Applying Statistics

Program 6 Guide

Each episode of *Go Figure?* can be used as an introduction or a "refresher" of basic mathematics concepts presented in a fun and creative way. It may be used in a classroom or an intervention setting. The accompanying CD-ROM edu-game was designed for use by students on an individual basis. The object of the edu-game is to solve a mystery. In order to do this, the student must solve mathematics problems in the specific content areas presented in the video series. Thus the digital video series is used to generate interest and enthusiasm in the presentation of mathematics concepts, and the CD-ROM allows students to practice using the concepts in a "video-game" format.

The three main characters in each DVD video program – the mysterious Pythagleo, plus two students named Carter and Chris who are trying to solve the mystery of Etna High School – discuss the targeted math concepts.

Chris, and to a lesser extent, Carter, verbalizes what each is thinking as they work through problems associated with the math concepts. The DVD programs assume that, like Chris and Carter, your students have already been introduced to the math concepts presented in the episode. The dialog may be too quick for some students. Every step that some of your students will need to solve similar problems on their own may not be mentioned in the programs. Therefore, pausing the DVD to review or present additional information will help adapt the learning situation to the needs of your students. See additional materials about teaching with videos and differentiated instruction in the Introduction of the Teacher Resources Guide.

Ohio Mathematics Content Standards and Benchmarks

Data Analysis and Probability Benchmarks

A. Read, create, and use line graphs, histograms, circle graphs, box-and-whisker plots, stem-and-leaf plots, and other representations when appropriate.
B. Interpret data by looking for patterns and relationships, draw and justify conclusions, and answer related questions.
E. Collect, organize, display and interpret data for a specific pupose or need.
F. Determine and use the range, mean, median and mode to analyze and compare data, and explain what each indicates about the data.

Math Content

- Mean: definition and how to find
- Mode: definition and how to find
- Median: definition and how to find
- Range: definition and how to find
- Probability: definition and examples

Episode Notes

- Pythagleo drops several reports labeled "Government Agencies Attempting to Suppress the Study of Phenomena" as he runs to avoid Carter and Chris. Chris and Carter study the reports and other data they find as they continue trying to solve the mysterious disappearance of the Etna High students in 1966. Pythagleo denounces any government involvement but Chris finds a folder marked "Etna High Test Subjects", "Confidential", and "FBI".

- The chart that is used to explain mean, median, and mode is misrepresented by Chris and Carter. See if students can find the error……Hint: there are "12" 3's instead of "15", as Chris explains.

Teacher Notes

The **mean** is the arithmetical average of a set of data. To find the mean, find the sum of all values in the set of data, then divide this sum by the number of items in the set.

The **mode** is the number or item that has the greatest frequency in the set of data. To find the mode record the frequency of each item and choose the item having the greatest frequency. Notice that the mode can be something other than a number. There can be more than one mode.

The **median** is the middle value of a set of data when the numbers are arranged in order of magnitude. To find the median of a set of data having an odd number of numbers, merely observe your data, perhaps counting from both ends, and pick the middle number. If the set of data has an even number of data points, then the median is the arithmetic average of the two middle terms (or half-way between them.)

A **probability** is a number that describes how likely it is that an event will occur. A probability is expressed as the ratio of the number of successful ways that an event can happen to the total number of ways that the event can happen.

$$\text{Probability} = \frac{\textit{Number of successful outcomes}}{\textit{total number of outcomes}}$$

Probabiltiy is a number between 0 and 1, inclusive.

A probability of 0 means the event is impossible to occur.
The probability that the sun will *not* rise tomorrow is 0.

A probabliity of 1 means the event must occur.
The probability that the sun *will* rise tomorrow is 1.

Applying Statistics
Worksheet 1

Choice *E*, in multiple-choice questions, is always: *I request help from the teacher*.

You may mark E in addition to one other choice if you think that you have the right answer to the question but you do not feel that you have a complete understanding of the problem.

Your teacher will decide whether to use the two-point or four-point scoring rubric for problems that use numbers, pictures, or words to justify/explain your answer(s). You may request help for these questions, too. Write the word "teacher" by your answer(s).

Use the chart for exercises #1-#3.

Etna High's basketball team recorded the following statistics when playing Circleville High on November 29, 1965.

