

Graphing Unit

Kentucky Core Content:

MA-M-3.1.3 Students will describe properties of, define, give examples of, and/or apply to both real-world and mathematical situations: Characteristics and appropriateness of graphs (e.g., bar, line, circle), and plots (e.g., line, stem-and-leaf, box-and-whiskers, scatter)

MA-M-3.2.1 Students will perform the following mathematical operations and/or procedures accurately and efficiently, and explain how they work in real-world and mathematical situations: Organize, represent, analyze, and interpret sets of data

MA-M-3.2.2 Students will perform the following mathematical operations and/or procedures accurately and efficiently, and explain how they work in real-world and mathematical situations: Construct and interpret displays of data (e.g., table, circle graph, line plot, stem-and-leaf plot, box-and-whiskers plot)

MA-M-3.3.1 Students will show connections and how connections are made between concepts and skills, explain why procedures work, and make generalizations about mathematics in meaningful ways for the following relationships: How different representations of data (e.g. tables, graphs, diagrams, plots) are related

MA-M-3.3.3 Students will show connections and how connections are made between concepts and skills, explain why procedures work, and make generalizations about mathematics in meaningful ways for the following relationships: How data gathering, bias issues, faulty data analysis, and misleading representations affect interpretations and conclusions about data (e.g., changing the scale on a graph, polling only a specific group of people, using limited or extremely small sample size)

MA-M-4.3.1 Students will show connections and how connections are made between concepts and skills, explain why procedures work, and make generalizations about mathematics in meaningful ways for the following relationships: How everyday situations, tables, graphs, patterns, verbal rules, and equations relate to each other

Main Ideas:

1. Numbers and statistics are an important part of everyday life.
2. Different types of graphs are appropriate for different data sets.

Grade Level: 8th Grade Science and Mathematics classes (can be done as a collaborative unit or completely in Science class)

Teacher Background Needed:

Teachers should have experience using the GraphMaster program, knowledge of where numbers are used in everyday life, and experience with many different kinds of simple laboratory experiments.

Students' Preconceptions:

1. Math and numbers are only useful in math class.
2. A bar graph is appropriate for all data sets.
3. The points are connected by lines in a scatter plot.

4. A proper survey can be conducted by polling a small number of people.
5. Accurate data can be taken by completing an experiment only once.
6. Proper scaling is not important on a graph.

Students' Prior Knowledge:

1. Students have experience making bar graphs.
2. Students should have knowledge of how to complete the labs and tasks assigned for data collection.
3. Students have seen various types of graphs before in different situations.

Pre-Assessment:

1. Students will take a pre-test consisting of released questions from the CATS exam on reading and interpreting graphs.

Evidence of Achievement:

1. Students will take a post-test consisting of the same questions from the pre-test.
2. Students will complete a poster project with at least one graph made on GraphMaster and other information relating to analysis and interpretation of graphs.
3. Students will complete other assignments and turn in a data collection booklet all of which will contribute to their final project grade

.SKILLS/CONCEPTS	# OF DAYS	Instructional Strategies	Assessment	Resources Needed	Kentucky Core Content
Numbers have an impact on our everyday lives	1	<p>Make data books</p> <p>Discussion of how numbers are important in everything we do</p> <p>Watching TV commercials and looking for number references</p>	<p>Answered questions in data book</p> <p>List of number references from commercial video</p>	<p>White and colored typing paper</p> <p>Scissors</p> <p>Video tape of TV commercials</p>	MA-M-3.3.1
<p>Pre-test</p> <p>Different types of graphs are appropriate for different data sets</p> <p>Numbers and graphs convey useful information in the news</p>	1	<p>Students take pre-test</p> <p>Discuss different graph types and when each is appropriate</p> <p>Students answer questions on graphs and charts taken from newspapers</p>	<p>Completed pre-test</p> <p>Answered questions</p>	<p>Pre-test worksheet</p> <p>Samples of different graphs, large enough for the class to see or on worksheets</p> <p>Graphs and charts from newspapers with questions on the back</p>	MA-M-3.1.3
Data collection	2-3	Students complete various mini labs and record data tables in their data books	Completed data book	<p>Appropriate materials for mini labs</p> <p>Data books</p>	MA-M-3.2.1

