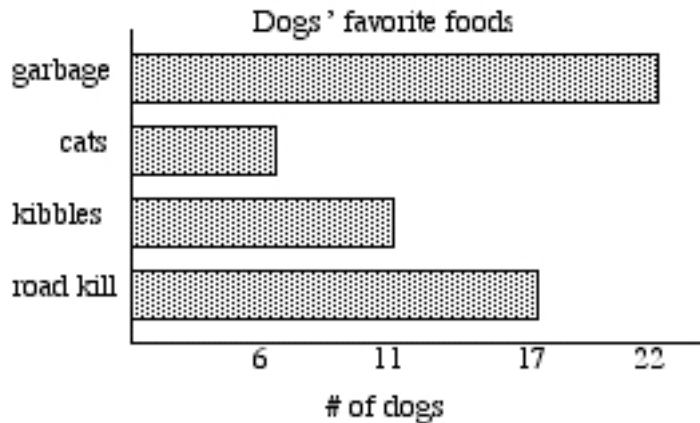


PART 3 MODULE 1

STATISTICAL GRAPHS, CHARTS, TABLES, PERCENTAGES, PERCENTILE

EXAMPLE 3.1.1

The bar graph below shows the results of a survey in which a number of dogs were asked "What is your favorite food?" No dog gave multiple answers.



What percent of dogs said that their favorite food was cats?

- A. 6% B. 17% C. 11% D. 30%

EXAMPLE 3.1.1 SOLUTION

First, we find the number of dogs who responded to the survey. We do this by recognizing that the numbers on the horizontal axis tell how many dogs gave each of the four responses. If we add those four numbers, we have the total number of dogs who responded:

$$6 + 11 + 17 + 22 = 56$$

There were 56 dogs who responded to the survey (we say that in this survey the *sample size* or *sample population* is 56, or simply that $n = 56$).

Now we read the graph and see that 6 of the 56 dogs gave the response "cats." Thus, we need to find the percentage that corresponds to "6 out of 56." To do this, we divide 6 by 56, and then multiply by 100%.

$$\frac{6}{56} \times 100\% \approx .107 \times 100\%$$

$$= 10.7\%$$

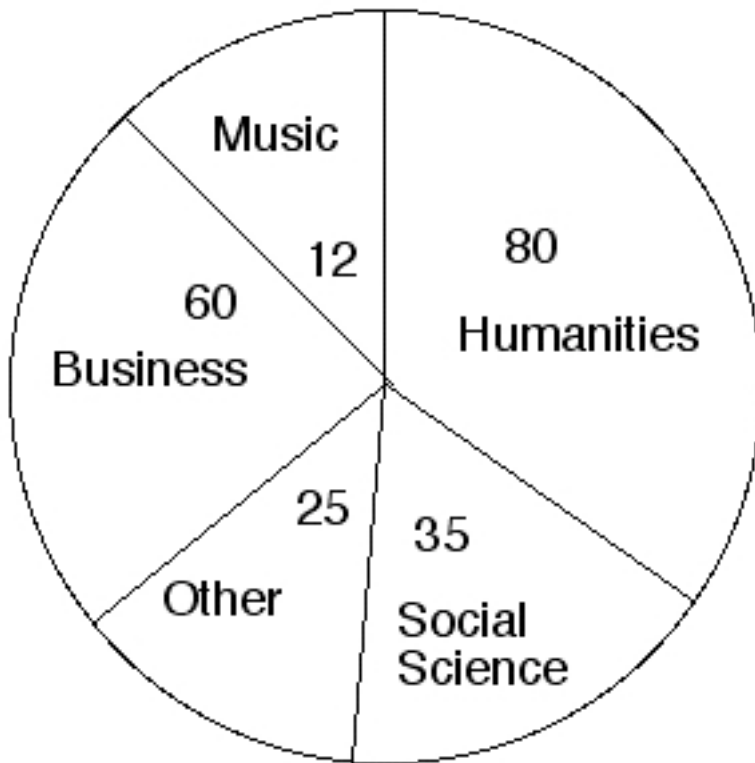
The best choice is C.

Notice that when we "multiply 0.107 by 100%" what we actually do is **move the decimal point two places to the right, and append a "%" sign.**

FACT: To convert a decimal number to a percent, we move the decimal point two positions to the right, and add a percentage sign.

EXAMPLE 3.1.2

The graph below shows the distribution according to academic major of a group of students. None of them have double majors.

