Grade 7 Circle graph

7.SP.3	
Construct, label and interpret circle graphs to solve problems.	1. Identify common attributes of circle graphs, such as 1.1. title, label, or legend 1.2. the sum of the central angles is 360^{o} 1.3. the data is reported as a percent of the total and the sum of the percents is equal to 100% 2. Create and label a circle graph, with and without technology, to display a given set of data. 3. Find and compare circle graphs in a variety of print and electronic media, such as newspapers, magazines, and the Internet. 4. Translate percentages displayed in a circle graph into quantities to solve a problem. 5. Interpret a circle graph to answer questions.

Clarification of the outcome:

- The outcome concerns what is sometimes called a pie graph or pie chart.
- This kind of graph is used for categorical data (e.g favourite movies). The area/size of the central angle of a "pie" section indicates percent or fraction of the total frequency. For example, if Gladiator was the favourite movie of 15 out of 25 people asked, then that section would represent 60% (15/25 = 60/100) of the graph. The central angle for the section would be .60 x 360 = 216 degrees.

Required close-to-at-hand prior knowledge:

- Proficiency with measuring angles.
- Understand central angles.
- Understand percent and fractions.

SET SCENE stage

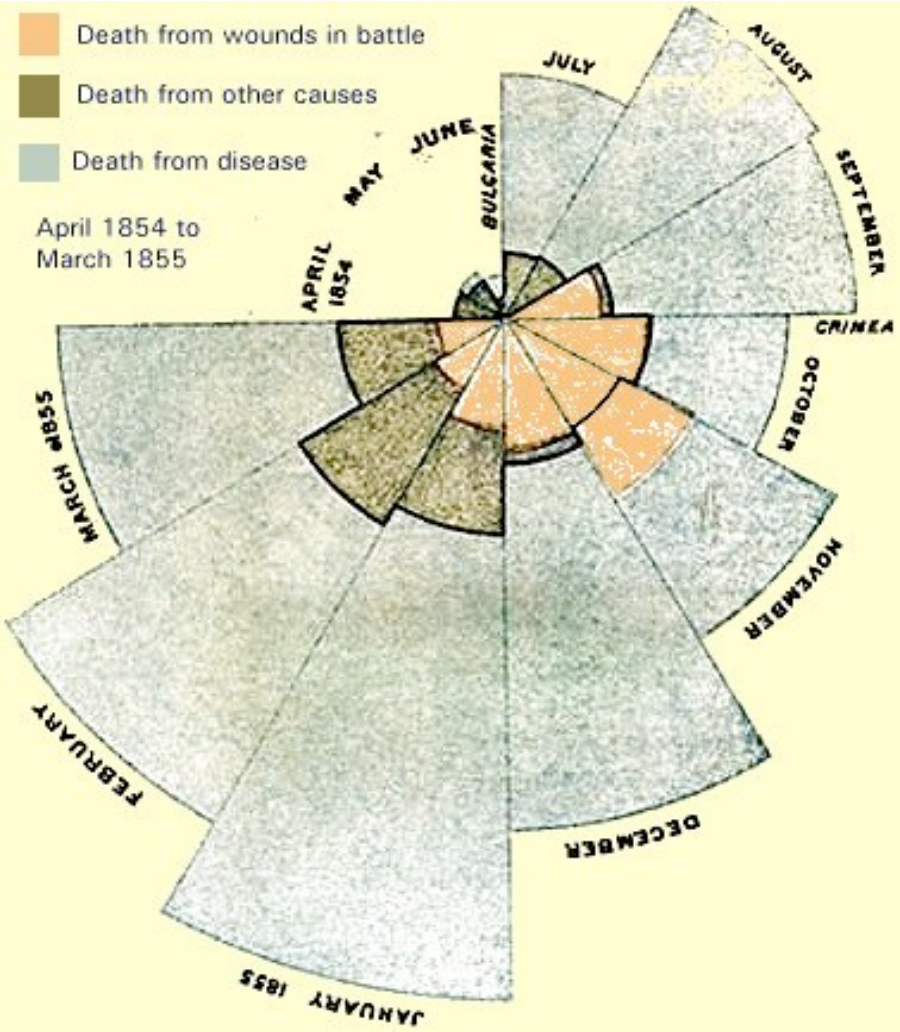
The problem task to present to students:

Organize students into groups. Ask them to research Florence Nightingale and write a brief report about her life and the graph she invented.

Comments:

The main purpose of the task is to get students thinking about the origins of a circle graph and "real world" uses for it.

