## Facts to Know

Graphs are effective tools used to compare data in clear, concise, visual terms.
Three of the most common graphs are bar graphs, circle graphs (pie charts), and line graphs.

## Pictograph

A pictograph uses pictures or symbols to compare data. It is useful for units where smaller numbers or even blocks of data are used. A key indicates the value of each symbol. Sometimes a symbol is cut in half to indicate half of the amount.

| fantasy | $\square \square \square$ |
| :---: | :---: |
| science fiction | $\square$ |
| humor | $\square \square \square \square \square \square \square \square \square$ |
| romance | $\square \square \square \square \square$ |
| true life | $\square \square$ |
| mystery | $\square \square \square$ |

Key 10 books

## Double-Bar Graph

A double bar graph is used to compare two sets of data within a given period of time or set of circumstances.


## Multiple-line Graph

A multiple-line graph compares two or more sets of data, which are changing over time. Two lines are usually used to compare how two events might be related to each other and affect each other over a period of time.

Number of Snacks Bought in a Ten-day Period


## Histogram

A histogram is a diagram, which often illustrates the frequency of an event and shows how data falls into different intervals. The intervals, represented by rectangular bars, may be the same width or they may vary. Histograms are usually used with continuous data, which falls into varying intervals.


- . . . . . . . . . Working with Pictographs and Histograms
A pictograph uses pictures or symbols to illustrate data comparisons. This pictograph illustrates the life span of various types of garbage.

Life Span of Garbage


Directions: Use the information on page 13 and this pictograph to answer these questions.

1. How many years does it take a cardboard box to decay? $\qquad$
2. How many years does it take pantyhose to decay? $\qquad$
3. How many more years does it take plastic bottles to decay than it takes leather shoes? $\qquad$
4. Which two items take the longest to decay? $\qquad$ How many years does each type take? $\qquad$
5. How long do plastic-coated cartons take to decay? $\qquad$
6. How would this pictograph help communicate the problems of landfills and the value of recycling in this country? $\qquad$
Directions: This histogram illustrates the frequency of graduation rates in a recent year and the states where this frequency occurs.
7. How many states have between $81 \%$ and $90 \%$ of its students graduating? $\qquad$
8. How many states have between $51 \%$ and $60 \%$ of its students graduating? $\qquad$
9. What percentage of students is graduating in 22 states? $\qquad$
10. How many states are represented in all?
11. About $65 \%$ of California's public high school students graduate. In what frequency is California recorded on the graph? $\qquad$
12. Vermont is the state with the highest graduation rate (89.9\%). In what frequency is Vermont included on the graph? $\qquad$

13. How might this histogram be used by public officials? $\qquad$

Ravineors

A double-bar graph is used to compare two sets of data. The double bar graph shown here illustrates the percentage of male/female attendance at several major colleges in the United States.


Directions: Use the information on page 13 and this graph to answer these questions.

1. What percentage of students at UCLA is male? $\qquad$ What percentage is female? $\qquad$
2. What percentage of students at Yale is male? $\qquad$ What percentage of students is female? $\qquad$
3. What percentage of students at NYU (New York University) is male? $\qquad$ What percentage is female? $\qquad$
4. In which two colleges is the percentage of male and female students almost the same? $\qquad$
5. Which college has the greatest disparity between the percentage of male and female students?
6. What is the total percentage of male and female attendance at each college? $\qquad$ Why? $\qquad$
7. Using the graph as a representative of college attendance, are more males or more females attending these colleges? $\qquad$
Directions: Study this double bar graph illustrating the points scored by two teams, the Bulldogs and the Wildcats, in the four quarters of a football game.

Bulldogs/Wildcats Football Game

8. What was the Bulldogs' best quarter? $\qquad$
9. What was the Wildcats' best quarter? $\qquad$
10. How many total points did each team score in the game?
11. Which team got better in the first three quarters?
12. How might a coach use this graph?

## 3

A multiple-line graph compares two or more sets of data, which are changing over time. This multiple-line graph illustrates the number of novel pages read each day for one week by two language arts students, Alyssa and Greg.

Directions: Use the information on page 13 and this graph to answer the following questions.


