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Math on the Move

Lesson 24

Reading Graphs and Tables

Objectives

- Read and interpret data from different types of data displays

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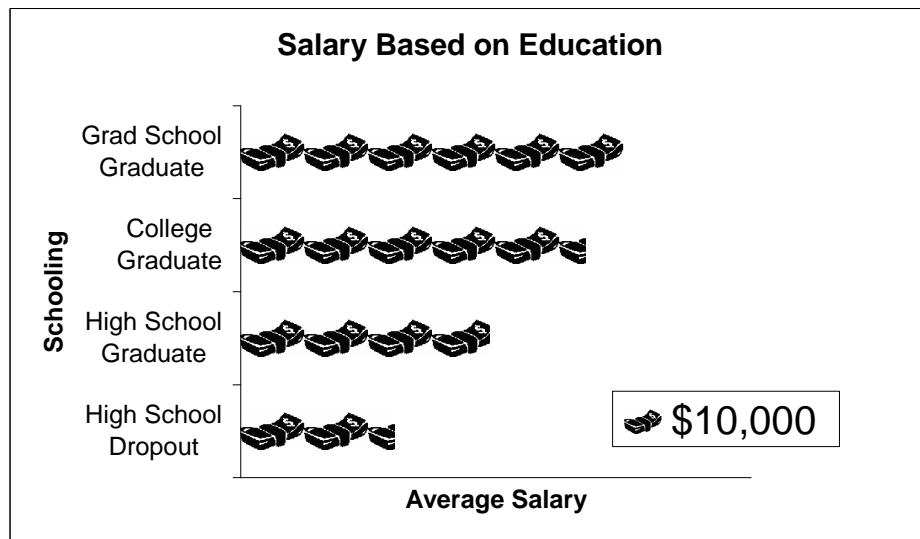
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One day, as you were reading the newspaper, you came across a **graph** showing the average salary of individuals based on their education.



- A **graph** is a term for any sort of visual way to show a relationship between two or more things.

To be more specific, this graph is a pictograph.

The pictograph is one of many graphs we use to portray different **statistics**.

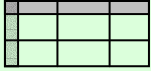
- **Statistics** is the branch of math that involves the collection, interpretation, analysis, and presentation of data. Data is information that is gathered for a specific purpose.

The next page has a list of different types of data displays that are commonly used.

Data Displays:



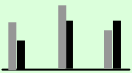
- Pie graphs show data as a part, or percent, of a whole.



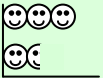
- Tables organize information by comparing groups of data.



- Bar graphs display data in different categories.



- Double bar graphs display two groups of data in different categories.



- Pictographs display data that has large, rounded numbers.



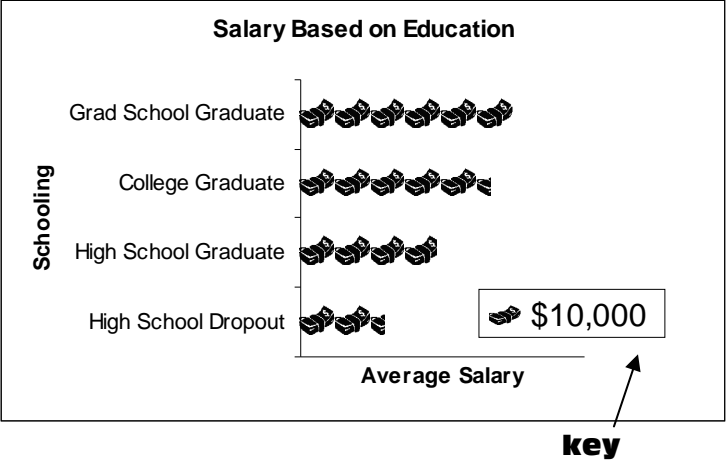
- Line graphs display data over time.

In this lesson, we will focus on how to read and analyze the data in the different data displays.

Let's look at the example of the pictograph.

