Tutor Note & Tips

A little background explanation:

There was some concern expressed in our community that the "Bigfoot Sightings" data from the Foundations Guide might be unnerving for some of our students. Out of a desire to consider the needs of all the children, we decided to deviate from a strict adherence to the Guide and instead found some fun data to coincide with the list of presidents from this week's new grammar. While we initially intended to use the number of presidents who owned various types of pets, we soon realized that this data wouldn't work for all graph types. Because individual presidents owned multiple types of pets, the sum total of the percentages of presidents would be greater than 100%, so it couldn't be graphed on a pie chart. We also couldn't accurately revert to "What percent of presidential pets were ____?" because that data wasn't consistently available—some of the animals in our research were merely listed as "a flock of sheep" or "chickens" without specifying an exact number. Finally, we settled on two separate data charts. The first, "Number of Pets Owned by Each President," can easily be used to make a line graph and pie chart and also works well for calculating mean, median, and mode. This data, however, is more well-suited for older children. The second, "Number of Presidents Who Owned Each Type of Pet," is more fun and could be used to practice making a bar graph, which may be a better fit for younger students (see tips below).

I've also included the sample script that I used with our older students in case the handouts aren't self-explanatory. Hopefully it will clarify how we used them in class. This week's hands-on science proved to be particularly tricky for creating cohesive, easy-to-follow handouts, but we made the best of it. The students at least found the information engaging and were eager to offer their commentary and opinions on the data. :) It excited them, and they had a lot of fun with it. They even talked about doing additional information-gathering at home to see if they could identify other trends in the data—and there were more than a few curious to find out how some animals came to live at the White House at all.

Some helpful tips with older students:

The activities for this week are a LOT to accomplish in 30 minutes, regardless of what data is used—particularly if your campus has to adhere to social-distancing mandates, making demonstration and individual assistance more difficult. With that in mind, we did as much as we could in class and then sent the rest home with the students to finish one-on-one with their parents (we included the script for those uncomfortable with the information on their own). Please feel free to copy and email this file as needed. If you want to send it to parents for finishing at home, I have no objections.

Because the presidential data isn't easily divided into smaller chunks, like regions of the country (with the Bigfoot data), I'd recommend having the students do a line graph to plot the initial data (like the tutor sample) instead of a bar graph. The line graph is a LOT faster and most of our older students were able to finish graphing all 45 data points in under 10 minutes. The rows of data on the chart are color coordinated to match the columns on the graph in order to make it a little easier for students to track point placement before "connecting the dots."

The pie chart is a little harder to grasp for students trying to estimate percentage distances. We completed that one together as a class, one piece at a time, using a larger version drawn on a white board to demonstrate while they

Tutor Note & Tips

replicated the same on their handouts.

We also emailed families in advance and asked them to send a calculator to class with their older students for the purpose of expediting the calculations of the mean. The median and mode were easy for them to do on their own without assistance. It is worth pointing out to students the circumstances in which finding the median would be useful—particularly in cases with extreme outliers like we observe in our data. Roosevelt's pets skewed our mean to be higher than one might expect, so the median actually provided a more accurate picture of the majority of our data. *(See sample tutor script)*

The bar graph for types of animals is a fun extra if time allows, giving them the opportunity to practice a 3rd type of data illustration. Though we ran out of time to complete this as a class, most students were intrigued enough by the data that they were excited to complete it at home on their own.

Some helpful tips for younger students:

Most of the graphing and calculations mentioned above were too much for our younger students to handle. Instead, we focused on the second set of data (the types of pets) and practiced drawing a bar graph to illustrate the data. Our Abecedarian and Apprentice tutors made a large paper version that they put up on the wall, and the class worked together to color in the bars for each animal. For the Abecedarians, the tutor pre-filled some of the bars so that there were fewer to do in class. They spent more time noting unexpected results and interpreting the data ("Can you believe how many presidents had bears?!?" or "Which bar on our graph surprised you the most?") and less time working with numbers. They briefly explained what the terms *mean, median,* and *mode* meant and asked the students to identify the mode (since that was easy to spot on their bar graph), but didn't expect students to do much with the median or mean. They also brought in toy representations of the animals to make it even more meaningful to these youngsters. On the data chart for types of pets, the rows of data are color coordinated to match the columns on the graph in an effort to make it a little easier for students to track. All of the "unique animals" for the last column (animals owned by only 1 president) are highlighted in gray to differentiate them.

Hope that helps!

Good luck,

Michelle McGrath

SAMPLE TUTOR SCRIPT (JOURNEYMEN & MASTERS)

Today we are going to talk about some ways that we can view, analyze, and communicate data.

- We can spend a lot of time gathering and recording data, but it's meaningless if we're not able to interpret its significance and communicate it effectively. So how can we do that?

