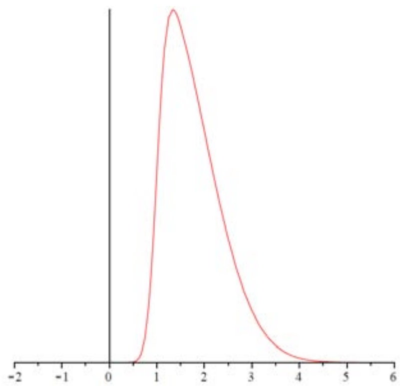
Normal Distribution

Extend Your Learning
Answers and Explanations

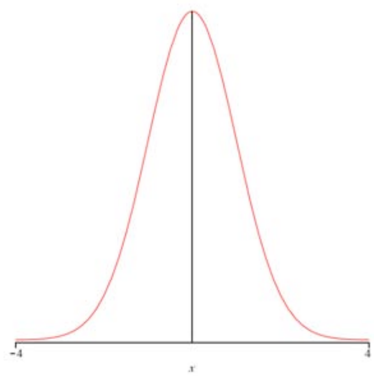
After watching the video, *Normal Distribution*, complete the following problems.

Consider the following distributions:

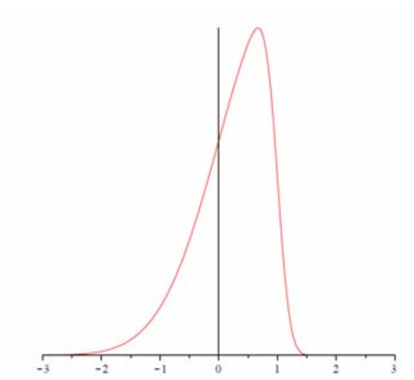
A.



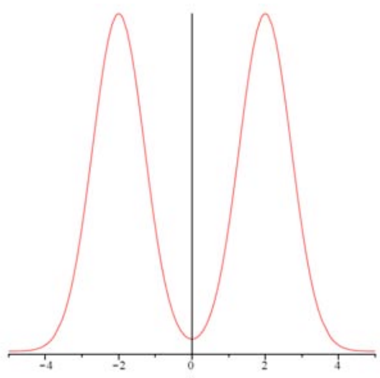
B.



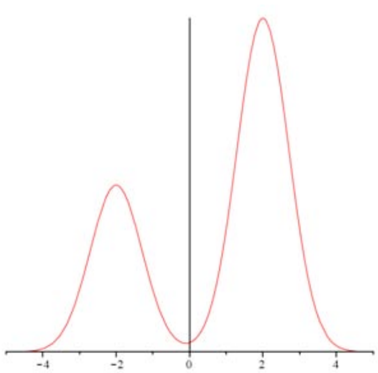
C.



D.



E.



1. Which, if any, is a normal distribution?
   B has all the properties of a normal distribution.

2. For which, if any, is the mean equal to the median?
   B, D

3. For which, if any, is the mean less than the median?
   C, E; The third distribution is skewed to the left. For both of these distributions the smaller values "pull down" the mean.

4. For which, if any, is the mean greater than the median?
   A; This distribution is skewed to the right. The smaller values in the data set "pull up" the mean.

A natural extension to learning about the normal distribution is using it to find a percentile rank for a particular score or piece of data in relation to the other data. If the data is normally distributed you can find a standardized score (also called z-score). The remainder of the problems will introduce computing and interpreting of a standardized score.

5. The students at a large high school take a math final at the end of each semester.

   a. The second semester scores are normally distributed with a mean of 85 and standard deviation of 5. Lucy earns a score of 95. How many standard deviations away from the mean is her score?
      95-85=10 and the standard deviation is 5. Ten divided by 5 is 2, so Lucy's score is 2 standard deviations above the mean.

      $$\frac{95-85}{5}=2$$

   b. The first semester scores were normally distributed with a mean of 86 and standard deviation of 4. Lucy earns a score of 95. How many standard deviations away from the mean is her score?
      95-86=9 and the standard deviation is 4, so her score is more than 2 standard deviations away from the mean but less than 3. To find out more precisely,

      $$\frac{95-86}{4}=2.25$$

   c. Compared to her peers, in which semester did she do better? How do you know?
      Lucy did better her first semester since she scored 2.25 standard deviations above the mean, while in the second semester she only scored 2 standard deviations above the mean. You could graph the distribution of scores for first semester and second semester and compare where her score lies on both. Lucy scored better than more people in both semesters.

d. How is the number of standard deviations away from the mean calculated given any mean and any standard deviation?

$$\frac{\text{score} - \text{mean}}{\text{standard deviation}} = \text{Number of standard deviations or z-score}$$

The number of standard deviations away from the mean is called a standardized score or z-score.

6. Koro received a 76 on a final with a mean of 87 and standard deviation of 8 while Jordan received a 67 on a final with a mean of 81 and standard deviation of 12. Who did better? Explain your answer.

Koro's z-score or standard score is $\frac{76 - 87}{8} = -1.375$.

Jordan's z-score or standard score is $\frac{67 - 81}{12} = -1.167$.

Jordan scored better in relationship to others taking the exam because his z-score was higher than Koro's. Koro scored better if you consider the percent correct.