SKILLS/CONCEPTS	# OF DAYS	Instructional Strategies	Assessment	Resources Needed	Kentucky Core Content
What makes a good survey?	1	Discussion of what factors must be considered in a good survey Completion of survey data sheet	Completed survey data sheet	Survey data sheet	MA-M-3.3.3
Students will begin a graphing project	1	Describe graphing project Assign graph topics Students will plan their graphing projects	Students must have plan 'okayed' before beginning their projects	Scoring rubric List of project topics Planning worksheet	MA-M-3.2.2
Students will learn how to use GraphMaster	2-2.5	Demonstrate GraphMaster program Students begin work on project by making and printing their graphs	Students must have graph(s) 'okayed' before printing	GraphMaster program Access to laptop computers or a computer lab and printer Blank discs (for saving graphs)	MA-M-3.2.2

SKILLS/CONCEPTS	# OF DAYS	Instructional Strategies	Assessment	Resources Needed	Kentucky Core Content
Students complete the graphing project	1-2	Students must make a rough copy of their final project Students then produce their final copy	Students must have their rough copy 'okayed' before starting the final	Card stock or poster board Paper Printed graphs Glue/tape Scissors markers	MA-M-4.3.1
Presentation of graphing projects	1-2	Students make a short presentation of their final project to the class	Presentation grade	Completed projects	MA-M-4.3.1
Interpreting graphs Post-test	1	Students answer questions from other student projects Students complete post test	Answers to project questions Completed post-test	Completed projects Post-test worksheet	MA-M-4.3.1

Graphing Unit: Making Data Collection Booklets

Objectives: Making a booklet for students to use to record the data they collect in their mini-labs later in the week.

Materials: White copy paper, scissors, Colored copy paper (optional), Markers/crayons/colored pencils (optional), stapler (optional)

Procedure/Time: Making the data booklets should only take about 10 minutes.

There are many different ways of making data books, and the teacher should choose which is best for his/her classroom. Some teachers may choose to simply staple blank papers together, others may desire something fancier or fun for the students to make. Teachers can have students decorate their books with markers or crayons if they so desire.

Assessment: Finished data book.

Graphing Unit: Numbers Are Everywhere!

Topic/question: How influential are numbers to our everyday life?

Kentucky Core Content/National Standards:

MA-M-3.3.1 Students will show connections and how connections are made between concepts and skills, explain why procedures work, and make generalizations about mathematics in meaningful ways for the following relationships: How different representations of data (e.g. tables, graphs, diagrams, plots) are related

Objectives: In this activity students should understand that numbers are in fact everywhere. Many middle school students feel that numbers are only important in math class, but after this lesson they should understand that numbers are associated with nearly everything in their daily routine.

Materials: video taped commercials (approximately 10-15 minutes worth)

Procedure/Time: This lesson should take most of one class period.

Begin class with a discussion on numbers. Ask students if they have used numbers yet that day and if so where. Ask them how important they think math and numbers are to their everyday lives (not counting math or science classes, of course.) Lead to a discussion of how numbers impact our lives without us knowing it: government regulations on food, clothing, toothpaste, vehicles, etc. Continue with discussion on how other numbers like π , the speed of sound, the speed of light, etc, were discovered through exhaustive experimentation—that is, many, many experiments were conducted and our accepted values take into account all of these experiments.

Next, tell the students they are going to watch some commercials. Instruct students to keep a record of each commercial and the numbers or number references contained in the commercial. These may be overt references, like ‘**4 out of 5** dentists recommend Trident’ or more hidden references like ‘**all** people love Prego.’ It is important to recognize both types of references, but teachers may want to discourage students from writing down phone numbers or dates. After watching the commercials, start a discussion of what the students found and relate back to how numbers really are everywhere.

Assessment: Answered questions in data booklets, in class discussions.

Teacher Notes: The teacher obviously needs to record some commercials from television before this lesson. If possible, recording one hour’s worth of commercials would be an interesting exercise, but may not yield the best results. It would be wise for the teacher to keep a list of the commercials along with information about what number references it contains.

Graphing Unit: Graphs in the News

Topic/question: There are different types of graphs and each one is suitable for particular kinds of data; graphs and charts are an important tool for conveying data.

Kentucky Core Content/National Standards:

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Objectives: This lesson should help students to understand which type of graph is appropriate for different data sets. Also, students should see many examples of graphs and data charts taken from newspapers and should then see how they are used to convey information.