Let's take a look at some fun presidential statistics about pets in the White House. Look at the **blue** chart labeled "Estimated Number of White House Pets per President." This chart tells use how many pets each president had while in the White House.

By just looking at the data on this chart, can you quickly identify which president had the most pets? *(write on handout)*

- How about which president(s) had the least pets? *(write on handout)*
- Do you think you can spot any trends in the data? *(write on handout)*
- Could you easily tell me if the overall trend was increasing or decreasing? *(write on handout)*
- Could you quickly and easily rank the presidents from greatest number of pets to least number of pets? *(write on handout)*

Identifying these kinds of patterns or trends isn't always easy when looking at a data table full of numbers like this. Sometimes the best way to interpret data is to find a way to visualize it instead. We can use tools like bar graphs, line graphs, and pie charts to help us "see" our data more clearly in order to observe patterns or quickly spot outliers.

- Using this data table, let's create a line graph to visually show the number of pets owned by each president. We'll do the first couple together, and then you can finish the rest. Notice on your handout that the color of each row in our data table matches the color of each president's column on our graph. This will help us keep our data points lined up correctly. We're going to first plot the dots on our graph, then we'll connect them with lines, kind of like a "connect the dots" picture. *(demonstrate on board)*
- Now let's show our data in a pie chart. To use a pie chart, we first have to calculate the percentages or fractions of our data. The whole "pie" represents 100%. We're going to divide our pie into pieces—the size of each piece will be determined by the percentage of presidents who own specific numbers of pets.
    - ⇒ First, we need to know how many total presidents are in our data. The total number of presidents will represent 100%. Although we have 46 terms represented, there are only 45 presidents listed because 1 president (Grover Cleveland) served twice.
    - ⇒ Now count how many presidents had more than 10 pets. (8) Fill in the number on your handout. Let's divide that number by 45 to see what percentage of our pie these pet lovers get. (18%) We're going to round our percentages to the nearest whole number.
    - ⇒ Each little hashmark around our circle represents 5% of our pie. We need to draw our first line from the center of our circle up to the top hash mark. Since 18% of the presidents had 10 or more pets, we now need to find the place for our second line. Starting at the next mark, we'll count by 5s—5%, 10%, 15%, 20%—so our second line needs to be drawn about halfway between the marks

representing 15% and 20%.

⇒ Don't forget to label this piece of the pie! It represents >10 pets.

⇒ Now how many presidents had 8 or 9 pets? (2) This time we're going to start counting our percentage from the end of our first piece of pie. *(continue through all pieces designated on handout—if short on time, just supply the numbers and calculations for them, then move on quickly to the graph)*

- Now look at your completed pie chart. Which piece is the biggest? So based on this observation, what is the most popular number of pets to have in the White House? (2) *(write on handout)*

Did these two graphs make it easier to "see" your data? *(write on handout)*

- Is it easier to spot trends? *(write on handout)*
- Would this make it easier to communicate your data to others? *(write on handout)*
- What are some other ways you might have organized your data to look for correlations (relationships or connections between the number of pets and various characteristics about the presidents)? On our line graph, we looked at how pet ownership varied over time. What else might have had an affect on how many pets a president owned? *(write on handout)*

⇒ For example, could you list the presidents on your graph in order of the number of children they had? You might want to see if the number of children affected the level of pet ownership.

⇒ Organize by age, by years in office, etc.

Visual graphs aren't the only way to analyze data. We can also calculate values like the mean, median, and mode to give us a clearer picture of the data set.

The **median** is the value that falls exactly in the middle of our data. To find the median, we first have to put all of our data values in order from least to greatest. I've already done this for you on your handout (see the line of blue numbers).

- Let's put our left index finger on the first number in the line (0) and our right index finger on the last number in the line (48). Now we're going to move both fingers one number at a time towards the center. When our fingers meet in the middle, we've found the median! We can double check our answer by counting the numbers on both sides of the median to make sure that there is the same amount to the left and to the right. *(write on handout)*
- **Medians** are most helpful for interpretating data that has extreme outliers that might skew the average values. Do we have any outliers like this in our data?

⇒ Yes! Roosevelt! His LARGE number of pets would make it look like the average number of pets in the White House was higher than it actually was. We'll take a closer look at this after we calculate the mean.

⇒ In cases like this, finding the **median** can give a more accurate representation of the "normal"

values in our data.

The **mode** of our data is the value that occurs most frequently. This is easiest to identify using our pie chart. What was the most common number of pets in the White House? That's right, 2! So 2 is the **mode** of our data. *(write on handout)*

Finally, we can also find the **mean** of our data, which just means finding the average value. Keep in mind, though, that averages can be skewed by extreme outliers like we discussed before. Let's see how this outlier affects our average.