Key
___ Alyssa
------ = Greg

1. How many pages did Greg read on Sunday? $\qquad$
2. How many pages did Alyssa read on Sunday? $\qquad$
3. How many pages did Greg read on Friday? $\qquad$
4. How many pages did Alyssa read on Friday? $\qquad$
5. On which day did Greg read the fewest pages? $\qquad$
6. On which day did Alyssa read the fewest pages? $\qquad$
7. Which student read the most pages during the week?
8. How many more pages did Alyssa read than Greg on Monday?
9. On which three days did Alyssa read exactly five pages more than Greg?
10. How many total pages did Alyssa read? $\qquad$
11. How many total pages did Greg read? $\qquad$
12. Which student was more consistent in doing the assigned reading?

Directions: Study this graph illustrating how many minutes Sarah and Catherine practiced playing the piano in a period of six weeks. Answer the questions below.

Minutes of Piano Practice Each Week for Six Weeks


Week

Key
13. How many minutes did Sarah practice the first week?
14. How many minutes did Catherine practice the first week?
15. How many minutes did Sarah practice for the entire six weeks?
16. How many minutes did Catherine practice for the entire six weeks?
17. Which student practiced more in the sixth week?
18. Did Catherine become a better or worse piano student during the six weeks? $\qquad$ Explain.

## -_ Sarah

------ = Catherine
mww.MathMovesU.com

2 How to Circle, and Line Graphs

## Facts to Know

Graphs are effective tools used to compare data in clear, concise, visual terms.
Three of the most common graphs are bar graphs, circle graphs (pie charts), and line graphs.

## Graphing Terms

- The range is the difference between the least and the greatest values in a set of data.
( $2,4,7,8,10,12$ )
$12-2=10$
The range is 10 .
- The scale is the set of values or numbers along the side of a graph.
- The interval is the regular difference between each unit on the scale. The interval is always the same between each unit of the scale.
- The axes are the two labeled lines, one vertical and one horizontal, along the sides of a graph. The scale runs along one of the axes.


## Single Bar Graphs

Single bar graphs offer a clear, visual presentation of facts. Bar graphs may be either vertical or horizontal. The names of the items being compared are listed, one in each block, along the bottom axis of the bar graph. The scale is marked in even intervals along the vertical axis.

## Single Line Graphs

Single line graphs are often used to compare change over time or the frequency of an event. The time intervals or items being compared are marked along the horizontal axis of the line graph. The scale is marked in even intervals along the vertical axis.

## Circle Graphs (Pie Charts)

Circle graphs, or pie charts, demonstrate how a whole is split into individual parts.
The parts are rarely equal. The size of the angle shows how one part compares to another. They are usually expressed in percentages of the whole, based on $100 \%$. Labels, listing names and amounts, are written on the slices of the graph.
 dranavest Raytheo

This single bar graph shows the number of electoral votes for each of the 10 most populated states. The states are labeled in blocks along the horizontal axis. The number of electoral votes is indicated on the vertical axis. There are 538 electoral votes distributed among the 50 states and the District of Columbia. They are elected by the people in each state to officially vote for the president of the United States. It takes 270 electoral votes to win an election.

Directions: Use the information on page 9 and the graph to answer these questions.

1. How many electoral votes does California have? $\qquad$
2. How many electoral votes does Texas have? $\qquad$

3. What is the interval between numbers on the scale? $\qquad$
4. How many electoral votes does New Jersey have? $\qquad$
5. What is the difference in the number of votes between Michigan and Illinois? $\qquad$
6. Which state has exactly one more electoral vote than Texas? $\qquad$
7. What is the total number of electoral votes of the 10 most populated states? $\qquad$
8. How many electoral votes are distributed among the remaining 40 states and the District of Columbia?
9. Why would a candidate spend more time campaigning in California than in North Carolina?
10. How many more votes than these 10 states would be needed to win a presidential election?
11. Which two pairs of states have the same number of electoral votes as California?
12. Why did the intervals start with 12 votes? $\qquad$
13. What could be misleading about this graph? $\qquad$

## Extension

Ten students at Arrow Valley Middle School were surveyed to determine the number of times they went to a fast food restaurant in one week. This table shows the results. Use the information to create a single bar graph.