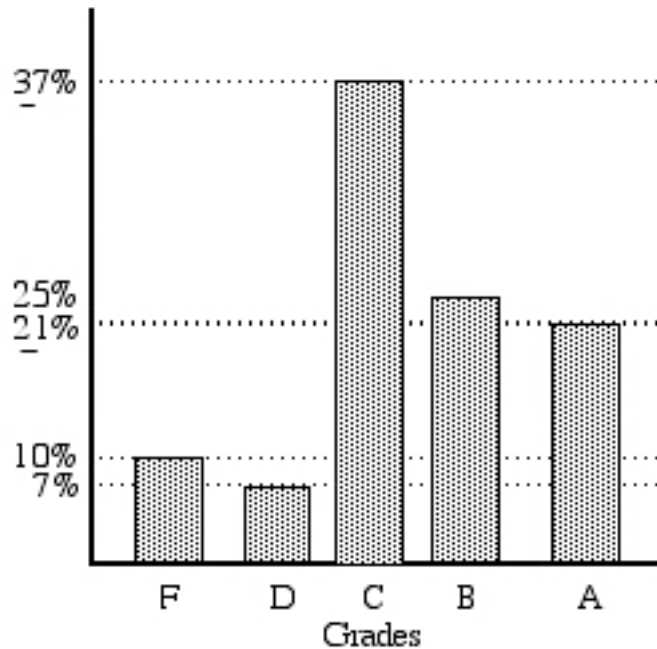


Approximately what percent are majoring in something other than music?

- A. 25% B. 12% C. 88% D. 94%

EXAMPLE 3.1.3

The graph below shows the percentage distribution of grades on an exam. Assuming that 828 people took the test, how many received grades of A or B?



PERCENT INCREASE OR PERCENT DECREASE

If a quantity increases or decreases, we can compute the percent increase or percent decrease.

PERCENT INCREASE

If a quantity is increasing, we compute percent increase as follows:

$$\text{percent increase} = \frac{\text{amount of increase}}{\text{beginning amount}} \times 100\%$$

This is the same as:

$$\text{percent increase} = \frac{\text{ending amount} - \text{beginning amount}}{\text{beginning amount}} \times 100\%$$

PERCENT DECREASE

If quantity is decreasing, we compute percent decrease as follows:

$$\text{percent decrease} = \frac{\text{amount of decrease}}{\text{beginning amount}} \times 100\%$$

Which is the same as:

$$\text{percent decrease} = \frac{\text{beginning amount} - \text{ending amount}}{\text{beginning amount}} \times 100\%$$

EXAMPLE 3.1.10

In July, Gomer had 12 pet wolverines and 10 fingers. In August, he had 15 pet wolverines and 8 fingers.

1. Find the **percent increase** in his wolverines.
A. 25% B. 125% C. 30% D. 3%

2. Find the **percent decrease** in his fingers.
A. 80% B. 180% C. 20% D. 120%

EXAMPLE 3.1.11

(The information in this example is factual, according to the Workers Rights Council.)

1. In a sweatshop in El Salvador, a seamstress is paid 74¢ for the labor required to sew one Liz Claiborne jacket (retail price: \$198). If she were to be paid a "living wage," her pay would for that job would increase to \$2.64. Find the **percent increase** in her pay if this were to happen.

2. Referring to the information in Part 1:

Suppose that the seamstress' pay is increased so that she receives a "living wage," and suppose that the entire cost of this is passed on to the consumer. Find the **percent increase** in the retail cost of the jacket.

WORLD WIDE WEB NOTE

For practice involving percent increase and decrease, visit the companion website and try THE PERCENTS OF CHANGE.

PERCENTILE RANK

The *percentile rank* of a value in a distribution tells the percent of scores that were less than the given value.

EXAMPLE 3.1.13

The information below refers to scores on a standardized exam.

| Score | Percentile |
|-------|------------|
| 800 | 99 |
| 700 | 85 |
| 650 | 75 |
| 600 | 55 |
| 450 | 50 |
| 350 | 30 |
| 300 | 25 |

1. What percent of test-takers had scores that were less than 350?
2. What percent of test-takers had scores that were greater than or equal to 600?
3. Approximately what percent of test-takers had scores that were between 700 and 450?

EXAMPLE 3.1.13 SOLUTIONS

We must answer all three questions by referring to the definition of percentile rank given above.

1. Since a score of 350 has a percentile rank of 30, the table tells us directly that 30% of the test-takers had scores less than 350.
2. Since a score of 600 has a percentile rank of 55, the table tells us directly that 55% of the test-takers had scores **less than** 600; this means that the other 45% of test takers had scores greater than or equal to 600 (because $100\% - 55\% = 45\%$).
3. Since a score of 700 has a percentile rank of 85, the table tells us directly that 85% of the test-takers had scores less than 700; likewise, the table tells us directly that 50% of the test takers had scores less than 450. Now we subtract: $85\% - 50\% = 35\%$. Roughly 35% of the test-takers had scores between 450 and 700. (This answer is approximate, because these 35% actually include the test-takers whose scores were exactly 450. The table does not provide enough information to permit us to answer this question precisely; despite that flaw, this phraseology is used on the CLAST).