- To find the **mean**, use your calculator to add up all of the pets owned by all of the presidents. What is the sum of all of the pets? (303) *(write on handout)*
- Now take that sum (303) and divide it by the total number of values. How many presidents did we report data for (hint: we already found this number when we made our pie chart). (45) *(write on handout)*
- The sum of your numbers (303) divided by how many numbers you added (45) gives you the average, or **mean**. (6.73) *(write on handout)*
- Is this number higher than you would expect it to be based on what you see in the data table? Let's take a look at our line graph again. Where would 6.73 be? Does that seem higher than the majority of the dots on our graph? What would cause it to be higher? Oh yeah! That's right! Roosevelt! Adding his extreme 48 pets raised our total!
    - ⇒ Now compare that to the **median** that we already found. (4) Where would the median fall on our graph? Does that seem more consistent with the majority of our values? Yes—this is a great example of why the median can be helpful in providing an overall picture, particularly when we have data with extreme outliers.

Another way we can visualize data is by using a bar graph. You've probably made bar graphs before in your math lessons with your moms at home. Pull out the **red** data chart labeled "Number of Presidents Who Owned Each Type of Pet at the White House." Do any of the animals listed surprise you?

- Using this table, let's create a bar graph. To save time, we're going to call any animal that was owned by only 1 president a "unique animal." We're going to graph all of the "unique animals" together in our last column. Notice on your handout that the color of each row in our data table matches the color of each animal's column on our graph. This will help us keep our bars lined up correctly. All of the "unique animals" on your chart are highlighted in gray so that you can identify them more easily.
- Did this make it easier to quickly identify information? What kind of animal is the most popular White House pet? Were there any other popular pets that surprised you?
- Would it be pretty easy to rank these animals from most popular to least popular now that you have your bar graph?
- Which value occurred most frequently? (2) So what was your **mode**? (2) Most pets were owned by 2 presidents.

Presidential Pets Data Analysis

Number of White House Pets per President

Which president had the most pets at the White House? _____

Which presidents had the least pets at the White House? _____

Can you spot any trends in this data? _____

By looking at the chart, could you easily tell me if the overall trend of number of pets in the White House was increasing or decreasing? _____ Easily rank them from most pets to least pets? _____

Data trends are often easier to identify using a graph. Bar graphs, line graphs, and pie charts can help us "see" our data more clearly so that we can identify patterns. Use your chart to plot the data on your graphs.

Did your graphs help you "see" your data? _____ Is it easier to spot trends? _____

Would they help communicate your data to others? _____

Discuss other ways you might organize the data to see correlations.

There are other ways to analyze data, too, by finding the ***mean***, ***median***, and ***mode***.

The ***median*** is the value that is exactly in the middle of your data. To find the median, put your data in order from least to greatest *(see line of blue numbers below—these have been taken from your chart)*, and then count inwards from both ends to find the point in the middle (with the same number of values before it and after it). What is the ***median*** number of pets in the White House? _____

0 0 0 1 1 2 2 2 2 2 2 2 2 2 2 2 2 3 3 4 4 4 4 4 4 4 5 5 5 5 6 6 6 7 9 9 1 13 14 15 22 26 29 48

The ***mode*** is a value that occurs more frequently than all of the others. What is the mode number of pets in the White House? _____

The ***mean*** is the average of our data. To find the ***mean***, add up all of the data values and then divide that total by the number (how many) values you used. What is the ***mean*** number of pets in the White House? _____

Sum of all pets = _____

Mean = Sum ÷ # of Values = _____ ÷ 45 = _____

Presidential Pets Data Analysis

Estimated Number of White House Pets per President

Order of Presidency	President	# of Pets
1	George Washington	26
2	John Adams	4
3	Thomas Jefferson	4
4	James Madison	1
5	James Monroe	1
6	John Quincy Adams	2
7	Andrew Jackson	6
8	Martin Van Buren	2
9	William Henry Harrison	2
10	John Tyler	5
11	James Polk	0
12	Zachary Taylor	2
13	Millard Fillmore	2
14	Franklin Pierce	9
15	James Buchanan	4
16	Abraham Lincoln	13
17	Andrew Johnson	0
18	Ulysses S. Grant	15
19	Rutherford B. Hayes	14
20	James Garfield	2
21	Chester Arthur	2
22 & 24	Grover Cleveland	9
23	Benjamin Harrison	4

Order of Presidency	President	# of Pets
25	William McKinley	4
26	Theodore Roosevelt	48
27	William Howard Taft	3
28	Woodrow Wilson	5
29	Warren G. Harding	5
30	Calvin Coolidge	29
31	Herbert Hoover	11
32	Franklin D. Roosevelt	7
33	Harry S. Truman	2
34	Dwight D. Eisenhower	2
35	John F. Kennedy	22
36	Lyndon B. Johnson	6
37	Richard Nixon	4
38	Gerald Ford	4
39	Jimmy Carter	3
40	Ronald Reagan	6
41	George H.W. Bush	2
42	Bill Clinton	2
43	George W. Bush	5
44	Barack Obama	2
45	Donald Trump	0
46	Joe Biden	2

*Not all pet details are available for terms of earlier presidents.