Number of Fast Food Visits in One Week

| Name | Frequency | Name | Frequency |
| :--- | :---: | :--- | :---: |
| John | 3 | Freddy | 5 |
| Sherry | 6 | Elaine | 1 |
| Jimmy | 10 | Ginette | 4 |
| Alex | 0 | Harry | 3 |
| Marianne | 2 | Hector | 7 |

This circle graph illustrates which elements are most abundant in the earth's crust.
Directions: Use the information on page 9 and the circle graph to answer these questions.

1. Which is the most abundant element in the earth's crust? $\qquad$
2. Which two elements make up three-fourth's of the earth's crust? $\qquad$
3. Which two elements together are equal to the amount of aluminum in the earth's crust?
4. Where would carbon, hydrogen, and sodium be included?
5. Which element makes up almost half of the earth's crust? $\qquad$

Elements as a
Percentage of the Earth's Crust


This circle graph illustrates the percentages of each major element in the human body.
6. Which element makes up more than half of the human body? $\qquad$
7. How much higher is the percentage of carbon than the percentage of nitrogen? $\qquad$
Major Elements as a Percentage of the Human Body
8. What percentage of the human body do the three major elements total?
9. On the graph, where do you think copper, phosphorus, and iron are included?
10. What body compound would have much of the hydrogen and oxygen? $\qquad$
11. Why is this type of graph so easy to use?

$\qquad$
$\qquad$

## Extension

- Survey 10 members of your class to determine their favorite pizza topping.

Convert each topping to a percentage. (If three of the ten students prefer pepperoni, that is $30 \%$ of the total. If one student prefers cheese, that is $10 \%$ of the total.)

- Create a circle graph illustrating the results of your survey.

The two line graphs indicate the number of hours spent on homework for two 8th grade students.
Number of Hours Spent on Homework in One Week


Directions: Use the information on page 9 and the two graphs above to answer these questions.

1. How many hours did Carlos spend doing homework on Tuesday? $\qquad$
2. How many hours did Janet spend doing homework on Tuesday? $\qquad$
3. On which day did neither student do any homework? $\qquad$
4. Both students had a huge science project due the Monday of next week. Which student put it off until the end? $\qquad$
5. Which student is more likely to use time effectively? $\qquad$ Why? $\qquad$
$\qquad$
6. How many hours did Janet spend on homework this week? $\qquad$
7. How many hours did Carlos spend on homework this week? $\qquad$
8. How many hours of homework a day did Carlos average over seven days? $\qquad$

## Extensions

- On Monday, Justin rode his scooter for $21 / 2$ hours. He spent the following amounts of time on his scooter for the next six days: 3 hours, $1 \frac{1}{2}$ hours, $1 / 2$ hour, 2 hours, $51 / 2$ hours, and 4 hours. Make a single line graph to illustrate how much time Justin rode each day of the week.
- Make a table estimating how many hours you slept in the last seven days. Then create a singleline graph from this table.

11. $61-70 \%$
12. $81-90 \%$
13. Answers will vary.
14. $47 \%$ male; $53 \%$ female
15. $51 \%$ male; $49 \%$ female
16. $41 \%$ male; $59 \%$ female
17. USC and Yale
18. NYU
19. $100 \%$; Students must be either male or female.
20. more females
21. 2nd quarter
22. 3rd quarter
23. Bulldogs 30; Wildcats 34
24. Wildcats
25. To see how his team played as the game progresses. (Answers will vary.)

| 1. 30 pages | 10. 410 pages |
| :--- | :--- |
| 2. 50 pages | 11. 300 pages |
| 3. 65 pages | 12. Alyssa |
| 4. 70 pages | 13. 90 minutes |
| 5. Wednesday | 14. 45 minutes |
| 6. Monday | 15. 375 minutes |
| 7. Alyssa | 16. 365 minutes |
| 8. 15 pages | 17. Catherine |
| 9. Tuesday, | 18. better; She |
| Friday, and | practiced more |
| Saturday | regularly. |