The first thing we must notice is the **key** or the **legend**.

- A **legend** or a **key** is used to make data displays easier to understand. The key brings meaning to colors, shading, or pictures used in a graph.

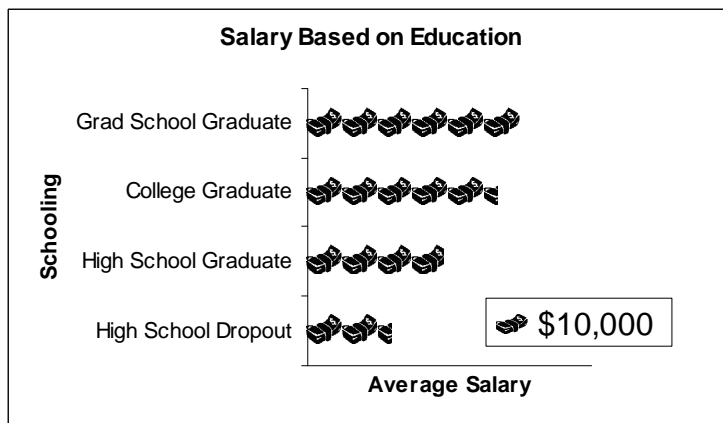


The key in this graph shows us that each stack of money represents \$10,000. In order to find the average salary each type of person makes, we count up the money stacks.

Example

Answer the following questions based on the pictograph given.

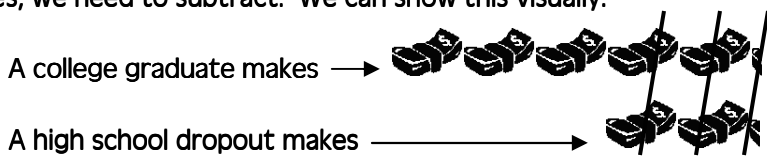
1. What is the average salary of a high school graduate?
2. What is the average salary of a high school dropout?
3. Who has the highest average salary?



4. About how much more does a college graduate earn than a high school dropout?

Solution

1. Next to the phrase "High School Graduate", there are 4 stacks of money. This means that the average salary of a high school graduate is $4 \times 10,000 = \$40,000$.
2. Next to the phrase "High School Dropout", there are $2\frac{1}{2}$ stacks of money. This means that the average salary of a high school dropout is $2\frac{1}{2} \times 10,000 = \$25,000$.
3. The highest number of money stacks is next to the graduate (grad) school graduate. Thus, the grad school graduate has the highest average salary.
4. To determine how much more a college graduate makes than a high school dropout does, we need to subtract. We can show this visually.



We can cross out money stacks to show subtraction. That leaves us with

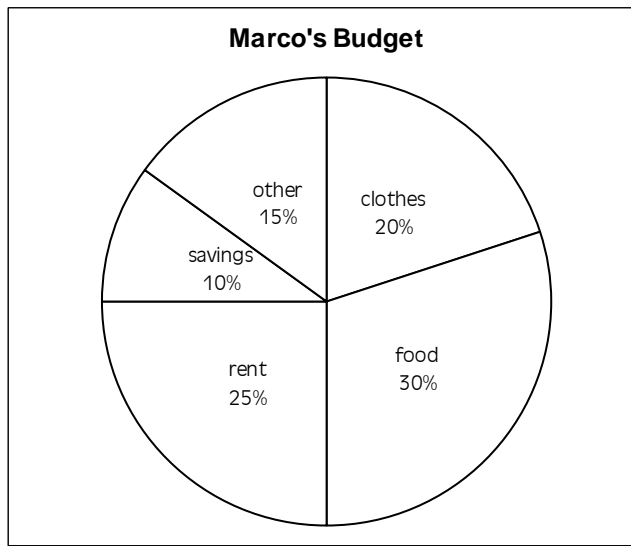


So, a college graduate makes 3 money stacks more than a dropout. The legend shows us that 3 money stacks is $3 \times 10,000 = \$30,000$. A college graduate makes \$30,000 more than a high school dropout.

