

**LESSON
MASTER****10-1****Questions on SPUR Objectives**

See pages 692–695 for objectives.

Properties Objective C

- Consider the binomial distribution function B with $n = 10$ and $p = 0.83$.
 - Give a formula for $B(k)$.

 - Give the function's domain.

 - Give the distribution's mode.

 - Give the function's maximum.

 - Describe how the domain and maximum value change if $n = 100$ and $p = 0.83$.

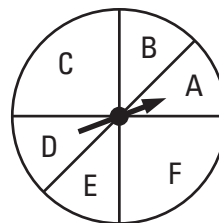
- Show that for a binomial distribution B with a fixed number of trials n and a fixed probability $p = 0.5$, $B(k) = B(n - k)$.

Uses Objective E

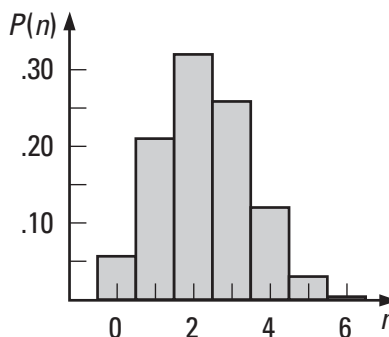
- Suppose the Food and Drug Administration is testing a new prescription medication which the manufacturer claims has a success rate of 60%. Assume this success rate and find the probability that at least 60% of the subjects given the medication will respond positively for the given number of people.
 - 10 people _____
 - 20 people _____

Representations Objective I

- Consider the spinner pictured at the right. Sectors A, B, D, and E have central angles of 45° , while sectors C and F have central angles of 90° .



- If the spinner is spun once, what is the probability that it will land in either sector A or sector C? _____
- Suppose the spinner is spun 6 times. Construct a histogram for the probability distribution P , where $P(n)$ is the probability that the spinner lands in sector A or sector C n times.



**LESSON
MASTER****10-2****Questions on SPUR Objectives**

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Skills Objective A**In 1–4, a binomial experiment is described.****a. Find the mean number of successes.****b. Find the standard deviation for the number of successes.**

1. The number of trials is 30 and the probability of success on each trial is 0.7. a. _____ b. _____
2. The number of trials is 100 and the probability of failure on each trial is 0.85. a. _____ b. _____
3. A student guesses randomly on a test with 50 true-false questions. a. _____ b. _____
4. Two fair dice are tossed 180 times. A success is tossing a 7. a. _____ b. _____

Uses Objective E

5. A manufacturer of spark plugs has estimated that the probability that a spark plug will be defective is 0.0125. A trucking company recently bought ten gross (1440) of these spark plugs for their fleet.
 - a. About how many spark plugs should the trucking company expect to be defective? _____
 - b. What is the probability that the trucking company will find exactly the expected number of defective spark plugs? _____
6. Suppose you flip a quarter 16 times and count the times it lands heads up.
 - a. What is the expected number of heads? _____
 - b. What is the probability that the number of heads is no more than one standard deviation from the expected number? _____
7. Suppose the following experiment is conducted: A die with s sides marked 1 through s is tossed n times and the number of times a 1 is tossed is recorded. After many repetitions of the experiment, it is found that the number of 1s tossed has a mean of 33 and a standard deviation of 5.5.
 - a. If the die is assumed to be fair, what is the most likely number of sides it has? _____
 - b. If the die is assumed to be fair, how many times n was it tossed in each experiment? _____

**LESSON
MASTER****10-3****Questions on SPUR Objectives**

See pages 692–695 for objectives.

Skills Objective F

1. Roland and Diane are playing a board game with a 6-sided die. Diane boasts that she has a lucky way of tossing the die which will give her a 6 more often than normal. Roland does not believe her, so he asks Diane to toss the die 12 times. She does so and gets five 6s.

- a. State a null and an alternative hypothesis for testing Diane's claim.

- b. Can your null hypothesis be rejected at the 0.05 significance level? Justify your answer.

- c. Roland, still doubting Diane's luck, does a test to see if the die is biased. He tosses it 12 times and gets three 6s. Test the claim that the die is biased at the 0.05 significance level. Be sure to clearly state your hypotheses.

2. A thermometer manufacturer claims that at least 95% of its thermometers are accurate to within 0.1°C .

- a. State a null and an alternative hypothesis for testing the manufacturer's claim.

