

Part 1: Multiple Choice. Circle the letter corresponding to the best answer.

1. The heights of American men aged 18 to 24 are approximately Normally distributed with a mean of 68 inches and a standard deviation of 2.5 inches. Only about 5% of young men have heights outside the range

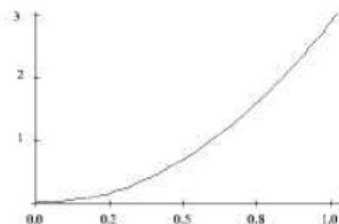
- (a) 65.5 inches to 70.5 inches
- (b) 63 inches to 73 inches
- (c) 60.5 inches to 75.5 inches
- (d) 58 inches to 78 inches
- (e) none of the above

2. Use the information in the previous problem. About what percentage of the men are over 70.5 inches tall?

- (a) 2.5
- (b) 5
- (c) 16
- (d) 32
- (e) 68

3. For the density curve shown to the right, which statement is true?

- (a) The area under the curve between 0 and 1 is 1.
- (b) The density curve is symmetric.
- (c) The density curve is skewed right.
- (d) The density curve is Normal.
- (e) None of the above is correct.



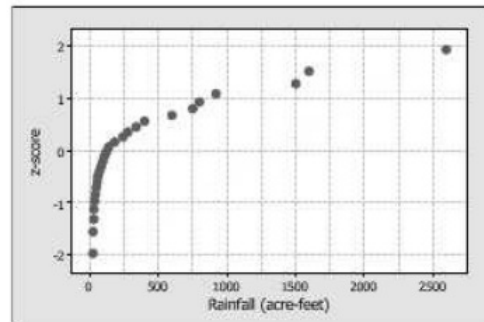
4. For the density curve shown in Question 3, which statement is true?

- (a) The mean and median are equal.
- (b) The mean is greater than the median.
- (c) The mean is less than the median.
- (d) The mean could be either greater than or less than the median.
- (e) None of the above is correct.

5. The area under the standard Normal curve corresponding to $-0.3 < Z < 1.6$ is

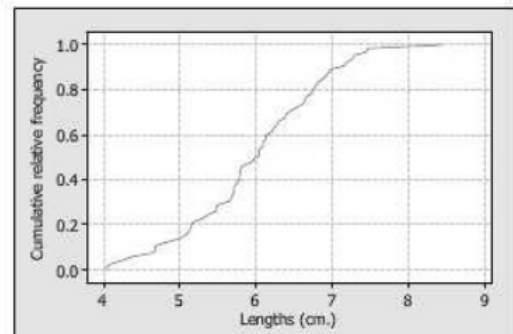
- (a) 0.3273
- (b) 0.4713
- (c) 0.5631
- (d) 0.9542
- (e) none of the above

6. The graph at right is a Normal probability plot for the amount of rainfall (in acre-feet) obtained from 26 randomly selected clouds that were seeded with silver oxide. Which of the following statements about the shape of the rainfall distribution is true?
- The distribution is Normal.
 - The distribution is approximately Normal.
 - The distribution is skewed left.
 - The distribution has no potential outliers.
 - The distribution is skewed right.



7. The distribution of the time it takes for different people to solve a certain crossword puzzle is strongly skewed to the right, with a mean of 30 minutes and a standard deviation of 15 minutes. The distribution of z-scores for those times is
- Normally distributed, with mean 30 and standard deviation 15.
 - Skewed to the right, with mean 30 and standard deviation 15.
 - Normally distributed, with mean 0 and standard deviation 1.
 - Skewed to the right, with mean 0 and standard deviation 1.
 - Skewed to the right, but the mean and standard deviation cannot be determined without more information.

8. The cumulative relative frequency graph at right shows the distribution of lengths (in centimeters) of fingerlings at a fish hatchery. The interquartile range for this distribution is approximately:
- 0.18 to 0.85 centimeters
 - 5 to 7 centimeters
 - 5.5 to 6.7 centimeters
 - 1.2 centimeters
 - 2 centimeters



9. Which of the following properties is true for all Normal density curves?
- They are symmetric.
 - The curve reaches its peak at the mean.
 - 95% percent of the area under the curve is within one standard deviation of the mean.
- I only
 - II only
 - I and II only
 - I and III only
 - All three statements are correct.

10. A fire department in a rural county reports that its response time to fires is approximately Normally distributed with a mean of 22 minutes and a standard deviation of 11.9 minutes. Approximately what proportion of their response times is over 30 minutes?
- (a) 0.03 (b) 0.21 (c) 0.25 (d) 0.75 (e) 0.79

Part 2: Free Response

Show all your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

The Dow Jones Industrial Average ("The Dow") is an index measuring the stock performance of 30 large American companies, and is often used as a measure of overall economic growth in the United States. Below is Minitab output describing the daily percentage changes in the Dow for the first three months of 2009 and the first three months of 2010. (Note that the market was open for 61 days during the first three months of each year. A negative value indicates a percentage decrease in the index for that day).