Materials: Newspaper clippings of graphs and data charts with questions associated with each, other examples of graphs for class discussion

Procedure/Time: This lesson should take most of one class period.

Begin class by showing different examples of graphs and having a class discussion on when each type is appropriate for representing a data set. The GraphMaster program help section/index has examples of graphs to print, also look in magazines or on the internet. Teachers may have examples from teacher supply companies or from math textbooks as well. In the discussion describe the differences in the graphs and why some are better than others depending on what data is being graphed (for example, why is a bar graph not appropriate for a graph of temperature v. time of boiling water? Why is a line graph not a good choice for a graph comparing arm span and height?)

After the discussion, put students into groups of two. Pass the graphs from the newspapers around the room and have each student (not each group of two!) answer a particular question for each graph. Rotate the graphs around the room until all students have answered a question relating to each graph. Collect the students answers and then go over some of the questions for an in class discussion.

Assessment: In class discussions and answered questions from newspapers.

Teacher Notes: If crunched for time, the newspaper portion of this activity can be done in another classroom or in homeroom and returned to the teacher for grading.

Graphing Unit: Data Collection

Topic/question: Where does the information from graphs come from?

Kentucky Core Content/National Standards:

MA-M-3.2.1 Students will perform the following mathematical operations and/or procedures accurately and efficiently, and explain how they work in real-world and mathematical situations: Organize, represent, analyze, and interpret sets of data

Objectives: This lesson will provide the students with experience in the laboratory and allow them to collect data to use for their final poster project.

Materials: materials will vary depending on what labs the teacher chooses

Procedure/Time: This part of the unit will take 2 to 3 class periods to complete.

The teacher should select about 15 short laboratories and set up ‘stations’ for each around the classroom. These mini-labs should provide students with different types of data and should be able to be completed quickly. Teachers should laminate instructions for each lab and tape them to the station, along with an example of what the student’s data chart should look like. Put students into pairs and let the pairs have 8 minutes at each station to collect as much data as they can in their data booklets. Students should do labs separately if possible and each student should record information in his or her data book. Collect the data books at the end of each class period and continue until all students have completed all stations or until time no longer allows.

Assessment: Completed data books

Teacher Notes: There are many options for mini-labs. Try to choose activities that will allow for many different types of graphs. You can also use probability games or simple data collection from newspapers.

Example stations: finding mass of different objects, mass v. distance experiment, temperature change over time, gathering weather data from newspapers, tossing a coin and recording heads v tails for each flip, measuring height v. arm-span, measuring foot length v. forearm length.

There are many, many other possibilities. This is a good way to have the students do some of the cookbook labs that are important but not inquiry based!

Graphing Unit: Graphs and Surveys

Topic/question: What factors go into making a good survey?

Kentucky Core Content/National Standards:

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Objectives: This lesson should help students to understand that both population and population size are very important factors in producing an accurate survey.

Materials: student demographic/survey worksheet

Procedure/Time: This lesson should take one class period.

Begin class with a discussion on surveys. Students have probably done surveys in past classes, even as early as elementary school. Discuss what goes into making an accurate survey, and what should be avoided. Ask questions like ‘Would you get good results for a survey if you asked the teachers here what their favorite subjects were?’ or ‘Is it better to survey a small number of people or a large number of people? Why?’

After discussion, have students fill out a survey/demographic sheet. This should have information that could be used later for the final projects to make a graph. Collect these sheets when students finish.

Assessment: Class discussion and completed survey sheets.

Teacher Notes:

If time allows and the teacher prefers students can actually conduct surveys instead of filling out the survey sheets.

Sample survey sheet questions: day of birth, date of birth, month of birth, height, eye color, left handed or right handed, gender, etc.

Pick things that would make interesting comparisons in a graph (may or may not produce correlations) Also include survey questions with options—having options makes it easier to work with the results in the graph (EX:

‘what is your favorite type of music: Rock Rap Country Christian Other (circle one)’)

If time is a problem, the survey sheets can be filled out in homerooms or in other classes and brought back in to the classroom for the final project.

Graphing Unit: Poster Project

Planning stage

Topic/question: What is the best way to present collected data?

