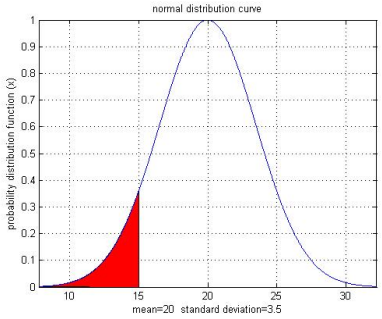
MT 143, Exam #2, Spring 2020 Name _____

Instructions: Show all work. Use exact answers unless specifically asked to round. Explain thoroughly using complete sentences. If you use your calculator to perform statistical tasks, say which command/operations you are using and what you entered into your calculator, and what you got back to show work. If you do not show work and the answer is incorrect, no credit will be awarded. After completing the questions, you will fill in the answers in a Blackboard "quiz", and you will be given a place to upload your work in case partial credit is possible. These questions will be auto-graded by the computer so you will see your initial results immediately. Comment in the gradebook for the problems you'd like to have reviewed for partial credit.

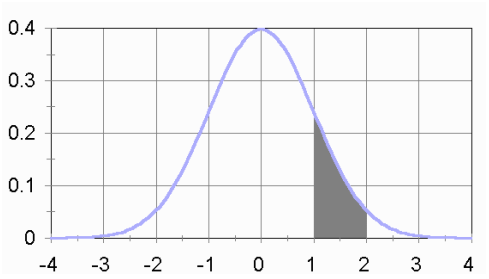
1. Suppose that we have a distribution with a mean of 140 with a standard deviation of 12. What is the standard score of the value 122 in this distribution? (5 points)

2. For each of the graphs below, find the probability (area) of the shaded regions. Parts b, c and d are all standard normal distributions with $\mu = 0, \sigma = 1$. For part a, $\mu = 20, \sigma = 3.5$. (5 points each)

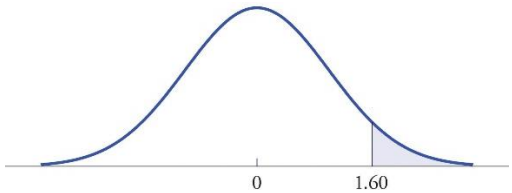
a.

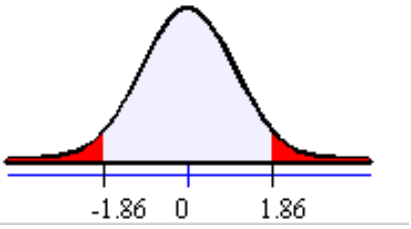


b.

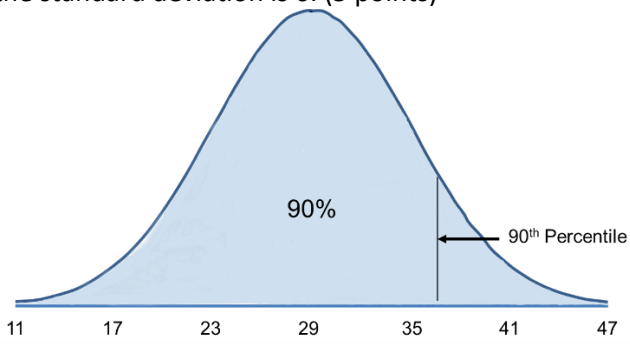


c.



d. 

3. On the graph below, find the x-value associated with the 90th percentile if the mean is 29 and the standard deviation is 6. (5 points)



4. Who has the highest score: a student (Tiffany) on a test with a mean of 85 and a standard deviation of 6 scores 90, or a student (Kishana) with a score of 83 with a mean of 72 and a standard deviation of 15? (5 points)

5. When we are constructing confidence intervals or a hypothesis test, why do we use the sampling distribution standard error rather than the standard deviation of the population distribution? (5 points)

6. Find the sampling distribution standard deviation for a sample of 103 people, with 61 respondents answering in the affirmative. (5 points)

7. A random sample of 1301 adult Americans was asked whether television was a luxury or a necessity. Of those surveyed, 521 indicated that television was a luxury they could do without. Construct and interpret at 95% confidence interval for the number of Americans who believe that television is a luxury. (10 points)

8. A recent Gallup poll asked American the number of book they read in the previous year. A preliminary survey found that the standard deviation of their sample was 16.6 books. Under that assumption, what is the minimum sample size needed to obtain a margin of error estimate of 4 books with 90% confidence? (5 points)

9. In a random sample of 100 estate tax returns that was audited by the IRS, it was determined that the mean amount of additional tax owed was $3421 with a standard deviation of $2583. Construct and interpret a 99% confidence interval for the mean additional amount owed on estate tax returns. (10 points)

10. The mean score on the SAT Math Reasoning exam is 516. A test prep company claims that the mean score of students who take their course is higher than this. Conduct a test of this claim if the mean score of students who take the test prep course is 522 based on a sample of 87 students. It is known that the population standard deviation of test is 126. Is there sufficient evidence to think that the test prep company is correct using a significance level of $\alpha = 0.01$? [Hint: conduct a t-test.] (15 points)
    a. What is the test statistic value?

    b. What is the corresponding p-value?

    c. Is there sufficient evidence for the test prep company's claim?

11. In August 2002, 47% of parents who had children in grades K-12 were satisfied with the quality of education the students received. In September 2010, the Gallup organization conducted a poll of 1013 parents who have children in K-12 and asked the same question. If those surveyed, 437 indicated that they were satisfied. Is this sufficient evidence to conclude that attitudes toward education have changed since 2002? [Hint: conduct a test of proportions.] (15 points)
    A. What is the test statistic value?

    B. What is the corresponding p-value?

    C. Is there sufficient evidence for the test prep company's claim?

12. As the newly hired manager of a company that provides cell phone service, you want to determine the percentage of adults in your state who live in a household with cell phones and no land-line phones. How many adults must you survey? Assume that you want to be 90% confident that the sample percentage is within 4 percentage points of the true population percentage.
    a. Suppose that nothing is known about the true percentage. (5 points)

    b. Redo the calculation with the added assumption that in a previous survey, about 8% of adults live in a household with only cell phones and no landlines. (5 points)

13. For each of the situations below, say whether you should use a normal distribution, a student T-distribution or neither to calculate a confidence interval. (5 points each)
    a. N=23, σ is unknown, population appears to be normally distributed.

    b. N=200, σ is unknown, population is very skewed.

    c. N=38, σ=15.0, population appears normally distributed.

    d. N=75, σ is unknown, population appears skewed.

14. Use the cross-tabulation table below to determine if preferred TV program is independent of gender. Conduct a χ^2 test. (20 points)

Gender	Preferred Program			
	Dance	Sports	Movies	Total
Women	16	6	8	30
Men	2	10	8	20
Total	18	16	16	50

    a. What is the expected number of men who prefer sports if the two variables are independent? (What is the value of this cell in the table of expected values?)

    b. What is the value of the test statistic?

    c. What is the p-value?

    d. Are the variables independent or dependent?