**Sources vary on exact numbers and/or types of animals at the White House during each presidency.

Presidential Pets Data Analysis

Number of White House Pets by President *(Line Graph)*

50
45
40
35
30
25
20
15
10
5

1. Washington
2. Adams
3. Jefferson
4. Madison
5. Monroe
6. Adams
7. Jackson
8. Van Buren
9. Harrison
10. Tyler
11. Polk
12. Taylor
13. Fillmore
14. Pierce
15. Buchanan
16. Lincoln
17. Johnson
18. Grant
19. Hayes
20. Garfield
21. Arthur
22. Cleveland
23. Harrison
25. McKinley
26. Roosevelt
27. Taft
28. Wilson
29. Harding
30. Coolidge
31. Hoover
32. Roosevelt
33. Truman
34. Eisenhower
35. Kennedy
36. Johnson
37. Nixon
38. Ford
39. Carter
40. Reagan
41. Bush
42. Clinton
43. Bush
44. Obama
45. Trump
46. Biden

Presidential Pets Data Analysis

Number of White House Pets per President *(Pie Chart)*

Using your data chart, fill in the blanks for each question below, then graph your results on the pie chart. The space between each hash mark represents 5%. Start at the top and work your way around, adding each percentage as you go. Label each piece of your pie chart.

How many presidents had more than 10 pets? ____= ___/45 = _____%

How many presidents had 8 or 9 pets? _____= ___/45 = _____%

How many presidents had 6 or 7 pets? _____= ___/45 = _____%

How many presidents had 5 pets? ____= ___/45 = _____%

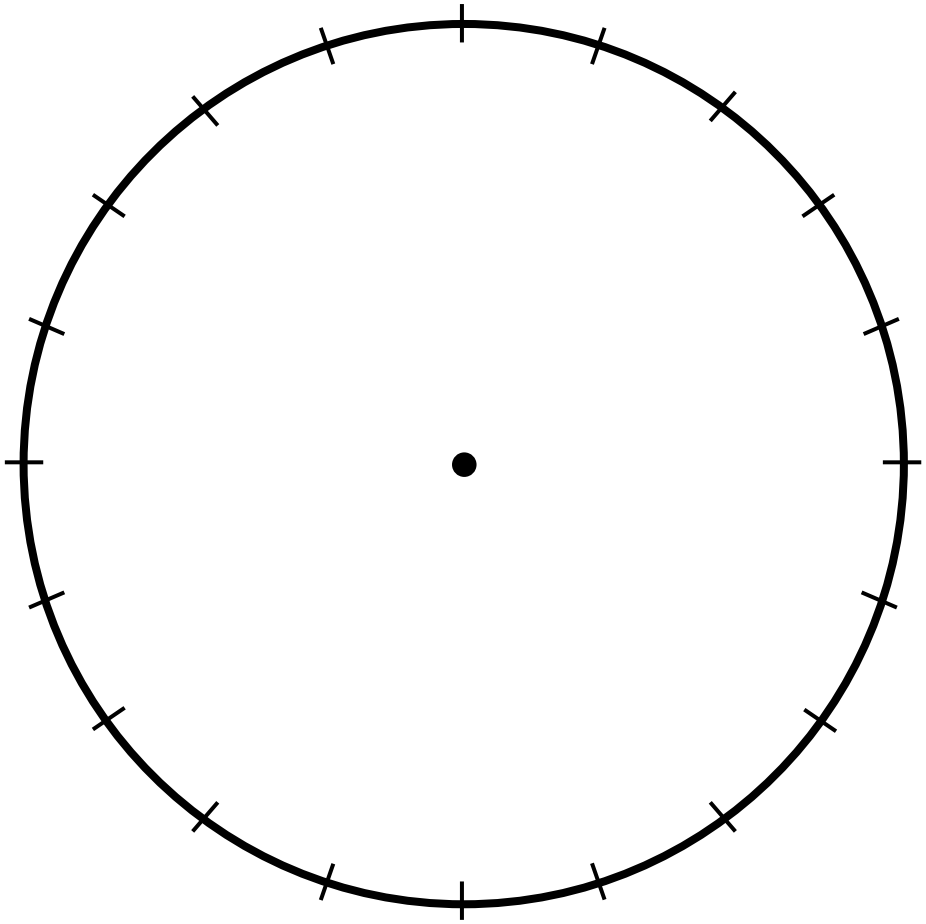
How many presidents had 4 pets? ____= ___/45 = _____%