- b. Suppose that of 20 thermometers randomly selected and checked for accuracy, five are found to give temperature readings which are off by more than 0.1°C . Test the manufacturer's claim at the 0.01 significance level.

**LESSON
MASTER****10-4****Questions on SPUR Objectives**

See pages 692–695 for objectives.

Vocabulary

1. What are the *inflection points* of the graph of the sine function? _____

Properties Objective D

2. Under what condition(s) does the graph of a binomial distribution approach that of a normal curve? _____

In 3–7, true or false.

3. The parent and standard normal functions have the same domain. _____
4. The parent and standard normal functions have the same range. _____
5. The areas under the parent and standard normal curves are the same. _____
6. The parent and standard normal curves have the same inflection points. _____
7. The scale-change transformation $S: (x, y) \rightarrow \left(\sqrt{2\pi}x, \frac{y}{\sqrt{2}}\right)$ maps the parent normal curve onto the standard normal curve. _____

In 8–11, let $f(x) = e^{-x^2}$ and $g(z) = \frac{1}{\sqrt{2\pi}} e^{-\frac{z^2}{2}}$.

8. $f(0)$ _____

9. $g(0)$ _____

10. $\lim_{x \rightarrow \infty} f(x)$ _____

11. $\lim_{z \rightarrow \infty} g(z)$ _____

12. What is the median of a standard normal distribution? _____

13. Consider the graph of the normal distribution function given by $h(x) = \frac{1}{\sqrt{\pi}} e^{-\frac{x^2}{3}}$.

- a. Find the graph's inflection points. _____

- b. Find the area between the graph and the x -axis. _____

**LESSON
MASTER****10-5****Questions on SPUR Objectives**
See pages 692–695 for objectives.**Skills** Objective B**Use the Standard Normal Distribution Table in Appendix D.**

1. a. Find the probability that a standard normal random variable z will take on a value between 0.05 and -1.02. _____
- b. Determine the area under the standard normal curve from $z = -1.02$ to $z = 0.05$. _____
2. About what percent of the data in a standard normal distribution are within 1.2 standard deviations of the mean? _____

In 3–6, evaluate the given probability.

3. $P(z > 1.5)$

4. $P(z < -2.24)$

5. $P(|z| \leq 1)$

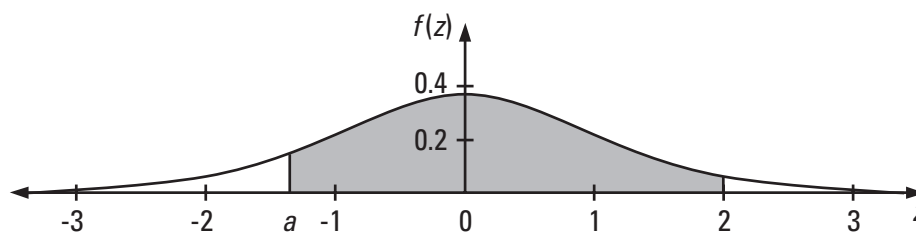
6. $P(-1.35 < z < 1.12)$

Properties Objective D**In 7–9, let z be a random variable with a standard normal distribution and let a be some constant. True or false.**

7. $P(z > a) = 1 - P(z < a)$ _____

8. $P(z = a) = 0$ _____

9. $P(|z| < a) = P(z < a) - P(z > a)$ _____

Representations Objective J**10. Refer to the standard normal curve graphed below.**

- a. Let the area of the shaded region for $z < 0$ be 0.398. Find a . _____
- b. What is the probability that a standard normal random variable will be in the shaded region of the graph? _____

**LESSON
MASTER****10-6****Questions on SPUR Objectives**
See pages 692–695 for objectives.**Properties** Objective D

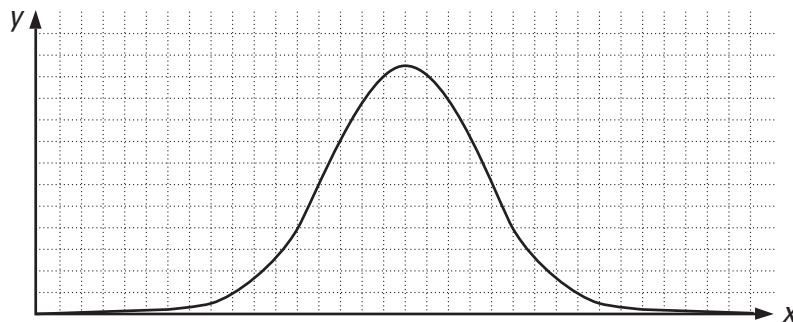
1. Explain why a binomial distribution with mean 16 and standard deviation 1.8 should not be approximated by a normal distribution.