Now we will get some practice with pie graphs.

Example

Marco creates a pie graph to represent his monthly budget. Answer the following questions based on the pie graph given.




1. What fraction of Marco's budget is for clothes?
2. What percent of Marco's budget is used for food and rent?
3. If Marco makes 2,500 a month, how much money does he put into his savings account every month?

Solution

1. According to the pie graph, 20% of Marco's budget is used for clothes. 20% is $\frac{20}{100}$, and this reduces to $\frac{1}{5}$. So, Marco uses $\frac{1}{5}$ of his budget for clothes.
2. Since we are trying to find the percent of both things, we must add the percentages together. Marco uses $25\% + 30\% = 55\%$ of his budget for food and rent.
3. According to the pie graph, 10% of Marco's budget is put into his savings account. So, Marco, puts $2,500 \times 10\% = 2,500 \times .10 = \250 into his savings account every month.

Think Back



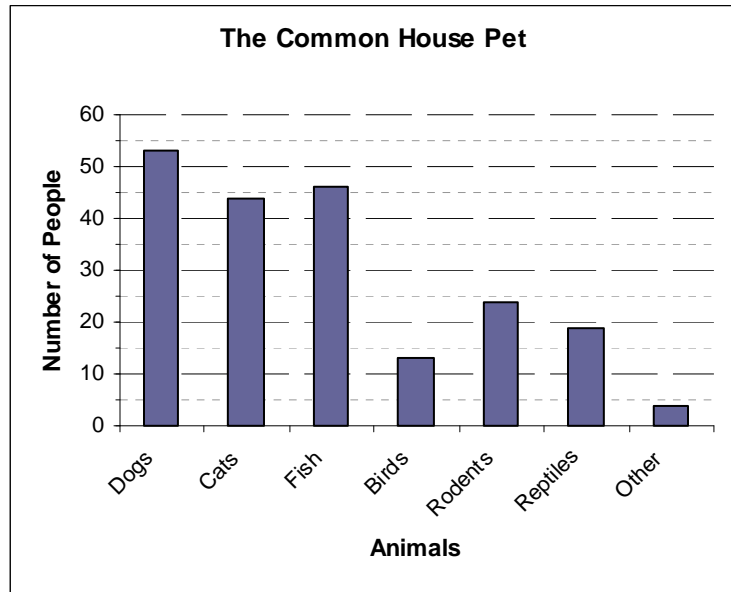
Remember that a percent is a rate out of 100. To convert a percent to a fraction, take the percent as the numerator and use 100 as the denominator. Lastly, reduce the fraction to lowest terms.

When you see a pie graph, make sure you remember that it separates parts of a whole.

Another type of graph is the bar graph.

Example

200 people were surveyed on the pets they own. This is the graph of the data collected. Answer the following questions based on the graph provided.

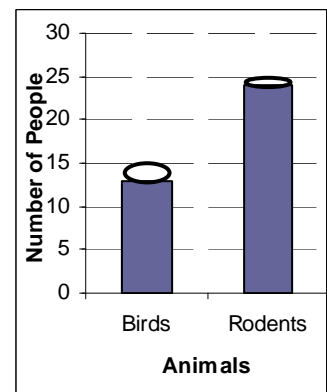
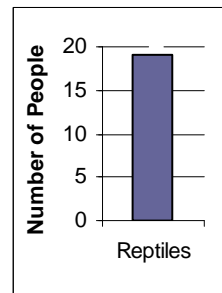


1. Which pet is most common?
2. How many people own reptiles?
3. How many more people own rodents than birds?

Solution

First, read all the labels on the graph. The bottom axis (the *x*-axis) has the types of animals, and the axis on the side (the *y*-axis) has the number of people. Notice that the numbers increase as they go higher up on the graph.