- Florence Nightingale played a significant role in changing public health procedures in England in the mid 1800s. She invented a type of graph (now called circle graph) to help convince health authorities about the flaws of existing medical practices. The graph used different radius lengths to show percent information about frequency of a category. The modern circle graph uses the size of the central angle/area of pie piece to show that information. [Refer to the article, *Polar Area Graphs*, **Mathematics Teaching in the Middle School**, Vol 4, #6, March 1999), pages 395-397.]



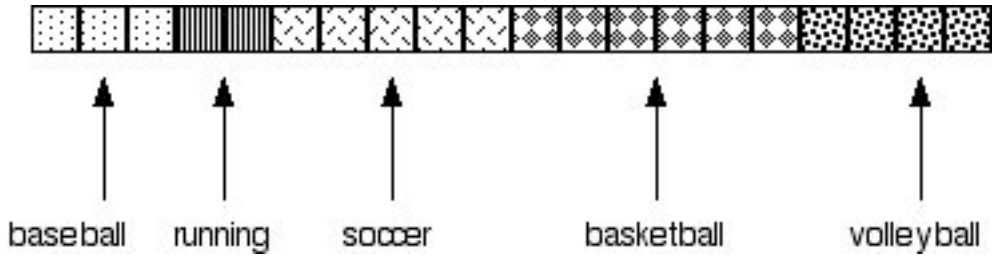
DEVELOP stage

Activity 1: Revisits SET SCENE and addresses achievement indicators 3 and 5.

- Ask selected groups to read their report on Florence Nightingale. Discuss her contribution to improving medical practices at the time.

Activity 2: Addresses achievement indicators 1, 2, 4, and 5.

- Ask students to collect data from twenty people on their favourite sport to play.
- For the data that students collected use a total amount that divides exactly into 100. For example, suppose 22 pieces of data were collected. Only use 20 pieces ($100 \div 20 = 5$, an exact division result). If they collected 26 pieces, use only 25 ($100 \div 25 = 4$, an exact result). The reason for this is that it is simpler to calculate percents if the total amount of data collected is a divisor of 100.
- Suppose the data collected were: baseball - 3 students; running - 2 students; soccer - 5 students; basketball - 6 students; volleyball - 4 students (a total of 20 pieces of data). Ask students to represent the data on a 20 cm by 1 cm grid (a twenty strip), where each square represents one student response (see diagram).



- Ask students to make the twenty strip into a circle by taping the two ends of the twenty strip together without overlapping them. Ask them to trace this circle on a sheet of paper, marking the beginning and ending of each favourite sport section on the traced circle. Have students find the approximate centre of the traced circle and join the marked beginnings/ endings to the centre to form a circle graph. Have them label each section of the circle graph (see diagram).

- Discuss the relationship between the twenty strip and the circle graph. Ask students to determine the percent values for each section of the circle graph. For this example, expect them to determine: baseball 15% (3/20 is 15/100), running 10% (2/20 is 10/100), soccer 25% (5/20 is 25/100), basketball 30% (6/20 is 30/100), and volleyball 20% (4/20 is 20/100).

Continued next page.

- Ask students to make a table of the data recorded on the twenty strip, with headings of: 'actual count', 'fraction of total count', 'percent of total count', and number of degrees. Ask students to complete that part of the table (see chart).
- Discuss that a complete rotation in a circle is 360 degrees and how to use percent to calculate the number of degrees for each section of the circle graph (percent of total count x 360). Have students calculate the number of degrees for each section and fill that information into the table.

SPORT	ACTUAL COUNT	FRACTION OF TOTAL COUNT	PERCENT OF TOTAL COUNT	NUMBER OF DEGREES
baseball	3	3/20	15%	.15 x 360 = 54
running	2	2/20	10%	.10 x 360 = 36
soccer	5	5/20	25%	.25 x 360 = 90
basketball	6	6/20	30%	.30 x 360 = 108
volleyball	4	4/20	20%	.20 x 360 = 72
totals	20	20/20	100%	360

- Ask students to use a protractor to measure the number of degrees for each section of the circle graph completed previously. Ask them to compare the measurements to the number of degrees recorded in the table. Discuss the comparisons.

Activity 3: Addresses achievement indicators 1, 2, 4, and 5, and practice.

- Provide students with favourite food data on 25 students (e.g. pizza - 12 students; hamburger - 10 students; hot dog - 3 students). Ask students to make a table like the one in activity 2 and to make a properly labelled circle graph of the data. Assist as needed. Discuss what the circle graph tells. [Note: 25 is divisor of 100.]