How many presidents had 3 pets? ____= ___/45 = _____%

How many presidents had 2 pets?____= ___/45 = _____%

How many presidents had 1 pet? _____= ___/45 = _____%

How many presidents had no pet? ___= ___/45 = _____%



Based on this chart, what is the most popular number of pets to have in the White House? _____

Presidential Pets Data Analysis

Number of Presidents Who Owned Each Type of Pet at the White House

Bar Graph Practice

Type of Animal	# of Presidents
Alligator	2
Badger	1
Bear	3
Bobcat	1
Cat	13
Chicken/Rooster	4
Cow	4
Coyote	1
Dog	33
Donkey	2
Duck	2
Duiker	1
Eagle	1
Fish	2
Goat	4
Goose	1
Guinea Pig	1
Hamster	2
Pygmy Hippopotamus	1
Horse	14
Hyena	1

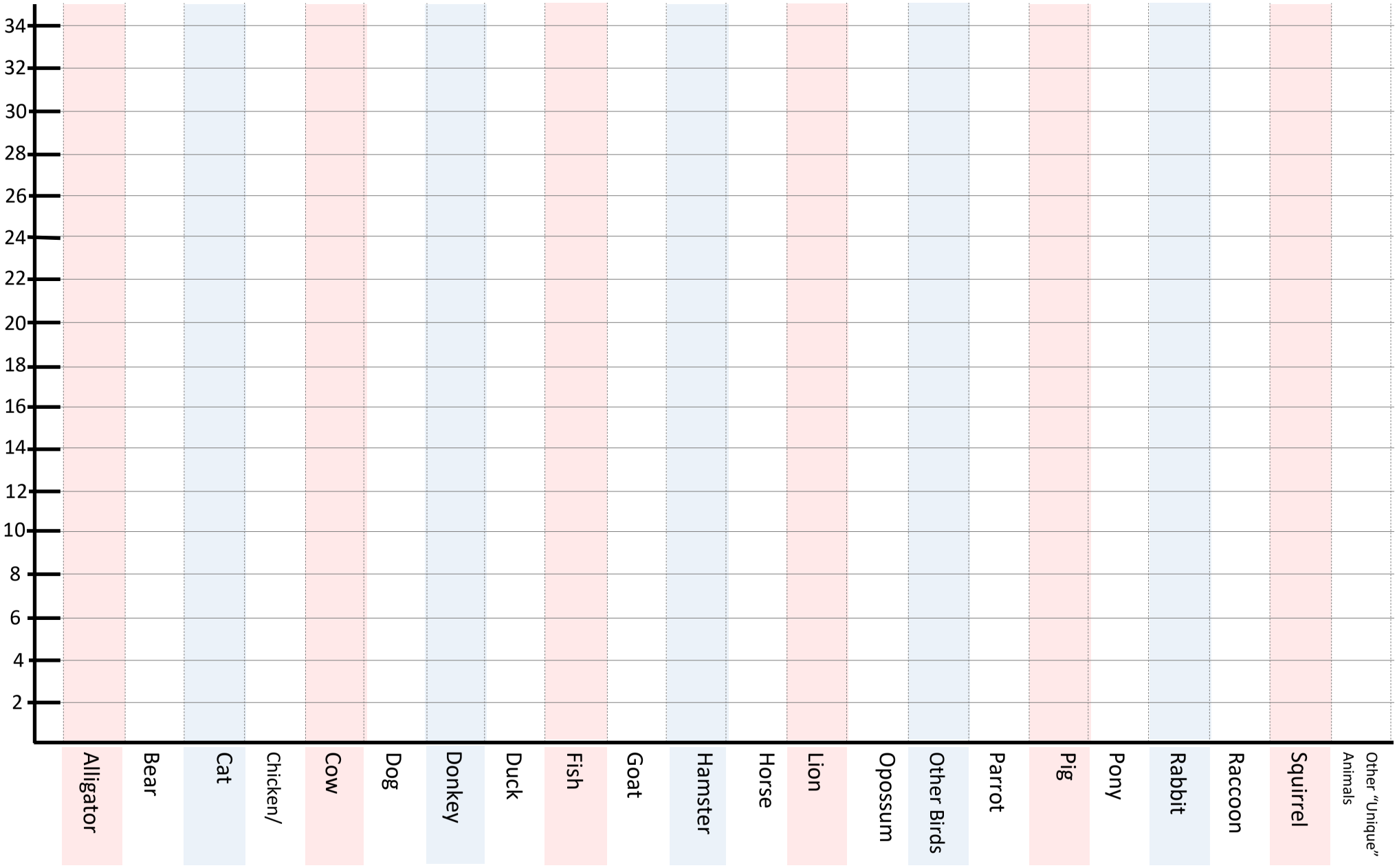
Type of Animal	# of Presidents
Lion	2
Lizard	1
Opossum	2
Other Birds *(Canaries, Cocks, Macaw, Mocking Birds, Parakeets, etc.)*	17
Owl	1
Parrot	5
Pig	2
Pony	6
Rabbit	4
Raccoon	2
Ram	1
Rat	1
Sheep	1
Silk Worms	1
Snake	1
Squirrel	2
Tiger	1
Turkey	1
Wallaby	1
Zebra	1

*Not all pet details are available for terms of earlier presidents.