1. The higher frequency of people occurs at the taller bars, since the numbers increase as you go higher up on the graph. The tallest bar occurs above dogs, so dogs are the most common pet. (53 people own dogs.)
2. Locate reptiles on the graph and find how high that bar goes. The top of the bar is just below the dotted line for 20. We will estimate that 19 people own reptiles.
3. Locate both birds and rodents on the chart. We need to compare their values. The top of the bar for rodents is slightly below 25, so we will assume 24 people own rodents. The top of the bar for birds is below 15, but there is more space between the bar and 15 than there is between the bar for rodents and 25. So, we will assume 13 people own birds. This means that $24 - 13 = 11$ more people own rodents than birds.

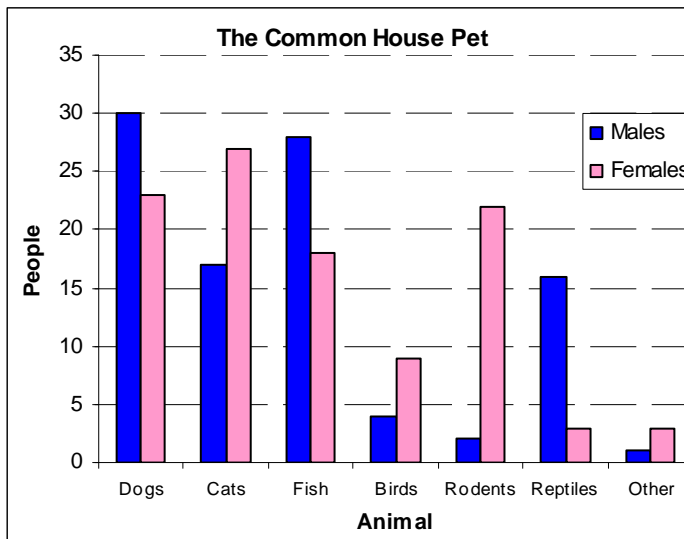


A graph that is similar to a bar graph is a double bar graph. This graph compares two groups of data.

Example

100 males and 100 females were surveyed about the pets they own. This is the graph of the data collected. Answer the following questions based on the graph provided.

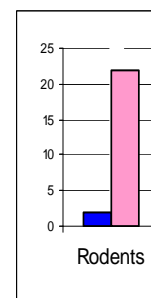
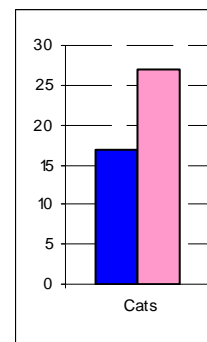
1. Which pet do more females own than any other?
2. How many males own cats?
3. Which pet has the largest difference between males and females?



Solution

First, we see that this graph has two differently shaded bars. Notice the key in the upper right hand corner of the graph. The blue (darker) bars represent males, and the pink (lighter) bars represent females.

1. To find which pet females own more than any other, we need to find the tallest pink bar. The highest pink bar occurs above cats. So, cats are the most common pet among females.
2. To find out how many males own cats, we need to look at how high the blue bar reaches on the graph. The solid gray bar is between the 15 and 20. It looks as if the top of the bar is slightly closer to 15 than 20, so we will assume that 17 men own cats.
3. The last question asks us to find the pet with the largest difference between males and females. This means we need to find the pet whose pink bar is the most different from its blue bar. If we look at the rodents category, we see the pink bar is really high, while the blue bar is really low. So, the answer is rodents.