Players	Points
Alf Frisky	18
Sam Awful	10
Jeremy Handsome	14
Scooter Doll	5
Peter Wolfe	16
Michael Malady	2
Tim Mantis	4
Sal Monella	3
Steve Board	1
Joe Schmoe	1

1. What is the mode?

   A. 5
   B. 1
   C. 4
   D. 3
   E. Teacher

2. What is the median?

   A. 4
   B. 5
   C. 4.5
   D. 1
   E. Teacher

3. What is the mean?

   A. 74 B. 9 C. 7.4 D. 9.2 E. Teacher

4. A bag or marbles suddenly appeared at Carter's feet as he searched Etna High. The bag had 12 red marbles, 15 blue marbles, and 13 green marbles. What is the probability of not choosing a red marble when picking one marble from this bag?

   A. $\frac{1}{2}$ B. $\frac{7}{10}$ C. $\frac{3}{10}$ D. $\frac{3}{4}$ E. Teacher

5. Chris reads a mean value of three books every week. She reads six books during the first week of vacation, two books the second week, and one book during the third week. If she wants to maintain the mean value of reading three books, how many books must she read during the fourth week?

   A. 3 B. 2 C. 1 D. 4 E. Teacher

6. Carter has 20 coins in his pocket. There are five nickels, ten dimes, and five quarters. Ignoring the size of the coins and randomly choosing one coin in the pocket, what is the probability of getting a nickel?

A. $\frac{1}{2}$ B. $\frac{10}{15}$ C. $\frac{1}{4}$ D. $\frac{1}{1}$ E. Teacher

7. A jar contains only red, white, and blue marbles. What is the probability of drawing a white or red or blue marble on a single draw?

A. $\frac{1}{3}$ B. 1 C. 0 D. $\frac{2}{3}$ E. Teacher

8. In exercise #7, what is the probability of drawing a green marble on a single draw?

A. $\frac{1}{3}$ B. 1 C. 0 D. $\frac{2}{3}$ E. Teacher

9. A bag contains three marbles of each color: red, green, and blue. From the nine marbles, a marble is drawn and seen to be red. The red marble is replaced. What is the probability of drawing a red marble on the next draw?

A. 3 B. $\frac{1}{3}$ C. $\frac{2}{3}$ D. 1 E. Teacher

10. A jar contains two red, five green, and four blue marbles. A red marble is randomly drawn from the container and not replaced. What is the probability of drawing a red marble on the next draw?

A. $\frac{1}{5}$ B. $\frac{10}{11}$ C. $\frac{1}{10}$ D.0 E. Teacher

Applying Statistics
Worksheet 2

Choice *E*, in multiple-choice questions, is always: *I request help from the teacher*.

You may mark E in addition to one other choice if you think that you have the right answer to the question but you do not feel that you have a complete understanding of the problem.

Your teacher will decide whether to use the two-point or four-point scoring rubric for problems that use numbers, pictures, or words to justify/explain your answer(s). You may request help for these questions, too. Write the word "teacher" by your answer(s).

1. A standard deck of playing cards has 52 cards, evenly distributed among four suits: spades, hearts, diamonds, and clubs. What is the probability of drawing a spade in a single draw?

   A. 4 B. $\frac{1}{4}$ C. $\frac{2}{3}$ D. $\frac{1}{2}$ E. Teacher

2. In exercise #1 what is the probability of drawing the 2 of spades?

   A. $\frac{1}{52}$ B. $\frac{1}{4}$ C. $\frac{3}{4}$ D. $\frac{1}{13}$ E. Teacher

3. In a classroom of 25 students, it is observed that 20 have brown eyes, 2 students have green eyes, and the rest have blue eyes. If you write all of the students' names on slips of paper and place them in a box, what is the probability of choosing a blue eyed student's name in a single draw?

   A. $\frac{3}{25}$ B. $\frac{20}{25}$ C. $\frac{22}{25}$ D. not enough information E. Teacher

4. Pythagleo needed to change some of the burned out light bulbs at Etna High. The fine print on the box from the Bright Lite Bulb Company said that, on the average, 1% of their light bulbs are defective. The box Pythagleo opened had 100 light bulbs. The first bulb he used worked just fine. It was not defective. What is the probability that the second bulb he uses will be defective and will not work?