**Sources vary on exact numbers and/or types of animals at the White House during each presidency.

Presidential Pets Data Analysis

Number of Presidents Who Owned Each Type of Pet at the White House



TUTOR SAMPLE

Number of White House Pets per President

Which president had the most pets at the White House? Theodore Roosevelt

Which presidents had the least pets at the White House? Polk, Johnson, and Trump

Can you spot any trends in this data? _____

By looking at the chart, could you easily tell me if the overall trend of number of pets in the White House was increasing or decreasing? No Easily rank them from most pets to least pets? Not easily

Data trends are often easier to identify using a graph. Bar graphs, line graphs, and pie charts can help us "see" our data more clearly so that we can identify patterns. Use your chart to plot the data on your graphs.

Did your graphs help you "see" your data? Yes Is it easier to spot trends? Yes

Would they help communicate your data to others? Yes

Discuss other ways you might organize the data to see correlations. organize by number of children (did children affect pet ownership?), organize by age, organize by years in office, etc.

There are other ways to analyze data, too, by finding the ***mean***, ***median***, and ***mode***.

The ***median*** is the value that is exactly in the middle of your data. To find the median, put your data in order from least to greatest *(see line of blue numbers below—these have been taken from your chart)*, and then count inwards from both ends to find the point in the middle (with the same number of values before it and after it). What is the ***median*** number of pets in the White House? 4

0 0 0 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 4 4 4 4 4 4 4 5 5 5 5 6 6 6 7 9 9 1 13 14 15 22 26 29 48

The ***mode*** is a value that occurs more frequently than all of the others. What is the mode number of pets in the White House? 2

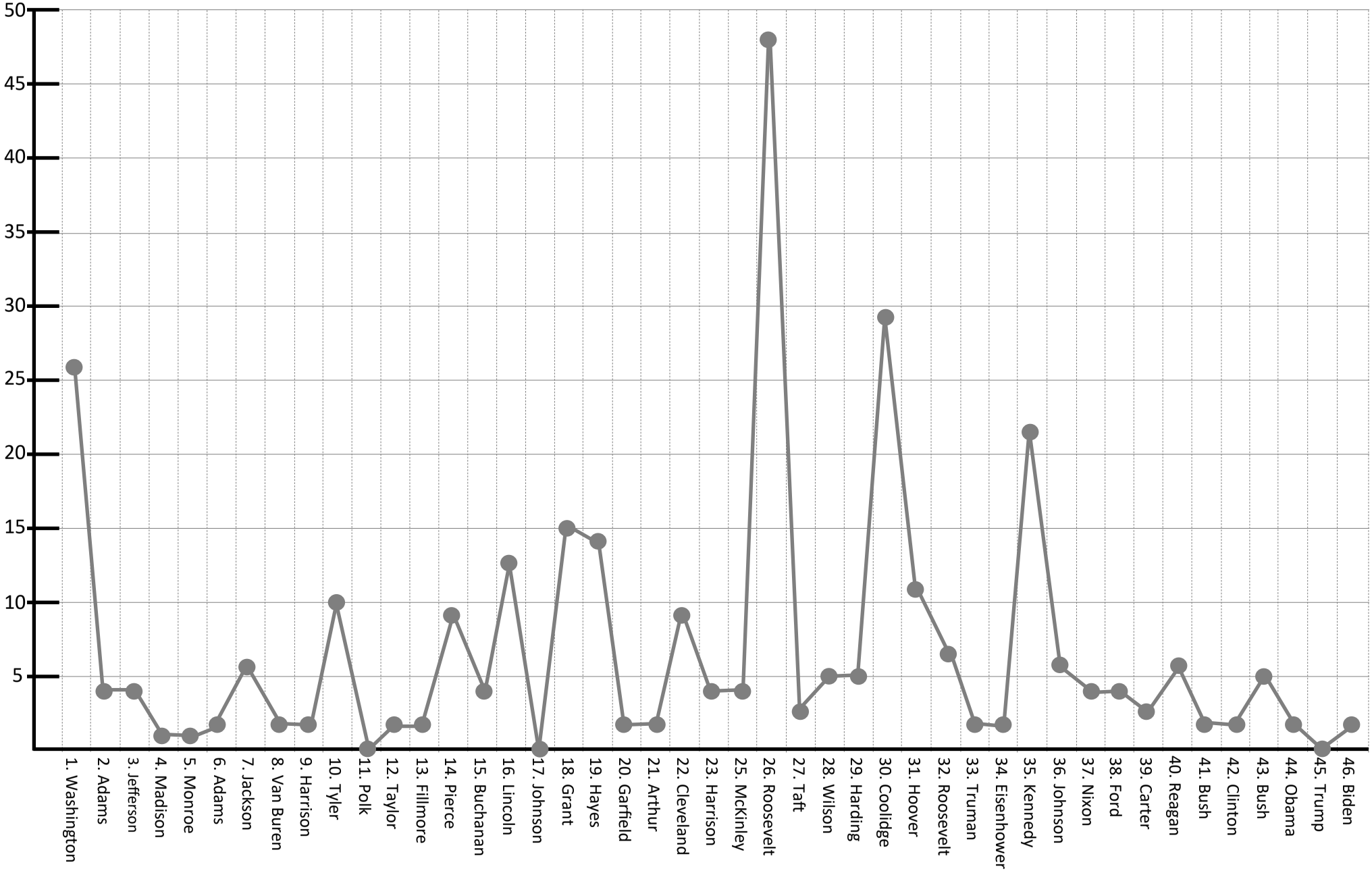
The ***mean*** is the average of our data. To find the ***mean***, add up all of the data values and then divide that total by the number (how many) values you used. What is the ***mean*** number of pets in the White House? 6.73

