1. Which is the formula for calculating a z-score?

|  |  |
| --- | --- |
| A | (x - x̄)/s |
| B | Σ(xi - x̄)2/s |
| C | Σ(xi - x̄)/N-1 |
| D | (xi - x̄)/N-1 |

1. The *sign* of a z-score indicates:
   1. how far away from zero the z-score is
   2. how close to the mean the associated value of x is
   3. whether the associated x value is greater than or less than the standard deviation
   4. whether the associated x value is greater than or less than the mean score
2. Describe the location in the distribution for each of three z-scores listed here:
   1. *z* = 0.25
   2. *z* = -2.50
   3. *z* = .50

(HINT for Q3: A z-score = 1.00 is located above the mean by 1.0 standard deviations).

1. If a sample has a mean of 100 and a standard deviation of 10, a z-score of -1.00 corresponds to the x value of:
   1. 10
   2. 90
   3. 99
   4. 110
2. If a sample has a mean of 100 and a standard deviation of 10, a z-score of 2.50 corresponds to the x value of:
   1. 12.5
   2. 102.5
   3. 110
   4. 125
3. If a sample has a mean of 3 and a standard deviation of 0.5, the x value of 2.5 has a z-score of:
   1. +0.50
   2. -0.50
   3. +1.00
   4. -1.00
4. If a sample has a mean of 3.5 and a standard deviation of 1.5, the x value of 6.5 has a z-score of:
   1. +1.50
   2. -1.50
   3. +2.00
   4. +3.00
5. For a sample with a mean of 50 and a standard deviation of 12, find the x value corresponding to each of the following z-scores:
   1. *z* = -0.25
   2. *z* = 2.00
   3. *z* = 0.50
6. For a sample with a mean of 30 and a standard deviation of 8, find the z-score for each of the following values of X: (*Don’t forget to include the sign – positive or negative – in your response*.)
   1. X = 26
   2. X = 42
7. A distribution of English exam scores has a mean of 70 and a standard deviation of 4, while a distribution of History exam scores has a mean of 80 and a standard deviation of 4. For which exam would a score of 75 have a higher standing relative to other students’ scores?
   1. English exam
   2. History exam
   3. Can’t tell with the information given
8. A distribution of Math exam scores has a mean of 70 and a standard deviation of 5, while a distribution of Chemistry exam scores has a mean of 70 and a standard deviation of 10. For which exam would a score of 75 have a higher standing?
   1. Math exam
   2. Chemistry exam
   3. Can’t tell with the information given
9. Suppose that we measured class size for all classes offered during the semester. The mean class size was 16, and the standard deviation was 3. Assume your PY 221 class has 18 students in it. What % of classes have fewer students in them? *Round to the nearest hundredth (i.e.,. the nearest full percentage point).*
   1. 20%
   2. 25%
   3. 67%
   4. 75%
10. Suppose that we measured class size for all classes offered during the semester. The mean class size was 16, and the standard deviation was 3. Assume your PY 221 class has 18 students in it. What % of classes have a greater number of students in them? *Round to the nearest hundredth (i.e.,. the nearest full percentage point).*
    1. 20%
    2. 25%
    3. 67%
    4. 75%
11. Suppose that we measured class size for all classes offered during the semester. The mean class size was 16, and the standard deviation was 3. Assume your Arabic 220 class has 7 students in it. What % of classes have a greater number of students in them? *Round to the nearest ten-thousandth (i.e.,. the nearest hundredth of a percentage point).*
    1. 1.30%
    2. 30.00%
    3. 87.13%
    4. 99.87%