   A. 1% B. 99% C. 98% D. 2% E. Teacher

5. Pythagleo has programmed 8 phone numbers into his phone. By pressing a 1, 2, 3, 4, 5, 6, 7 or 8 one of his friend's phone numbers would be automatically dialed. Pythagleo knows that his best friend's number was programmed as one of the even numbers, but forgot which one. If he randomly presses an even number, what is the probability that he pressed the correct speed dial button for his best friend on the first try?

   A. $\frac{1}{8}$ B. $\frac{5}{8}$ C. $\frac{1}{2}$ D. $\frac{4}{9}$ E. Teacher

6. A regular, two-sided coin is tossed nine times, falling heads up on each toss. What is the probability of the next toss being a tails up?

A. $\frac{1}{2}$ B. $\frac{1}{10}$ C. $\frac{9}{10}$ D. 1 E. Teacher

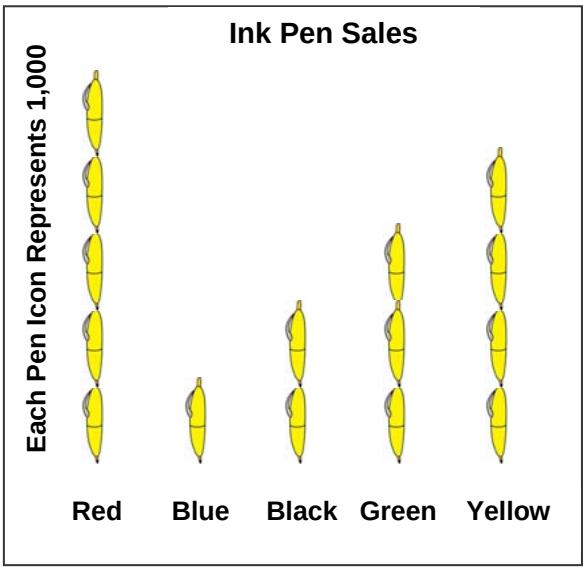
7. Diane has a list of four numbers. The mode is 5, the median is 6, and the mean is 7. What are the four possible numbers?

A. 5, 5, 6, 11 B. 5, 5, 7, 11 C. 5, 5, 6, 7 D. 5, 6, 7, 11 E. Teacher

Use the pictograph for exercises #8-#10.

8. What is the total number of pens illustrated in the pictograph?

A. 15
B. 15,000
C. 4,000
D. 7,500
E. Teacher



9. What color represents the mode?

A. Red
B. Blue
C. Black
D. Green
E. Teacher

10. What is the mean number of pens sold?

A. 3 B. 3,000 C. 5 D. 15,000 E. Teacher

Applying Statistics
Worksheet 3

Choice *E*, in multiple-choice questions, is always: *I request help from the teacher*.

You may mark E in addition to one other choice if you think that you have the right answer to the question but you do not feel that you have a complete understanding of the problem.

Your teacher will decide whether to use the two-point or four-point scoring rubric for problems that use numbers, pictures, or words to justify/explain your answer(s). You may request help for these questions, too. Write the word "teacher" by your answer(s).

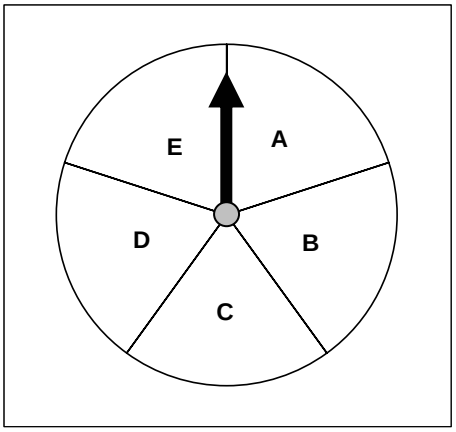
1. This table shows the depth of the water in Burns Reservoir for five days.

    a. Calculate the mean of the water depth levels.
    b. Explain what the mean indicates about these water depths.

Burns Reservoir **Water Levels**	
Day	**Depth (in feet)**
Monday	87
Wednesday	87
Tuesday	89
Friday	90
Thursday	92

2. Pythagleo will spin the spinner shown 100 times. He thinks that if the spinner lands on A or C that the missing students from Etna High School are more likely to *appear* or *come* back. Which prediction is reasonable for the number of times the spinner will land on either A or C?

