 92. But further investigation shows that, although the student population is roughly the same (and normal\*), the average AP Calculus grade at South Park is 80 and the standard deviation is 10, while the average AP Calculus grade at Springfield is 94 with a standard deviation of 4. (South Park is known for its difficult teaching staff…)

One way to compare these two scores is to transform each score to a z-score. A z-score is found by subtracting the mean from the desired score and dividing that difference by the standard deviation. In other words:



This means that Kenny has a z-score of z(88) = (88 – 80)/10 = .8, while Bart has a z-score of z(92) = (92 – 94)/4 = -.5 . Clearly Kenny has the higher z-score.

If all the scores in a data set are converted to z-scores, the new data set will have a mean of 0 and a standard deviation of 1. Why is that true?

Another nice aspect of z-scores is that, if the populations are normal\*, we can actually find the percentile rank of both students by checking a z-score table or using a calculator. The percentile rank is the probability that all other scores will score lower than a given score, so it is the area bounded by the normal curve, the x-axis and the region to the left of the vertical line that denotes the value of that score.

The table in your book (Pg. 296) shows the percentile rank of various z-scores. Use that table to find percentile ranks for Kenny and Bart.

P(z <.8) = P(z < -.5) =

This can also be done using your calculator. Press 2nd VARS to get options about statistical DISTRIBUTIONS. Then choose 2:normalcdf. Type in the lower z-score of your region and then type in the upper z-score of your region. Close parentheses and press ENTER. This gives you the percent of data (or the area under the curve or the probability that a score will lie) within the region. If you type in the (lower limit, upper limit, mean, standard deviation), it will give you the percent, but you won’t need to find the z-score.

If we are given the percentile rank, we can find the “cut-off” score by finding the 3:invnorm . Type in the percentile rank (as a decimal) then the mean and standard deviation, and the calculator will return the “cut-off score”. Note that you must input the area below your needed score (the percentile rank) in order to use this command.

Try these:

I. If the mean score on a statistics test is 78 with a standard deviation of 14,

1. Find the percentile rank of a score of 95.

2. Find the percentile rank of a score of 70.

3. What is the probability that a randomly chosen test grade will be between 80 and 90?

4. Sam claims to have scored in the upper 10% of the class. What do we know about his test grade?

5. The lower 5% must go to a remediation class. What is the cut-off score for that class?

6. The middle 80% of the scores will lie between what 2 values? (Check your answer!)

II. The average attendance at certain local basketball games is 275 with a standard deviation of 68.

1. What percent of the games should have over 400 people present?

2. What percent of the games should have less than 100 people in attendance?

3. 90% of these games (centered about the mean) should have between \_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_ people in attendance. Fill in the blanks.

4. Find the cut-off score for the top 10% of games attendance.

5. Find the cut-off score for the lower 5% of games attendance.

Answers: I. 1. 88.77% 2. 28.39% 3. 24.75% 4. He scored above 95. 5. 55 6. 60 and 95

II. 1. 3.3% 2. 0.5% 3. 163 and 387 4. 362 5. 163