Descriptive Statistics: Dow 2009, Dow 2010

Variable	N	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Dow 2009	61	-0.198	2.331	-4.600	-1.530	-0.310	1.150	6.820
Dow 2010	61	0.078	0.821	-2.640	-0.270	0.110	0.465	1.660

Both distributions are approximately Normally distributed.

11. Consider a day when the Dow increased by 1%. In which year, 2009 or 2010, would such a day be considered a better day for the stock market, relative to other days in that year? Provide appropriate statistical calculations to support your answer.

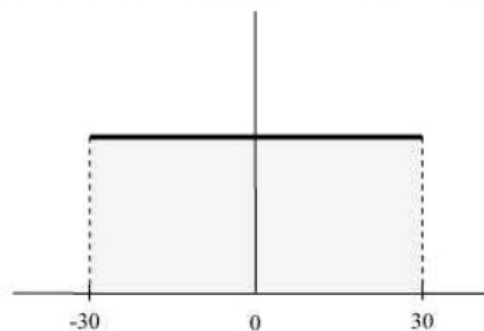
12. Based on these data, estimate the number of days that the Dow *decreased* by more than 1% in these 61 days.

13. Estimate the 19th percentile of daily change for the first three months of 2010.

14. "Normal" body temperature varies by time of day. A series of readings was taken of the body temperature of a subject. The mean reading was found to be 36.5°C with a standard deviation of 0.3°C . If you wanted to convert the temperatures to the Fahrenheit scale, what would the new mean and standard deviation be? (Note: $^{\circ}\text{F} = ^{\circ}\text{C}(1.8) + 32$).

A local post office weighs outgoing mail and finds that the weights of first-class letters is approximately Normally distributed with a mean of 0.69 ounces and a standard deviation of 0.16 ounces.

15. What is the 60th percentile of first-class letter weights?
16. First-class letters weighing more than 1 ounce require additional postage. What proportion of first-class letters at this post office require additional postage?
17. Old-fashioned mechanical alarm clocks were not very accurate about when the alarm went off. The density curve below describes the distribution of times a certain alarm clock went off. The scale on the x -axis represents when the alarm went off, in seconds, before (negative) or after (positive) the alarm was set to go off. What proportion of the time did the alarm go off within 10 seconds of the time it was set for? Shade the appropriate area on the graph to show how you found the answer.



Test 2A

Part 1

1. b 95% of the ages should be within 2 standard deviations of the mean, which is the interval $68 - 5$ to $68 + 5$ or 63 to 73. Thus 5% are outside that interval.
2. c 70.5 is one standard deviation above the mean. Since 68% are within one standard deviation, the remaining 32% are evenly divided into the regions above and below that interval.
3. a The area under any density curve is equal to 1. This curve is skewed left, so it isn't symmetric, Normal, or skewed right.
4. c Since the curve is skewed left, the mean will be "pulled down" by the values in the tail, making it less than the median.
5. c Percentile of $z = 1.6$ minus percentile of $z = -0.3$ is $.9452 - .3821 = .5631$.
6. e The distinct curve in the plot indicates that the distribution is strongly skewed (right).
7. d The distribution z -scores is a linear transformation, so it won't change the shape of the distribution. (See explanation at Quiz 2.1A).
8. d $Q_1 \approx 5.5$ and $Q_3 \approx 6.7$, so IQR is approximately 1.2.
9. c All Normal curves are symmetric and peak at the mean, but 95% of the area is within 2 standard deviations of the mean, not 1.
10. c $z_{30} = \frac{30 - 22}{11.9} = 0.67$, which is the 75th percentile of the Standard Normal curve, so about 25% of the times are above that value.

Part 2

11. In 2009, the z -score for 1% was $\frac{1 - (-0.198)}{2.331} = 0.514$. In 2010, the z -score for 1% was $\frac{1 - (0.078)}{0.821} = 1.123$. This means that 1% had a higher relative standing in 2010 than in 2009. (Percentiles for a 1% increase were 69.6% in 2009 and 86.9% in 2010.)
12. $z = \frac{-1 - (-0.198)}{2.331} = -.34$, percentile for $-.34$ is .3669. 61 days \times .3669 = 22.38, or about 22 days.
13. z for 19th percentile (from Table A) is -0.88 . So $-0.88(0.821) + 0.078 = -0.644$ or about a 0.64% decrease.
14. Mean = $36.5(1.8) + 32 = 97.7$ °F. Standard deviation = $0.3(1.8) = 0.54$ °F.
15. z for 60th percentile is 0.25, and $0.69 + 0.25(0.16) = 0.73$ ounces.
16. $z = \frac{1 - 0.69}{0.16} = 1.94$, which has a proportion of $1 - 0.9738 = .0262$ letters above it requiring additional postage.
17. The width of this region is 20 seconds, which is one-third the 60-second range of values. Hence the proportion is 0.33. See figure below.