    A. 4
    B. 20
    C. 40
    D. 80
    E. Teacher



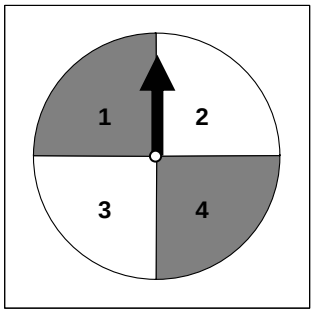
3. Carter is playing a game with a numbered octahedron and a coin. The octahedron is numbered from 1 to 8 and the coin has a heads side and a tails side. On each turn, the numbered cube is rolled and the coin is flipped. How many outcomes are possible?

    A. 2 B. 10 C. 12 D. 16 E. Teacher

4. Chris and Carter weighed each of the numbered wooden balls used in the coded message that was supposed to help them learn more about the disappearance of the Etna High students. They thought that there might be an additional clue in the results. The mode of the weights of 12 wooden balls was 7 ounces. Which statement explains what the mode represents?

    a. The difference between the lightest and the heaviest wooden ball was 7 ounces.
    b. The most common weight of the wooden balls was 7 ounces.
    c. The average weight of the wooden balls was 7 ounces.
    d. The lower quartile of the weights was 7 ounces.
    e. Teacher

5. Pythagleo is spinning the spinner shown. He predicts that the chance of the arrow landing on any number on the spinner is $\frac{1}{4}$. Which activity would best allow Pythagleo to test his prediction?



    A. Spin the spinner 4 times and see if it lands on the 4.
    B. Spin the spinner 200 times and see how close to 50 times the arrow lands on each number.
    C. Spin the spinner eight times and check to see whether the arrow lands on each number twice.
    D. Have a friend or classmate spin the spinner 10 times with his/her eyes closed and see how many times it lands on the 4.
    E. Teacher

6. Carter has a dodecahedron with a different color on each of its twelve faces. The faces are colored: black, blue, white, yellow, pink, purple, orange, brown, gold, gray, turquoise, and green. If Carter rolls the dodecahedron once onto a table top, what is the probability that it will stop rolling with a blue or yellow face down (touching the table)?

    A. $\frac{1}{12}$ B. $\frac{1}{6}$ C. $\frac{2}{10}$ D. $\frac{1}{1}$ E. Teacher

7. Fifty senior citizens from Enigma, Ohio, were surveyed to find out their willingness to share information about the disappearances at Etna High in 1966. A rating of 10 meant "very willing to share information." A score of 1 meant "unwilling to share anything." Ten people's responses are shown in the table. What is the range?

Willingness to Share Information	
Person A	1
Person B	3
Person C	2
Person D	2
Person E	2
Person F	1
Person G	4
Person H	3
Person I	3
Person J	2

    A. 1
    B. 2
    C. 3
    D. 4
    E. Teacher

8. The parents' organization at the elementary school in Enigma, Ohio, sold raffle tickets to raise money to buy playground equipment. To help promote the raffle and raise interest, four prizes were given: $200, $100, $75 and $25. Each ticket cost $7.00 and 2000 tickets were sold.

    a. Write a fraction (in lowest terms) that expresses the ratio between the total amount of money given away in prizes and the total money raised by the ticket sales.
    b. What percent (rounded to the nearest whole percent) of the money raised was paid out in prizes?
    c. Use numbers, pictures, or words to explain your answers.

9. Chris is on the baseball team at Western High School. His batting averages for the last seven games were .478, .267, .188, .193, .196, .245, and .358. What is the mean for his batting averages?

    A. 275 B. .275 C. 1.925 D. .245 E. Teacher

10. The stem-and-leaf plot represents the Carter's Social Studies quiz scores for the first half of the school year.

    a. What is the mode of the data set?
    b. What is the median?
    c. What is the range?
    d. Use numbers, pictures, or words to support your answers.

Carter's Quiz Scores

7	4 5 6 6 8
8	3 7 9
9	1 4 4 5 6 6 7 7 8 9 9
10	0 0 0 0 0

Key: 10|0 = 100%

11. Pythagleo was paid for ten weeks of work at Etna High School. His mean (average) earnings were $275 per week for the first nine weeks. In the last week (week ten), he earned $515 because he worked so much overtime. How was Pythagleo's mean weekly earnings for the ten weeks affected by the overtime of the last week?