*Scroll to next page for key.*

1. A
2. D
3. (I) The score is located above the mean by ¼ of a standard deviation

(II) The score is located below the mean by 2 ½ standard deviations

(III) The score is located above the mean by ½ of a standard deviation

1. B A z-score of -1.00 indicates that the x value (the raw score x) is one standard deviation below the sample mean. The sample mean is 100, and the standard deviation is 10. Therefore, “one standard deviation below the sample mean” is 100 – (10 x 1) = 90.
2. D A z-score of 2.50 indicates that the x value (the raw score x) is 2.5 standard deviations above the sample mean. The sample mean is 100, and the standard deviation is 10. Therefore, “2.5 standard deviations above the sample mean” is (10 x 2.5) + 100 = 25 + 100 = 125
3. The z-score represents how many standard deviations above or below the mean is a given value of x. The x value of 2.5 is 0.5 units away from the mean of 3.0. Since the standard deviation itself is 0.50, 2.5 is simply *1 standard deviation below the mean*, which means a z-score of -1.00 (answer choice D).
4. The x value of 6.5 is *3 units above the mean* (6.5 – 3.5 = 3), but to determine the *z-score* ask yourself not how many units but rather, how many *standard deviations* is 6.5 above the mean? 3 units is equivalent to 2 standard deviations, since a standard deviation is 1.5 in this example. (A standard deviation is 1.5 units, so 6.5 is *2* standard deviations above the mean of 3.5). Choice C is the answer.
5. (a) x = 47, (b) x = 74, (c) x = 56. To solve, plug the known values from the question text into your z-score equation. z = (x - x̄)/s. You know *z* as it’s given in a, b, c (e.g., -0.25). You know that x̄ = 50, and s = 12. Solve for x by, first, cross-multiplying - multiply z-score (z) by the standard deviation (s). Set this value equal to (x – 50). Then isolate x by adding 50 to both sides of the equation.
6. (a) *z* = -0.50, (b) *z* = +1.50. z = (x - x̄)/s Plug the known values into this equation. We know x̄ and s from the question stem, and we know x from the a and b. For part a, (26 - 30)/8 = (-4)/8 = -0.50
7. A. Given that the standard deviations of the two samples are identical (the scores are equally spread out around their respective means), we can just pay attention to the mean score for each exam. The mean scores of the two classes’ exams suggests that a score of 75 would have a higher standing (be a better grade relative to the other grades in that class) in the class where the mean was lower, that being the English class.
8. A. Similar to the problem we went through in class related to PY and BI exam scores, if the means are equal then we look to the standard deviations to see how spread out the scores are. A larger standard deviation implies that the scores are more spread out above and below the mean. A small standard deviation implies that the scores are all pretty close to the mean. Given that scores are pretty spread out on the Chemistry exam (s=10), a score of 75, while above the mean, is still probably below many of the other scores in the class, which are going to be farther from that mean of 70. Given that scores are pretty clustered around 70 on the Math exam (s=5), there are probably many other scores between the 70 and the score of 75, which implies that the student did better than these other students and that there are unlikely to be many scores above the student. Therefore, the student would have a higher standing in his or her Math course (that is, he or she would be a better scorer relative to his/her classmates in Math, but a slightly more average scorer in Chemistry).
9. D First calculate the z-score associated with your raw score of 18. Z = (x – x-bar) / s = (18-16)/3 = +.67

Then look at your standard normal probabilities table, and search for a z-score of +.67

The probability listed for +.67 is .7486, which means that 75% of classes fall below a z-score of +.67, which means that 75% of classes have class sizes that fall below our own.

1. B We already know that our z-score for our class size is +.67, and that this z-score reveals that 74.86% of classes have class sizes that fall above our own. This means that 100% - 74.86% = **25.14% ~ 25%** of classes have class sizes larger than our own.
2. D First calculate the z-score for a class size of 7. Z = (x – x-bar) / s = (7 – 16) / 3 = -9/3 = -3.00.

Go to your standard normal probabilities table, and search for a z-score of -3.00. The table reveals that .0013 is the probability of scores falling below yours (i.e., of having a class size that is smaller than yours), which means that 1 - .0013 = .9987 is the probability of scores falling above yours (i.e., of having a class size that is greater than yours). So our answer is .9987, or 99.87%.