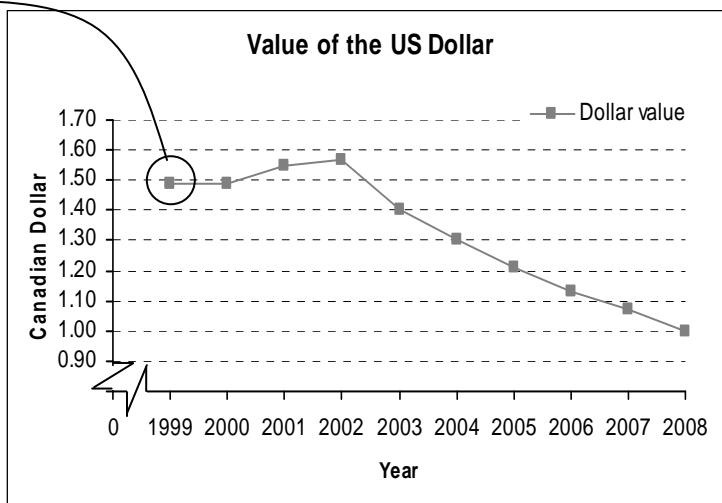


The last type of graph we will look at is the line graph.

Example

Suppose you are traveling from the United States to Canada. You go to exchange your money when you cross the border. You trade 1 U.S. dollar for 1 Canadian dollar and question why you had to do this if they are worth the same. The man who helps you exchange your money gives you the following line graph which shows the exchange rate over the past 10 years. The graph shows how many Canadian dollars you would receive if you exchanged \$1 US. For example, in 1999 you could exchange \$1 US for \$1.49 Canadian.

1. During which year was the value of the US dollar the highest?
2. How much could you exchange \$1 US for in 2003?
3. During which two years did the value of the dollar stay the same?
4. If you went to Canada with \$50 US in 2004, how much would you get in Canadian dollars?



Solution

This graph shows us the exchange rate between US and Canadian dollars. If you get more Canadian money, the value of the US dollar is high. If you get less Canadian money, the value of the US dollar is low.

1. To determine the year that had the highest value of the US dollar, you must find the highest point on the line graph. The graph peaks at the year 2002. \$1 US could be exchanged for \$1.57 Canadian.
2. The dot above 2003 reaches \$1.40. So, you could exchange \$1 US for \$1.40 Canadian.
3. To find the years where the value of the dollar stayed the same, we must find where the dots stay at the same level. Between the years 1999 and 2000, the value of the dollar did not change. (The slope between the two years is zero. Zero slope means there is no change.)
4. The dot above 2004 reaches \$1.30. So, you could exchange \$1 US for \$1.30 Canadian. However, the problem asks you to find out how much you would get if you had \$50 US.

Let's set this up as if it were an equation.

$$\text{\$1 US} = \text{\$1.30 Canadian}$$

Multiply both sides by 50

$$(50) \times \text{\$1 US} = \text{\$1.30 Canadian} \times (50)$$

$$\text{\$50 US} = \text{\$65 Canadian}$$

In 2004, if you went to Canada with \$50 US, you could exchange that for \$65 Canadian.

The last type of data display we will look at is a table.

Example

The table provided compares the populations of the three largest cities in the US for three different years.

Populations of the Three Largest US cities			
(Rounded to the nearest thousand)			
	1980	1990	1997
New York City	17,540,000	18,087,000	19,876,000
Los Angeles	11,498,000	14,532,000	15,609,000
Chicago	7,937,000	8,066,000	8,642,000

Answer the following questions based on the table provided:

1. What was the population of Chicago in 1980?
2. By how much did the population of Los Angeles increase from 1990 to 1997?
3. How much greater was the population in New York City compared to Chicago in 1990?

Solution

The table organizes the cities into rows and the years into columns.

1. Find the row labeled Chicago. Then follow along that row until you reach 1980. The population of Chicago in 1980 was 7,937,000 people.

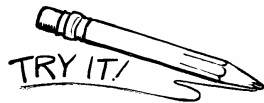
$$\begin{array}{r}
 2. \text{ Take the population of Los Angeles in 1997, and } 15,609,000 \\
 \text{ subtract the population in 1990 from that. } \quad \underline{-14,532,000} \\
 \hline
 1,077,000
 \end{array}$$

The increase in population was 1,077,000 people.