EXAMPLE 3.1.14

The table below gives an accurate portrayal of the distribution of humans according to IQ.

| IQ | Percentile |
|-----|------------|
| 135 | 99 |
| 119 | 90 |
| 115 | 84 |
| 104 | 60 |
| 100 | 50 |
| 92 | 30 |
| 87 | 20 |
| 80 | 10 |
| 76 | 4 |

1. What percent of humans have IQs greater than or equal to 119?

- A. 90 B. 99 C. 9 D. 10

2. Approximately what percent of humans have IQs between 92 and 104?

- A. 30 B. 50 C. 20 D. 10

3. What percent of humans have IQs less than 87?

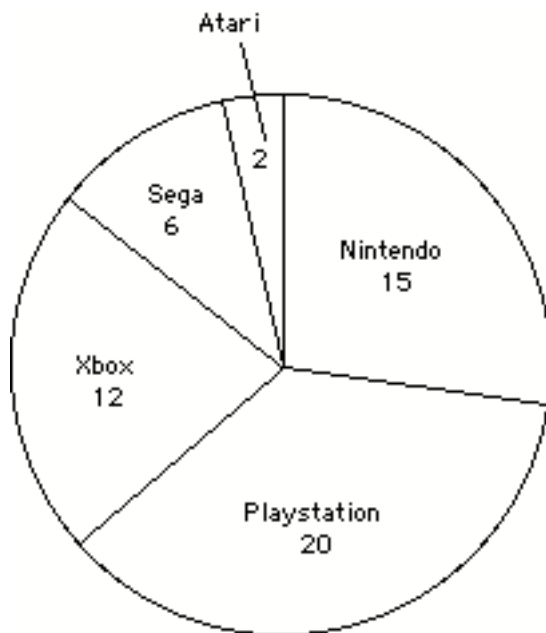
- A. 24 B. 20 C. 14 D. 10

WORLD WIDE WEB NOTE

For practice involving percentile rank, visit the companion website and try THE PERCENTILATOR.

PRACTICE EXERCISES

1 - 2: A number of couch potatoes were asked “What is the most important thing in the



universe?” Their responses are summarized in the pie chart below.

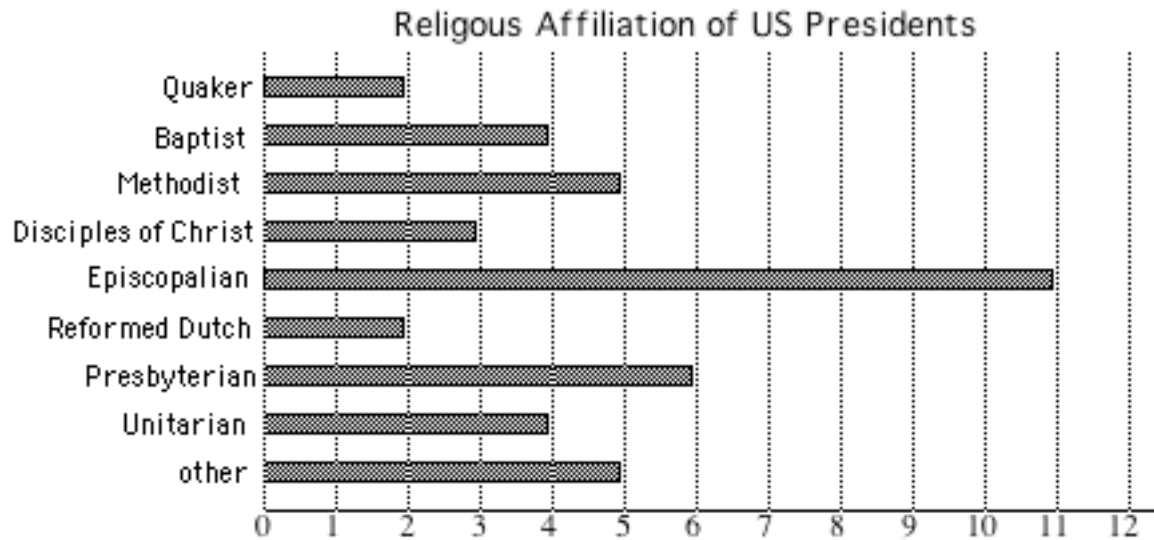
1. What percent said “Playstation?”