Sum of all pets = 303

Mean = Sum ÷ # of Values = 303 ÷ 45 = 6.73

TUTOR SAMPLE

Number of White House Pets per President *(Line Graph)*



TUTOR SAMPLE

Number of White House Pets by President *(Pie Chart)*

Using your data chart, fill in the blanks for each question below, then graph your results on the pie chart. The space between each hash mark represents 5%. Start at the top and work your way around, adding each percentage as you go. Label each piece of your pie chart.

How many presidents had more than 10 pets? _8_ = _8_/45 = _18_%

How many presidents had 8 or 9 pets? _2_ = _2_/45 = _4_%

How many presidents had 6 or 7 pets? _4_ = _4_/45 = _9_%

How many presidents had 5 pets? _4_ = _4_/45 = _9_%

How many presidents had 4 pets? _7_ = _7_/45 = _16_%

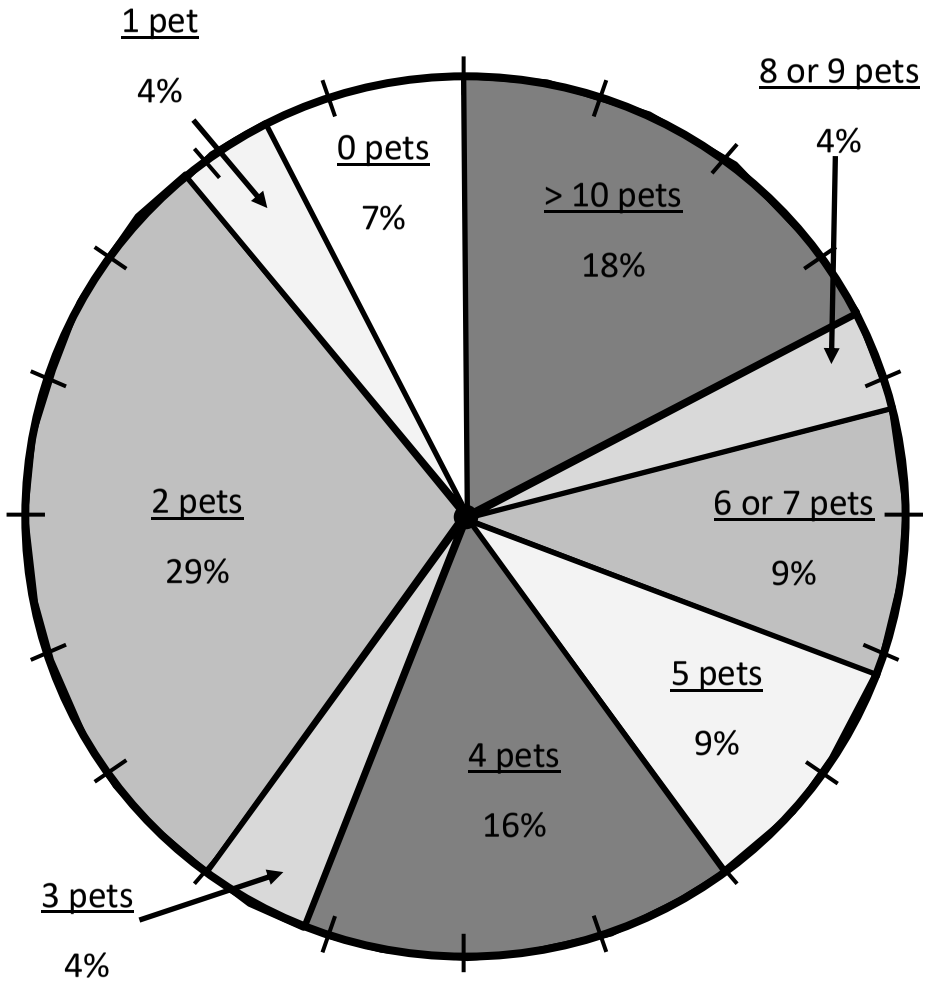
How many presidents had 3 pets? _2_ = _2_/45 = _4_%