Activity 4: Addresses achievement indicators 1, 2, 4, and 5, and practice.

- Provide students with favourite pet data on 50 students (e.g. dog - 27 students; cat - 11 students; bird - 6 students; snake - 2 students; rabbit - 4 students). Ask them to make a table and then make a properly labelled circle graph of the data. Assist as needed. Discuss what the circle graph tells. [Note: 50 is divisor of 100.]

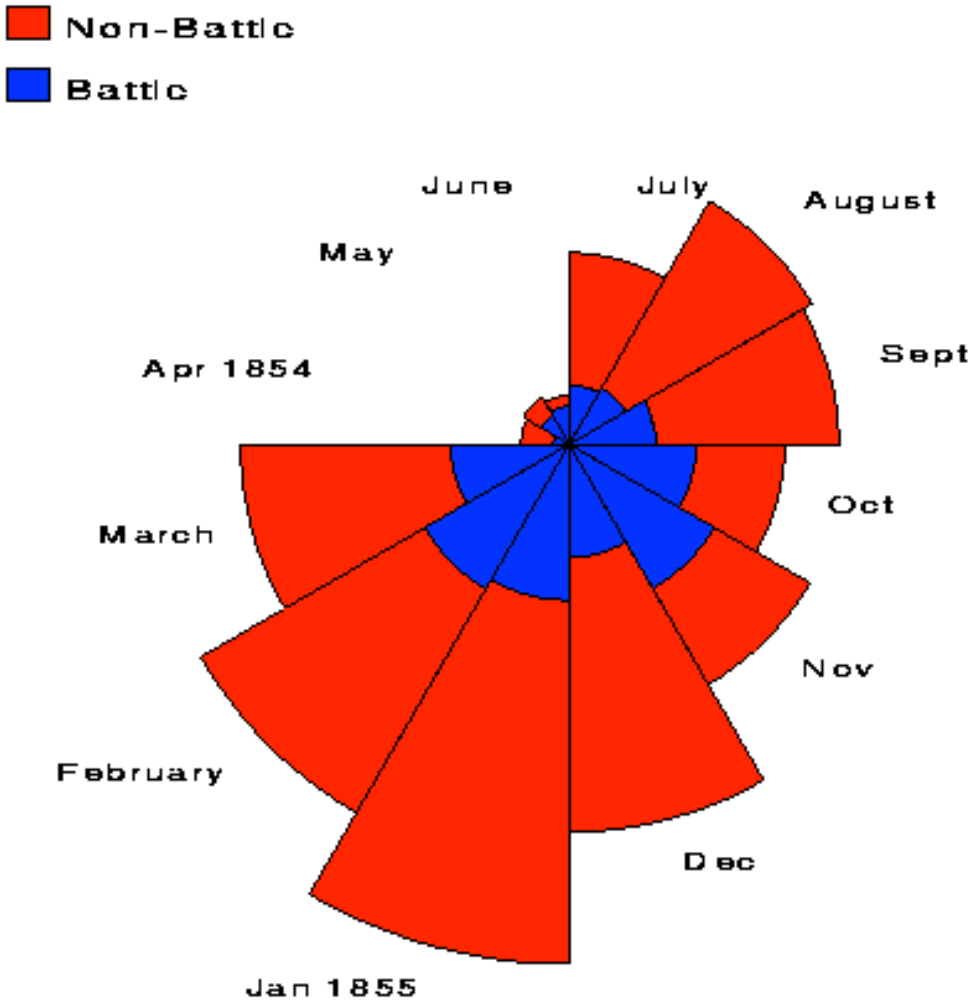
Activity 5: Addresses achievement indicators 1, 2, 4, and 5, and practice.

- Provide students with data on 100 math test scores. Have them organize the data into ten intervals of ten (1-10, 11-20, 21-30, . . . 91 - 100). Have students calculate the percent of test scores in each interval and use the percent information to calculate the number of degrees needed for each interval. Have them make a circle graph. Assist as needed. Discuss what the circle graph tells.

Activity 6: Revisits SET SCENE, addresses achievement indicators 1 through 5, & practice.

- Organize students into groups. Provide them with the following Nightingale circle graph (see next page). It shows causes of Army mortality for the months July through March. ENSURE students realize that the length of a radius indicates the frequency of a category.
- Have students think about a method for converting the Nightingale circle graph to modern form. Discuss their ideas and use one that involves the radius to convert the 1850s graph to modern form. Discuss whether the converted form represents the original graph reasonably well.