    A. the mean did not change
    B. increased by $24
    C. increased by $299
    D. increased by $515
    E. Teacher

12. Chris has one green, one white, one red, one yellow and one blue tee shirt. She also has one pair of black jeans, one pair of dark blue jeans, and one pair of light blue jeans. Chris was so tired from trying to solve the mystery of Etna High School that she chose a tee shirt and a pair of jeans from her closet without even looking at what she is doing. What is the probability that Chris chose a yellow tee shirt and a pair of black jeans? Use number, pictures or words to support your answer.

Applying Statistics

Answer Keys, Program 6: Worksheets 1 – 3

Each question on every worksheet offers the students the option of marking "Teacher" instead of or in conjunction with answering the question. The "Teacher" option is included to support student understanding and achievement. Students may have as much help and guidance as they need to understand concepts and master skills.

Instructors may decide whether to use the two or four point scoring rubric for constructed response problems (problems that use numbers, pictures, or words to justify/explain student answers). See the appendix for the complete rubrics.

Two-Point Scoring Rubric	Four-Point Scoring Rubric
2 – Complete	4 – Complete
1 – Partial	3 – Clear
0 – Inadequate	2 – Partial
	1 – Minimal
	0 - Inadequate

Worksheet 1

1. B. 1
2. C. 4.5
3. C. 7.4
4. B. $\frac{7}{10}$
5. A. 3
6. C. $\frac{1}{4}$
7. B. 1
8. C. 0
9. B. $\frac{1}{3}$
10. C. $\frac{1}{10}$

Worksheet 2

1. B. $\frac{1}{4}$
2. A. $\frac{1}{52}$
3. A. $\frac{3}{25}$
4. A. 1%
5. C. $\frac{1}{2}$
6. A. $\frac{1}{2}$
7. B. 5, 5, 7, 11
8. B. 15,000
9. A. Red
10. B. 3,000

Worksheet 3

1. The mean is 89°. The mean shows how deep the water would be in Burns Reservoir if it was the same all five days. Answers should reflect the following 1) (87 + 87 + 89 + 90 +92) ÷ 5. 2) The definition of mean is the average of the numbers in a data set. An average is a number that typifies a set of numbers of which it is a function.
2. C. 40
3. D. 16
4. B. The most common weight of the wooden balls was 7 ounces.
5. B. Spin the spinner 200 times and see how close to 50 times the arrow lands on each number.
6. B. $\frac{1}{6}$
7. C. 3
8. $\frac{1}{35}$, 3%. Answers should reflect the following:
   1) Total money earned. 2000 x $7 = $14,000
   2) Total prize money. 200 + 100 + 75 + 25 = $400.
   3) Ratio. $\frac{400}{14000} = \frac{400 \div 400}{14{,}000 \div 400} = \frac{1}{35}$
   4) Convert the fraction to a percent. $\frac{100}{1} \times \frac{1}{35} = \frac{100 \times 1}{1 \times 35} = \frac{100}{35} = .0285 \, or \, 3\%$
9. B. .275
10. Mode: 100%, Median: 95.5% Range: 26%. Answers should reflect the following:
    1) Mode is the score that appears most often and Chris got a 100% five times.
    2) Median is the central number (or the average of the central 2 numbers in a data set with a even amount of numbers) when a data set is ordered least to greatest. For the 24 numbers in the Chris's scores {74, 75, 76, 76, 78, 83, 87, 89, 91, 94, 94, 95, 96, 96, 97, 97, 98, 99, 99, 100, 100, 100, 100, 100}, the two central numbers are 95 and 96. The average of 95 and 96 is 95.5%.
    3) Range is distance between the lowest number and the highest number in a data set. 100 – 74 = 26%.
11. B. increased by $24
12. $\frac{1}{15}$. Answers should reflect the following:
    1) There are 5 different colors of tee shirts.
    2) There are 3 different colors of jeans.
    3) There are 15 different possible combinations of the tee shirts and the jeans. 5 x 3 = 15
    4) Of the 15 possible combinations of outfits, there is only one combination that is the yellow tee shirt and the black jeans. 1 : 15 is $\frac{1}{15}$