Kentucky Core Content/National Standards:

MA-M-3.2.2 Students will perform the following mathematical operations and/or procedures accurately and efficiently, and explain how they work in real-world and mathematical situations: Construct and interpret displays of data (e.g., table, circle graph, line plot, stem-and-leaf plot, box-and-whiskers plot)

Objectives: This part of the unit will pull the other lessons together. Students will use what they have learned in other lessons to produce a final project for the unit.

Materials: List of graph topics, Data and Graphing Plan Sheet, scoring rubric (optional)

Procedure/Time: This part of the unit should take one class period.

Before class, the teacher must make a list of possible graphs that can be made from the data collected in the mini-labs or the information from the survey/demographic sheets. In class, the students must work in pairs and will choose one of the topics for their project. They must then complete the Data and Graphing Plan Sheet and have it approved by the teacher before moving to the next part of the project.

Assessment: Students must have their worksheets approved by the teacher before moving forward in the assignment.

Teacher Notes: If possible, choose as many possible graph topics as you have pairs of students. The fewer repeated topics you have the better the end result will be as one of the final activities is to share projects in a presentation format.

Data and Graphing Plan Sheet

Name _____

Name _____

This sheet must be stamped/approved before using the *Graph Master* program.

What factors or variables are you going to compare?

How many books/data sheets will you need to do this? Why?

What type of graph do you think you will need to make? Why?

Do you think there will be any correlation? If so, what kind?
If not, why?

Graphing Unit: Mastering GraphMaster

Topic/question: How do you use the program GraphMaster to make graphs?

Kentucky Core Content/National Standards:

MA-M-3.2.2 Students will perform the following mathematical operations and/or procedures accurately and efficiently, and explain how they work in real-world and mathematical situations: Construct and interpret displays of data (e.g., table, circle graph, line plot, stem-and-leaf plot, box-and-whiskers plot)

Objectives: Students will learn the basic steps to producing graphs with the computer program GraphMaster.

Materials: GraphMaster program (Tom Snyder Productions), access to laptops in the classroom or access to school computer lab, computer projector, screen

Procedure/Time: This part of the unit will take 2 to 2.5 class periods.

Before class, the teacher should familiarize him/herself with the GraphMaster program and prepare some data for a demonstration for the class. The program will interpret the data to some degree and (95% of the time) will not allow you to make graphs that are inappropriate for a data set. Be sure to investigate the program as much as you can—that way you won't be overwhelmed by questions you can't answer! The manual with the program is very helpful, and the program is very easy to use, but there can still be unexpected challenges.

After the demonstration, students are ready to get data books or survey sheets and collect the data they need and make their graphs using GraphMaster. Students should have their graphs approved by the teacher before printing.

Assessment: Printed graphs

Teacher Notes: The more helping hands available in the classroom for this, the better. Some students may finish very quickly, others may need quite a bit of time to make a good graph; the teacher may let the students who finish quickly be helpers for the activity. Some students may want to produce multiple graphs and this is the teacher's choice. Colors on bar graphs and histograms can be changed and pictures on pictographs can be changed to a limited choice of icons. If your printer is black and white only students can print a 'coloring book' version of their graphs that they can color for their project. When entering numerical data, only use numbers; for example, do not enter '36 cm', enter '36' and make sure the title of that column of data is 'length in cm'.

****Mastering GraphMaster****

Directions for graphing your data

Step 1: Open GraphMaster on your computer

Step 2: Click on '**New Data Set.**' This will bring up an empty spreadsheet (data table)

Step 3: Enter the data you want on the x-axis of your graph (the *independent variable*) under column A.

Step 4: Enter the data you want on the y-axis of your graph (the *dependent variable*) under column B.

Step 5: When you finish entering your data, click on the '**Graph**' button on the left side of the screen. This will bring up a screen that says '**Choose the variables to graph.**' Select '**variable A**' and '**variable B.**'

Step 6: Click '**OK.**' This will bring up a window that says '**Click to choose a graph type.**' Choose the most appropriate graph for your data set. Click on this graph type and it will give you a description of what the graph will be like. When you have made the best decision, click '**OK.**'

Step 7: GraphMaster will display your graph!

Step 8: Click on the graph where it says '**Title**' to put an appropriate title on your graph.

Step 9: Click on the graph where it says '**Variable A**' to put an appropriate label on that part of the graph.

Step 10: Click on the graph where it says '**Variable B**' to put an appropriate label on that part of the graph.