Uses Objective E

2. Suppose a global computer network is able to transmit digital data at speeds of 1.5 Mbps (megabits per second). Assume this is the mean speed and that the speed is normally distributed with a standard deviation of 0.2 Mbps. If someone needs to send a data file of 400 Mb to an office in Japan, what is the probability that the data transmission will take less than 5 minutes?
3. A flask is divided in half by a permeable membrane which allows atoms of helium to pass freely from either side of the flask to the other side. The flask is filled with approximately 10^6 helium atoms. Assuming that there is an equal probability that a helium atom is on either side of the membrane, find the probability that at any moment either side of the flask will contain more than 50.1% of the helium atoms.

Representations Objective J

4. Consider a normal probability distribution with mean 17 and standard deviation 3.5.
- Find an equation to model this distribution.
 - Draw a graph of the distribution.



- What is the area under this graph between $x = 13.5$ and $x = 20.5$?

**LESSON
MASTER****10-7****Questions on SPUR Objectives**

See pages 692–695 for objectives.

Uses Objective F

1. Suppose a car manufacturer claimed its new economy car has an average highway gas mileage of 37 mpg with a standard deviation of 5 mpg. After receiving numerous complaints, a consumer group decided to test a random sample of 40 such vehicles. For the sample, they found the mean gas mileage to be 35 mpg. At the 0.01 significance level, test whether the average gas mileage is less than the manufacturer claims. Be sure to state your hypotheses clearly.

Uses Objective G

2. In Ohio in 1995–1996 the scores of the seniors taking the mathematics section of the Scholastic Aptitude Test (SAT-M) had a mean of 535 and a standard deviation of 104. What is the probability that a random sample of 40 of these students will have a mean SAT-M score less than 520? _____
3. a. Consider an experiment in which a fair six-sided die is tossed 400 times. Describe the distribution of the outcomes. Give the distribution's mean and standard deviation.
(Recall $\mu = \sum_{i=1}^n x_i \cdot P(x_i)$ and $\sigma^2 = \sum_{i=1}^n (x_i^2 \cdot P(x_i)) - \mu^2$.)

b. Suppose you repeat the experiment of part a many times. Describe the distribution of the means of these experiments. Give the distribution's mean and standard deviation.

**LESSON
MASTER****10-8****Questions on SPUR Objectives**
See pages 692–695 for objectives.**Uses** Objective H

1. A military expedition using a GPS (Global Positioning System) receiver finds their altitude to be 1233 ± 28 m. If the margin of error represents the 95% confidence interval for the receiver, what is the probability that the expedition is above 1261 m? _____
2. Suppose an astronomer has made many measurements of the distance to a distant star cluster and finds the data to be normally distributed with a mean of 624 kiloparsecs and a standard deviation of 35 kiloparsecs. (1 kiloparsec = 3.08×10^{19} meters)
 - a. What is the 90% confidence interval for the distance to the cluster? _____
 - b. What is the 99% confidence interval for the distance to the cluster? _____
3. A research team studying the dietary habits of American adult females charts the daily sodium intake of 100 randomly selected women over the course of 2 months. For their sample group, they find the daily sodium intake to have a mean of 2,850 mg with a standard deviation of 450 mg. Because the sample size is large, the researchers feel the standard deviation of the sample represents the standard deviation of the entire population of American women.
 - a. What should the research team report as the 95% confidence interval for the mean daily sodium intake of American women? _____
 - b. If the research team had wanted to report the mean sodium intake with a 95% confidence interval of 36 mg, what should their sample size have been? _____
4. Standardized tests are called “standardized” because they are given to a large number of students whose scores serve as the standard scores for others. Initially, standardized tests must be given trials. Suppose a standardized test with a total score of 40 is sampled with 200 randomly selected students from a population, and there is a mean of 16.7 and a standard deviation of 6.3 for the sample.
 - a. Give the 90% confidence interval for the population mean. _____
 - b. To reduce this confidence interval to one half its size, what size sample would be needed? _____