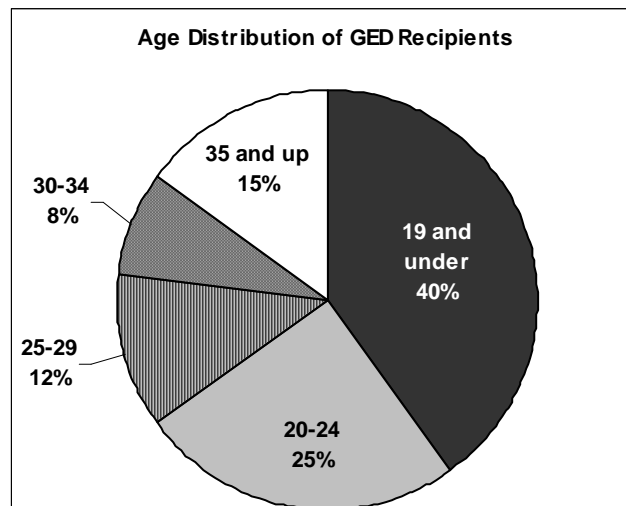
$$\begin{array}{r}
 3. \text{ Take the population of New York City in 1990, and } 18,087,000 \\
 \text{ subtract the population of Chicago in 1990 from that. } \quad \underline{-8,066,000} \\
 \hline
 10,021,000
 \end{array}$$

New York City had 10,021,000 more people in 1990.

Now you need to get some practice reading data displays on your own.

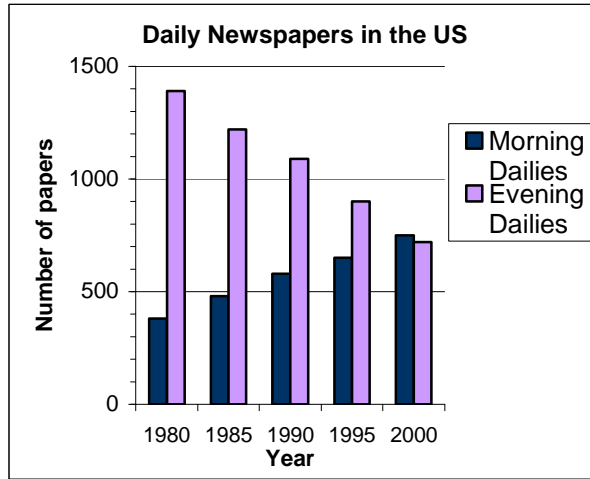


1. The following pie graph shows the age distribution of GED recipients.



- The graph divides GED recipients into how many age groups?
- Which age category represents the greatest number of GED recipients?
- Suppose in one year, 500,000 people received their GED. How many people were 35 and older?
- Suppose in another year, 120,000 people who received their GED were between the ages of 20 and 24. How many total people took the GED exam?

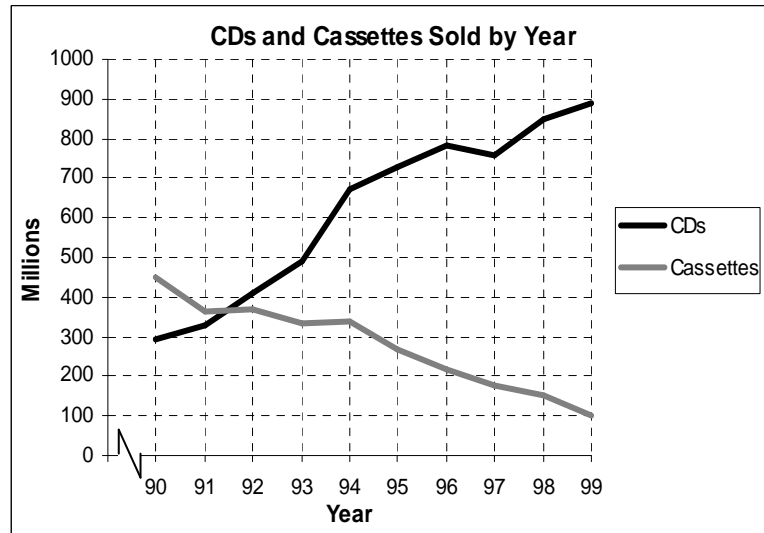
2. The following bar graph shows the number of newspapers sold each year.