- A. 36.4% B. 20% C. 80% D. 63.6%

2. What percent didn't say “Xbox?”

- A. 12.0% B. 88.0% C. 21.8% D. 78.2%

3 - 4: Refer to the bar graph below, showing the religious affiliations of US presidents.



3. What percent of US presidents were Unitarian?

- A. 4.0% B. 40.0% C. 9.5% D. 95%

4. What percent weren't Presbyterian?

- A. 96.0% B. 85.7% C. 14.7% D. 4.0%

5. Last year, Gog the cave man owned 44 stones and 11 sticks. This year, Gog the cave man owns 39 stones and 42 sticks. Find the percent decrease in stones.

- A. 11.36% B. 112.82% C. 88.64% D. 45.45%

6. Last year, Dorothy owned 143 ear rings and 79 nose rings. This year, Dorothy owns 41 ear rings and 150 nose rings. Find the percent increase in nose rings.

- A. 89.87% B. 71.33% C. 47.33% D. 147.06%

7. Last year, Dan owned 113 vinyl LP records. This year, Dan's supply of vinyl LP records has increased by approximately 67%. How many vinyl LP records does Dan have now?

- A. 76 B. 7571 C. 180 D. 189

8. Last year, Socrates owned 574 Pokemon cards. This year, Socrates's supply of Pokemon cards has decreased by approximately 32%. How many Pokemon cards does Socrates have now?.

- A. 184 B. 18368 C. 542 D. 390

The table at right shows the percentile distribution of people according to IQ. Refer to it for exercises 15 - 17.

| IQ | Percentile |
|-----|------------|
| 145 | 99 |
| 130 | 97 |
| 115 | 84 |
| 101 | 50 |
| 85 | 16 |
| 70 | 4 |
| 55 | 1 |

9. What percent of people have IQs less than 85?
A. 16 B. 5 C. 4 D. 21
10. What percent of people have IQs of 130 or more?
A. 99 B. 97 C. 196 D. 3
11. Approximately what percent of people have IQs between 101 and 130?
A. 147 B. 50 C. 47 D. 84

The table at right shows the percentile distribution of professional wrestlers according to weight (pounds).

| Weight | Percentile |
|--------|------------|
| 450 | 98 |
| 350 | 85 |
| 300 | 50 |
| 275 | 40 |
| 250 | 30 |
| 235 | 25 |

12. Approximately what percent of wrestlers weigh between 300 and 450 pounds?
A. 48 B. 85 C. 233 D. 35
13. What percent of wrestlers weigh less than 275 pounds?
A. 55 B. 60 C. 45 D. 40
14. What percent of wrestlers weigh 450 pounds or more?
A. 98 B. 2 C. 198 D. 15

The table at right shows the percentile distribution of final exam scores for MGF1106 Sections 01-08, Spring 1999. Refer to it for exercises 21 - 23.

| Score | Percentile |
|-------|------------|
| 100 | 99 |
| 90 | 86 |
| 80 | 63 |
| 73 | 39 |
| 65 | 25 |
| 55 | 14 |

15. What percent of students had scores less than 80?
A. 78 B. 63 C. 37 D. 39
16. Approximately what percent of students had scores between 65 and 80?
A. 88 B. 38 C. 39 D. 64
17. What percent of students had scores greater than 90?

- A. 99 B. 86 C. 10 D. 14

The table at right shows the percentile distribution of SAT Math scores among a sample of students enrolled in MGF1106 during Fall, 1999.

| Math SAT | Percentile |
|----------|------------|
| 660 | 94 |
| 590 | 84 |
| 540 | 64 |
| 510 | 41 |
| 480 | 23 |
| 440 | 7 |

18. Approximately what percent of students had scores between 440 and 510?

- A. 41 B. 23 C. 7 D. 34

19. What percent of students had scores greater than 590?

- A. 84 B. 94 C. 16 D. 6

ANSWERS TO LINKED EXAMPLES

EXAMPLE 3.1.2 D

EXAMPLE 3.1.3 381 students

EXAMPLE 3.1.4 56.7 million people

EXAMPLE 3.1.5 1. True 2. False 3. False 4. True

EXAMPLE 3.1.6 1. True 2. False 3. False 4. True

5. False 6. True

EXAMPLE 3.1.7 A

EXAMPLE 3.1.10 1. A 2. C

EXAMPLE 3.1.11 1. 257%, 2. about 1%

EXAMPLE 3.1.14 1. D 2. A 3. B

ANSWERS TO PRACTICE EXERCISES

- 1. A 2. D 3. C 4. B 5. A 6. A**
7. D 8. D 9. A 10. D 11. C 12. A
13. D 14. B 15. B 16. B 17. D 18. D
19. C