Causes of Mortality in the Army in the East April, 1854 to March 1855



From: F. Nightingale, "Notes on Matters Affecting the Health, Efficiency and Hospital Administration of the British Army", 1858

Activity 7: Addresses achievement indicators 3, 4, and 5.

- ✦ Provide/have students find on Internet and/or in newspapers/magazines examples of circle graphs. Have students compare the various graphs (size, topic, appropriateness) and tell what each graph tells us about the matter at hand.
- ✦ Select a few of the graphs and pose problems such as: "*Suppose 100 000 people were involved in the food survey. How many of those people eat spinach, based on the fact that the graph tells us 18% of the people surveyed eat spinach?*" Have students solve the circle-graph problems.

Activity 8: Assessment of teaching.

- Provide students with a completed circle graph showing percents (see example). Ask them to explain what the graph tells them.
- Ask them to determine the number of degrees and to explain how to determine the number of degrees for each section.
- Ask them to solve the problem: "*Suppose 3000 people were surveyed for the show data. How many of them like adventure shows?*"

If all is well with the assessment of teaching, engage students in PRACTICE (the conclusion to the lesson plan).

An example of a partially well-designed worksheet follows.

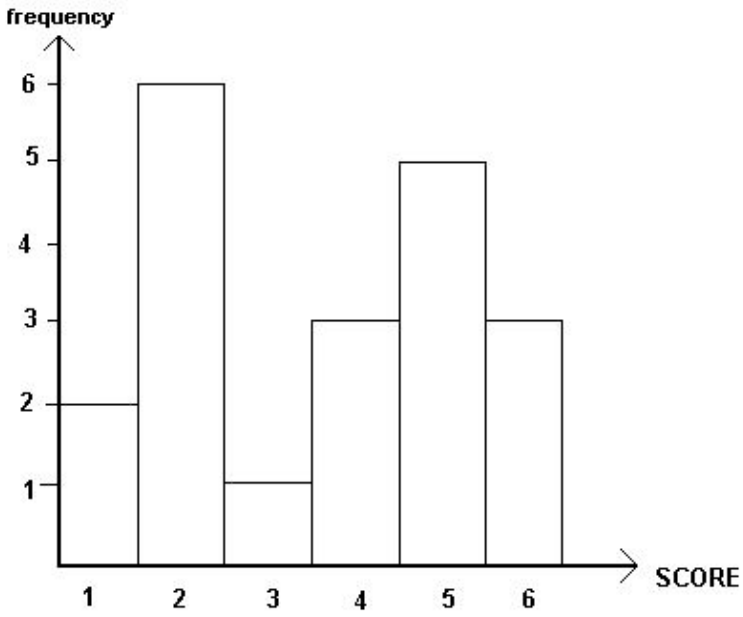
The worksheet contains a sampling of question types. More questions of each type are needed.

The MAINTAIN stage follows the sample worksheets.

Question 1.

The bar graph shows the number landing face up when a die was rolled many times.

Create a circle graph from the information shown in the bar graph. Clearly label the circle graph and indicate the size of each central angle.



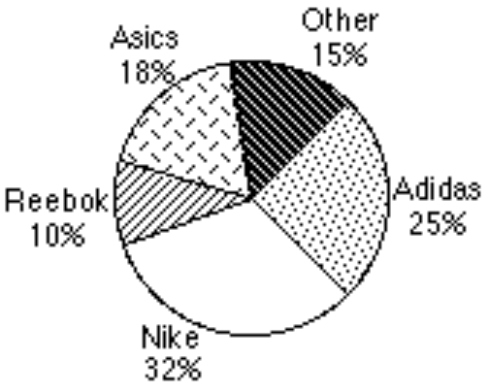
Question 2.

Make a properly labelled circle graph of the data shown in the table.

Table: Favorite Type of Movie				
Comedy	**Action**	**Romance**	**Drama**	**SciFi**
4	5	6	1	4

Question 3.

The circle graph shows runners sold in the month of November at a store that sells running supplies. If a total of 200 runners were sold in November, how many of each type were sold?



MAINTAIN stage

Mini-task example

Every so often:

- Present a circle graph and have students:
  - Describe how to determine the size of a central angle for a section from the frequency percent.
  - Describe what the graph tells them.

Rich-task example

Have students engage in data management projects that are integrated with another subject area (e.g. social studies or science), where drawing and interpreting circle graphs is needed for the project.

Comments

This is a rich-task because it is integrates circle graphs with other matters.