- a) According to the graph, the US had approximately how many morning dailies in 1980?
 - (1) 300
 - (2) 400
 - (3) 1400
 - (4) 1500
- b) About how many evening dailies were there in 1995?
 - (1) 900
 - (2) 750
 - (3) 600
 - (4) 550
- c) The number of morning and evening dailies were both between 700 and 800 during which year?
 - (1) 1980
 - (2) 1990
 - (3) 1995
 - (4) 2000

3. The following line graph compares the number of CDs sold to cassettes sold over a period of 10 years.

- a) In what year were 150 million more cassettes sold than CDs?
- b) Approximately how many CDs were sold in 1993?
- c) What was the first year that cassette sales were below CD sales?



4. The following table shows the New York Mets record and fan attendance over 6 years.

a) In what year did the Mets have the most wins?

b) In what year did the Mets have the highest average attendance?

c) How many more people went to games in 2006 compared to 2002?

Season	Wins	Avg. Attendance
2002	75	35,960
2003	66	28,165
2004	71	28,979
2005	83	35,217
2006	97	43,327
2007	88	47,579

Review

1. Highlight the following definitions:

- a. graph
- b. statistics

2. Highlight the data displays chart.

3. Highlight all the "Think Back" box.

4. Write one question you would like to ask your mentor, or one new thing you learned in this lesson.



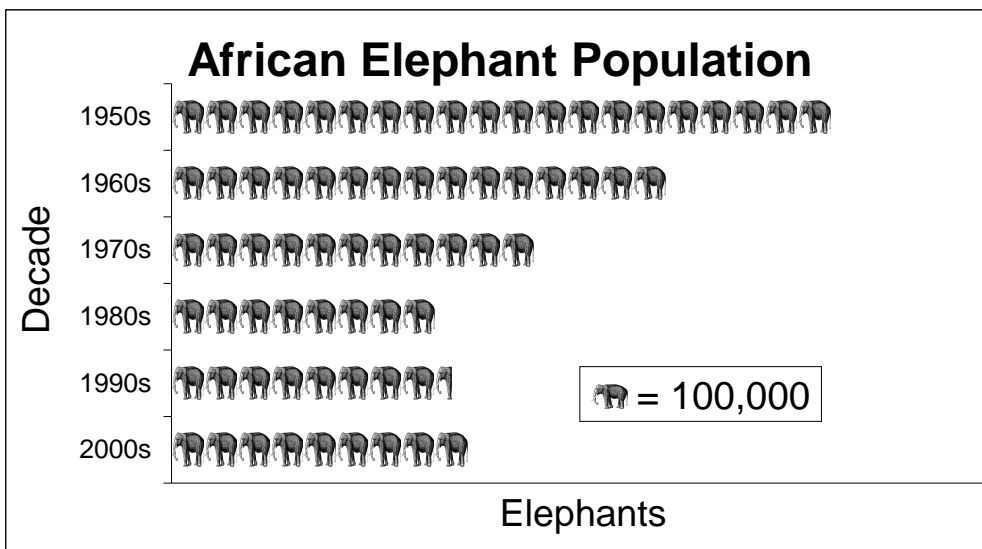
Practice Problems

Math On the Move Lesson 24

Directions: Write your answers in your math journal. Label this exercise Math On the Move – Lesson 24, Set A and Set B.

