

The learner will demonstrate an understanding and use of graphing, probability, and data analysis.

# 4

## ***4.01 Create and evaluate graphic representations of data.***

*Notes and textbook references*

### **A. Coin Toss Circle Graph I** (Blackline Master IV - 1)

Materials: Two coins, Hefty Plate, three crayons. Have students toss the two coins 36 times. On each trial record the results as Two Heads, Two Tails, or One of Each. Color code these results and use the Hefty plate to create a circle graph. The 36 dimples around the edge of the Hefty plate correspond to the 36 trials.

### **B. Coin Toss Circle Graph II** (Blackline Masters IV - 2 and

IV - 3)

Materials: Two coins, colored pencils. Have students toss two coins 50 times. On each trial record the results as Two Heads, Two Tails, or One of Each. Use the percentage graph to record the results on a circle graph.

### **C. Double Line Graph** (Blackline Master IV - 4)

Students are provided with data on income from video arcade games and video game rentals. These data are graphed on a double line graph to emphasize difference in trends over time.

### **D. Double Bar Graph** (Blackline Master IV - 5)

Students in the sixth grade are studying nutritional health and weight issues. These data from 1998 show how obesity varies in adults by gender and various ethnic groups. The double bar graph allows students to compare differences among the groups.

### **E. Beliefs About UFOs** (Blackline Master IV - 6)

Students are provided with a graph showing how individuals surveyed feel about UFO sightings. Students answer questions based on the graph shown. A good follow up would be to have students conduct their own survey and construct a circle graph to display the data.

## ***4.02 Analyze data using spreadsheets.***

**A. Fast Food Nutrition** Use the links in 1.09 E to find data concerning the number of calories, fat, carbohydrate, protein, and sodium content in fast foods. Enter the data in a spreadsheet. Construct graphs and use the table and formulas to compare data.

**B. World Factbook** Explore the world using the [CIA World Factbook](http://www.odci.gov/cia/publications/factbook/) found at <http://www.odci.gov/cia/publications/factbook/>. Collect data from the countries of Europe, enter the data on a spreadsheet and compare the various countries. Some interesting data to explore are land area, population, percentage of citizens who are literate, number of airports, and gross national product. Compare the number of persons per airport or number of persons per square mile. Use the spreadsheet to order the countries by these comparisons.

## ***4.03 Locate points in all quadrants of the coordinate plane using ordered pairs.***

**A. Initial Point** (Blackline Master IV - 8) Have students make a block letter drawing of one of their initials in the first quadrant of the grid. One corner should be at the origin, (0,0). They should then make a list of all the coordinates used at the corners of the block letter. In a new list change all the coordinates so that each  $x$  is decreased by 5 and each  $y$  is multiplied by -2. For example, the point (3, 5) would become (-2, -10). Plot the new list of points and connect them in a manner corresponding to the way they were connected in the original letter. How does this transformation change the way the letter looks?

**B. Four in a Row** (Blackline Master IV - 7)

Materials : Transparency of the playing mat, transparency markers in two colors.

Instructions: The class is divided into two teams. To start play, the teacher puts an algebraic expression on the overhead. On a team's turn, they will give coordinates for a point they wish to capture. That point is circled. If the team can then give the correct answer for substituting the coordinates into the expression, the team captures that point, and the circle is filled in with the color chosen for that team. If the team in play cannot provide a correct answer, the opposing team gets an opportunity to fill in the circle. Teams alternate play until one team has captured four points in a row horizontally, diagonally, or vertically.

If the leader wishes to direct students toward negative numbers, he/she

may circle a point in the 2nd, 3rd, or 4th quadrant that may be used by either team as a free spot. Each round of the game lasts only a few minutes, thus making this game an excellent time filler. You may wish to play several rounds with your students to determine a winner.

*Notes and textbook references*

#### ***4.04 Use measures of central tendency to compare two sets of data.***

**A. Europe vs. Former Soviet Republic** Use the CIA World Factbook (<http://www.odci.gov/cia/publications/factbook/>) to find data on European countries. Compare countries from the former Soviet Republics with other European countries. For comparison purposes you may use quantities such as money: exchange rates with the dollar or purchasing power, illiteracy rates. Some comparisons could be made on a per capita basis. Other examples are cell phones in use and electricity or petroleum consumption.

**B. Sports Comparisons** Have students follow a favorite team throughout the season. Have them keep track of the number of points scored in each game won, and the number of points scored in each game lost. Use mean and median to compare winning games with losing games. Students can also use the data to compare two teams. The website: <http://www.amstat.org/sections/sis/sports.html> offers statistics from a wide variety of sports.

**C. Asteroid Study** (Blackline Master IV - 9) Students in the sixth grade are studying the solar system. The data provided in this chart give information on asteroids that have been studied. Students will use mean, median, and mode to analyze the data.

#### ***4.05 Construct convincing arguments based on analysis of data and interpretation of graphs.***

**A. Asthma Statistics** Use the data found at <http://www.nhlbi.nih.gov/health/prof/lung/asthma/asthstat.pdf> to help students form conclusions based on the available statistics on asthma. This article contains line and bar graphs as well as relevant statistics.