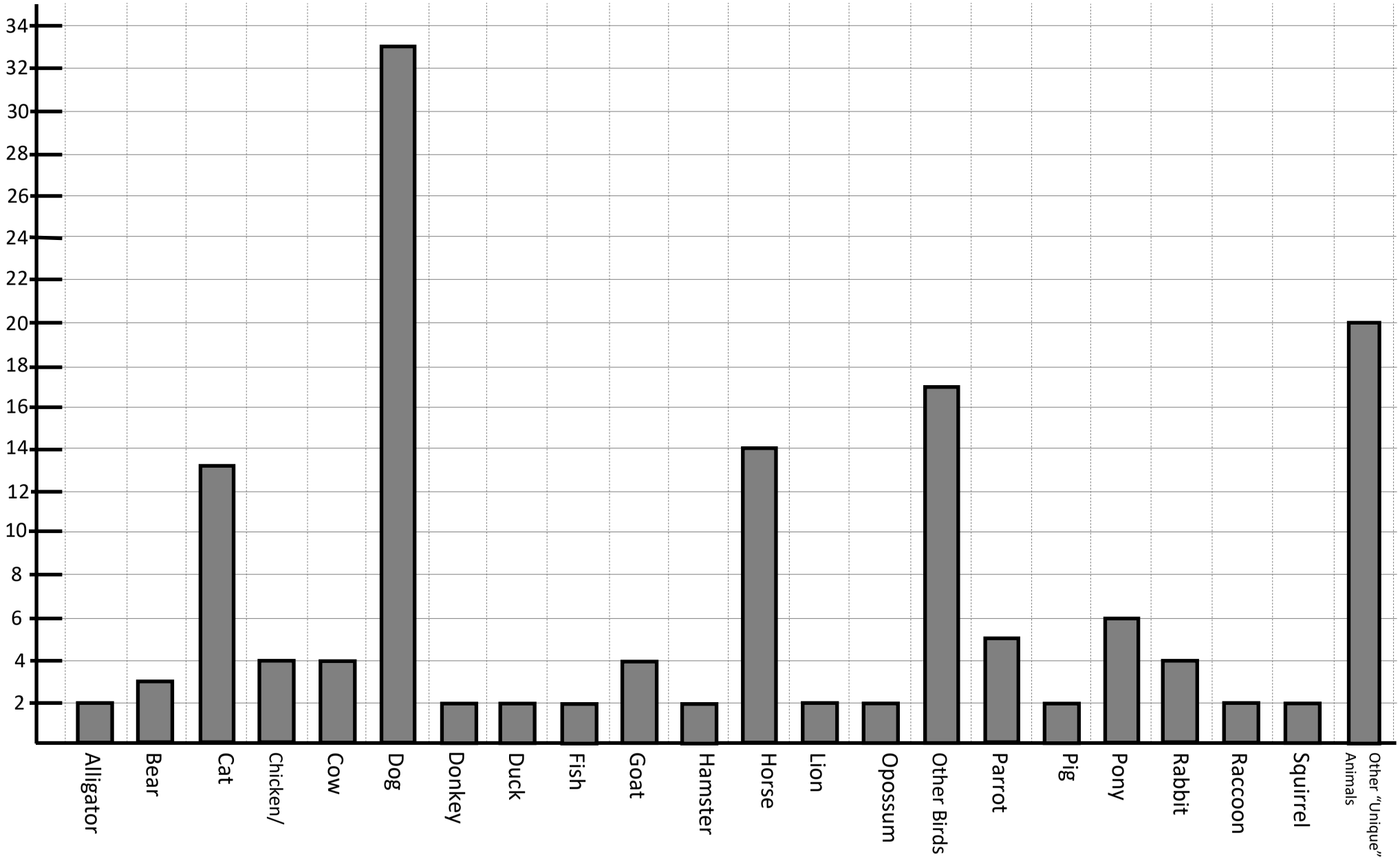
How many presidents had 2 pets? _13_ = _13_/45 = _29_%

How many presidents had 1 pet? _2_ = _2_/45 = _4_%

How many presidents had no pet? _3_ = _3_/45 = _7_%

Based on this chart, what is the most popular number of pets to have in the White House? _____2_____



Tutor Sample

Number of Presidents Who Owned Each Type of Pet at the White House *(Bar Graph)*