NOTE: If you are making a CIRCLE GRAPH or a PICTOGRAPH please ask your teacher for more directions!

Directions for printing your graph

Step 1: After you have made all of the graphs you need and made all the alterations you need to make, click on '**File**' from the toolbar at the top of the screen.

Step 2: Click on '**Print.**' This will bring up a window that says '**Click to select items to print.**'

Step 3: Select the Data Table and any graphs you wish to print. **DO NOT** select '**Notebook**'

Step 4: Check the box that says 'Print bars and circle segments unfilled' to print your graph coloring-book style (you will have to color in your bars or circle segments later)

Step 5: Click '**OK**'

Step 6: Follow any directions your computer gives you for printing.

Graphing Unit: Poster Project

Completing the Project

Topic/question: Finishing the unit with a poster project.

Kentucky Core Content/National Standards:

MA-M-4.3.1 Students will show connections and how connections are made between concepts and skills, explain why procedures work, and make generalizations about mathematics in meaningful ways for the following relationships: How everyday situations, tables, graphs, patterns, verbal rules, and equations relate to each other

Objectives: To produce a poster with a graph of a particular set of data and be able to make some observations from the graph. Students will also write questions about their graphs for the other students to answer.

Materials: Card stock or poster board, markers/colored pencils, tape or glue, scissors, GraphMaster graphs, white copy paper, scoring rubric (optional)

Procedure/Time: This lesson should take 1-2 class periods.

Taking two sheets of card stock, fold both in half length wise and tape them together to resemble a tri-fold presentation board. Students can use this for their final poster, putting their names and class period on the front (where the two flaps fold over). On the inside left flap students can put their data charts and list some conclusions they can draw from their graph. On the inside right flap students can answer why they chose the type(s) of graph(s) they did, what other kinds of graph(s) they could use, and give 'real life' examples of where they could see this type of graph. In the middle section students will place their graph(s). On the back of the poster students should put three questions that other students should be able to answer based on the information they are given in the graph.

Students should use copy paper to make a rough draft of their posters and have this approved before they make their final project so as to save card stock. This will also help to ensure that students make a better final score on their posters. When students are finished, they should turn all their materials in to the teacher.

Assessment: approval on rough draft, completed poster

Teacher Notes: Teachers may wish to use poster board instead of card stock tri-folds. Encourage students to write questions that require a little more thought and effort than simply looking at the graph, maybe making a prediction or something similar. Teachers may want to make a scoring rubric and provide this for the students as they make their posters. Encourage students to make their posters as creative as possible—some may want to include clip-art or stickers for decoration on the front.

Graphing Unit: Poster Presentation

Topic/question: Presentations of the unit's final project

Kentucky Core Content/National Standards:

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Objectives: In the poster presentation, students will share the information on their posters and make explanations of why they chose the graph(s) they did. Students can share any interesting findings they might have uncovered on their graphs.

Materials: Completed poster projects

Procedure/Time: Depending on presentation lengths and class size, this should take 1-1.5 class periods.

Have student groups present their posters in front of the class, sharing the information they have included and making observations about their data. This is a good conclusion to the project, and a good experience for the students to speak in front of class.

Assessment: completed presentation, students receive a grade as part of their project grade

Teacher Notes: Presentation is optional. If time does not allow for it, omit the presentation.

Graphing Unit: Interpreting Graphs

Topic/question: Using the graphs made by other students to practice interpreting and answering questions about graphs.

Kentucky Core Content/National Standards:

MA-M-4.3.1 Students will show connections and how connections are made between concepts and skills, explain why procedures work, and make generalizations about mathematics in meaningful ways for the following relationships: How everyday situations, tables, graphs, patterns, verbal rules, and equations relate to each other

Objectives: Students will answer the questions that other students wrote about their graph posters.

Materials: Completed posters

Procedure/Time: This activity should take one class period.

Give each student a completed graph poster and have him/her answer the questions about that graph on the back of the poster. After a few minutes, have students trade posters and answer those questions. Continue as time allows. Finish with class discussion on some questions and their answers and a review of the unit activities.

Assessment: Completed questions, oral review

Teacher Notes: Another option is to lend the completed posters to other classrooms in the school to have those students answer the questions as a review of reading and interpreting graphs. We tried this and found it to be very effective.