**B. Obesity Statistics** Use the information at the website <http://www.niddk.nih.gov/health/nutrit/pubs/statobes.htm> to inform students about obesity risks and remedies. The article includes bar graphs, formulas for calculating Body Mass Index, and quoted statistics.

**C. Alien Language** (Blackline Master IV - 10) In the book, *My Teacher is an Alien*, by Bruce Coville, a small sample of the alien language is given. The double bar graph shown highlights the differences between letter usages in that language and normal English. Students use the data presented to make comparisons.

**D. Mini Review – Statistics** (Blackline Masters IV - 11 and IV - 12) This mini review covers most of the statistics topics in this unit. Students should work in pairs to share strategies.

### ***4.06 Design an experiment to test a theoretical probability; record and explain results.***

**A. Are Spinners Really Random?** (Blackline Master IV - 13) Use the black line master provided to test spinners for randomness. Use a paper clip as a spinner arrow. The spinner provided can be used to test for four, five, or six outcomes. Students should select which dial on the spinner they will test and then work in pairs to spin the spinner 120 times. They will record the actual outcomes and compare with the expected outcome. Students should discuss any difference from the expected value and brainstorm as to why those discrepancies may have occurred. Were the outcomes drastically different throughout the class? Is the average of all class outcomes closer to the expected value?

**B. Spin to Win** (Blackline Masters IV - 14 and IV - 15) In playing this game, students compare expected to experimental outcomes in three different ways. They calculate the outcomes and probabilities of a single spin, they calculate the probabilities of spinning more than, less than, or equal to 50 cents, and they predict the outcome of playing a carnival game. The expected value of playing this game is the average of all 12 outcomes, a bit more than 58 cents. In spite of the fact that students will win more than 55 cents less than 25% of the time, the expectation is for the player to win in the long run. This is a good activity to bring out the law of large numbers.  
HINT: An easy way to make the pie chart is to use a Hefty plastic plate. These plates have 36 dimples around the rim to correspond to the 36 trials in this game.

## 4.07 Make predictions based on the probabilities of simple events.

**A. Weather** Weather reporting stations, including The Weather Channel, predict the chances of rain for many areas. Have students keep track of data from such a reporting station. Along with the data, have them record whether rain fell or not during the time period specified. After following the data for 40–60 days, have the students compare the predictions with the actual event. For example, if they look at all the times when a 25% chance of rain was predicted, did it actually rain on about 25% of those days?

**B. Free Throw Percentages** Free throw percentages can be interpreted as an empirical (observed) probability. For instance, if a player hits 90% of his free throws, this means that a good estimate of his probability of being successful on his next shot is 90%. Have students keep data on a favorite basketball player. Does his free throw percentage actually equal his probability of being successful when attempting a free throw?

**C. Application Contingency** (Blackline Master IV - 16)  
Students are provided with age and gender data for applicants to join a space colony. Students will apply the definition of simple probability to answer the questions about these applicants. Note: A contingency table displays data in a table that covers all possibilities, all contingencies. In this case, the applicants must be male or female, and their ages must fall into one of the categories. No applicants were allowed below the age of 20.

**D. Space Race** (Blackline Master IV - 17)  
Materials: A pair of dice. Students follow instructions to bet on a space race. They should discover that space ship number one has no chance of progressing, and that it is much more likely that ships numbered six, seven, and eight will come in first. The table below illustrates why these numbers are rolled more often.

+	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

**E. Mini Review – Probability** (Blackline Masters IV – 18 and IV – 19) This mini review covers most of the concepts of probability from this section. Students should be allowed to work in pairs to share strategies.

#### ***4.08 Use inductive and deductive reasoning to solve problems.***

**A. Matrix Logic** (Blackline Master IV - 20) Many resources can be found with matrix logic puzzles in them. These are good activities to develop the logical abilities of students. The black line master shows one example of this type of problem and the matrix that may be used to help solve it.

**B. Halley’s Comet** (Blackline Master IV - 21) Data about Halley’s Comet are provided. Students will use these data to find a pattern governing the appearance of the comet near Earth. Observing instances of behavior that follow a pattern is the heart of inductive reasoning.

**C. Distance from Earth to Venus** (Blackline Master IV - 22) Students are provided with a graph showing the distance from Earth to Venus. The graph provides a pattern which students may use to draw some inductive conclusions.

#### ***4.09 Analyze problem situations, use an organized approach, and select appropriate strategies and technology to solve problems involving probability and statistics.***

**A. Planet Collector Cards** (Blackline Master IV – 23 and IV – 24) Students use the spinner to simulate buying Captain Krypton Cereal in the attempt to get an entire collection of Planet Collector Cards. Each student should conduct the experiment three times. Then data from the entire class can be gathered to determine how many boxes of cereal one might expect to buy to get the entire set.

**B.** See activity 1.09 D.