1. 20 years
2. 40 years
3. 35 years
4. cans and bottles; 85 years
5. $71 / 2$ years
6. It shows how long it takes garbage to disintegrate. Answers will vary.
7. 8 states
8. 8 states
9. $71-80 \%$
10. 50 states
11. $(9,12,14,16,16,19,22,23,28)$ Mode: 16
Yes, it is in the middle and the median is the same.
Median: 16
Yes, it matches the mode and is close in value to most of the numbers.
12. $(7,9,10,10,11,14,14,15,18$, 20, 21, 31, 38)
Mode: 10, 14
No, the number 10 is too close to the first numbers. 14 is more representative.
Median: 14
No, there are many greater numbers after 14.
13. $(19,25,28,28,32,44,48,48,51$, 57, 64, 70)
Mode: 28, 48
No, 28 is too near the first numbers;

48 is more representative.
Median: 46
Yes, it's about in the middle of the values.
4. $(31,37,39,40,40,47,47,47,48$, $49,49,49,61,70)$
Mode: 47 and 49
Yes, 47 is near the center. 49 is less representative because it is nearer to the end of the series.
Median: 47
Yes, it is representative because it is in the center and the same as one mode.

## Page 19

1. Total: 6,988

Divide by: 10
Mean: 698.8 (699)
Yes, it is representative because most of the numbers are 600s and 700s.
2. Total: 65

Divide by: 9
Mean: 7.2 (7)
No, the number of moons is very
variable.
3. Total: 277

Divide by: 14
Mean: 19.8 (20)
Yes, many of the numbers are near 20.
4. Total: 1,113

Divide by: 14
Mean: 79.5 (80)
Yes, it is relatively representative of the numbers; a good average.
5. Total: 2,595

Divide by: 12
Mean: 216.3 (216)
Yes, many of the numbers are in or near the low 200s.
6. Total: 112

Divide by: 16
Mean: 7
Yes, it matches the mode and is
near the center between 2 and 12 .
Page 20

1. Mode: 13 Median: 13

Mean: 9.6 (10)
Most representative: mode and median
Reason: They reflect the values best and are midway between high and low values.
2. Mode: 23 Median: 23

Mean: 23.3 (23)
Most representative: 23
Reason: They are all the same.
3. Mode: 8 Median: 8

Mean: 8.3 (8)
Most representative: all
Reason: They all are the same value.
4. Mode: 46 Median: 49

Mean: 51.9 (52)
Most representative: mean and median
Reason: They are closer to the center of the numbers in terms of value.
5. Mode: 23 Median: 29.5

Mean: 32.2 (32)
Most representative: median and mean
Reason: The mode is too near the first values; The others are representative of the numbers.
Page 22

1. 5 to 10 hrs .
2. 1 to 3 hrs .
3. yes
4. strong
5. positive
6. (trend line on graph)

## Page 23

1. 7 shots
2. 2 shots
3. yes
4. strong
5. negative
6. (trend line on graph)
7. 7 or 8 shots
8. (trend line on graph)
9. weak correlation
10. strong
11. likely

Page 24
1.

## Page 26

1. skateboarding 4. $16.7 \%$ ( $17 \%$ )
2. aerobics and 5 . biking; cheerleading and walking
3. 60

## Page 27

1. 8
2. It should have shown the entire scale, if possible.
3. There was not enough space.
4. no
5. no

Extension: Answers will vary.

## Page 28

1. $(0,1,3,4,4,5,5,5,6,6,6,7,7$, $7,7,7,7,7,8,8,8,8,8,8,9,9$, $9,9,9,9,9,10,10,10,10,12)$
2. 7 students
3. 1 student
4. 1 student
5. $(0,1,12)$
6. 7,9
7. 7.5
8. 7 (7.1)
9. Yes
10. Yes. All of the measures are similar and close in value.
Extension: Answers will vary.
Page 30
11. 6
12. ABCD BACD CABD DABC ABDC BADC CADB DACB ACBD BCAD CBAD DBCA ACDB BCDA CBDA DBAC ADCB BDAC CDBA DCAB ADBC BDCA CDAB DCBA
13. $4!=4 \times 3 \times 2 \times 1 ; 24$
14. $5!=5 \times 4 \times 3 \times 2 \times 1 ; 120$
15. $6!=6 \times 5 \times 4 \times 3 \times 2 \times 1 ; 720$
16. $7!=7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$; 5,040
17. $10!=10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \mathrm{x}$ $3 \times 2 \times 1 ; 3,628,800$