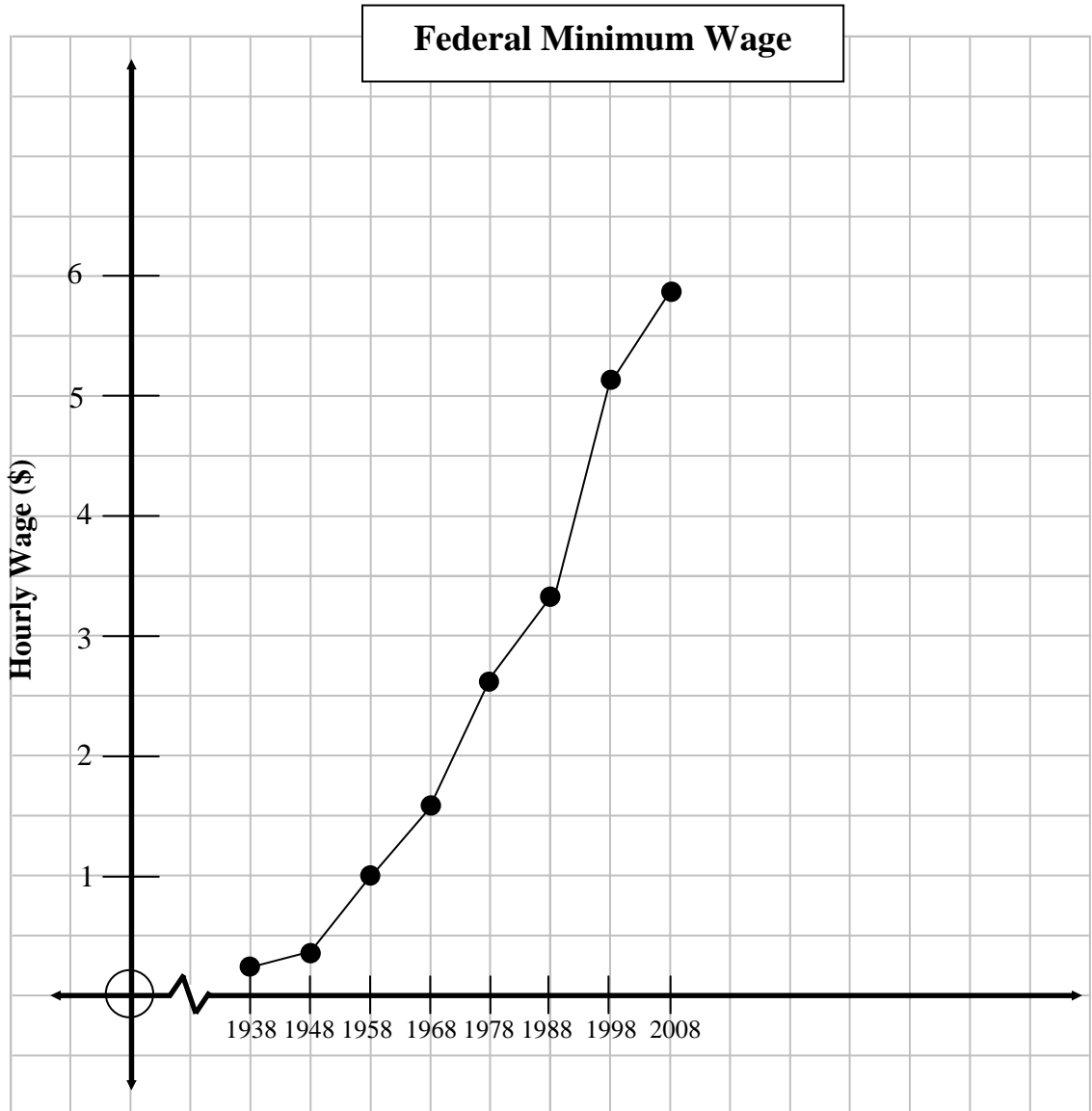
Set A

1. Answer the following questions on the pictograph below.



- How many elephants were there in the 1980s?
- How many more elephants were there in the 1950s than the 1970s?
- Between which two consecutive* decades was there the biggest decrease in elephant population?
(* Consecutive means they occur one right after the other.)

2. Find the following information by reading the graph.



- What was the minimum wage in 1978?
- When was the minimum wage above \$5?
- When was minimum wage below \$1?

Set B

- Why do we use graphs to represent data?

