Mapping Our World

GIS Lessons for Educators
This module covers the concepts and skills that will be discussed and used in the rest of the book. As your students step through the activities, they will be introduced to the geographic inquiry method and acquire a working understanding of GIS theory and practice—the “how to” of ArcMap as well as a sense of its conceptual framework, foundation, and purpose. By the end of the lesson, they will find themselves competent users of a basic GIS.

This module serves as a comprehensive introduction to the rest of the book. We suggest that you and your students complete it before moving on. Please note that the format of module 1 contains one lesson in two parts. Modules 2 through 7 each contain a global, a regional, and an advanced investigation lesson.
ArcMap: The Basics

Lesson overview

This module introduces the basic concepts and skills of GIS that will prepare your students for the lessons ahead. The activities laid out here will instruct them in starting ArcMap, navigating the computer to find the prepared map documents and data, and acquiring functional skills to help them use GIS. At the same time, students will also learn the steps involved in the process of geographic inquiry.

The format of this module differs from that of the rest of the book: it has one lesson in two parts, not the global, regional, and advanced investigation lessons found in modules 2 through 7. We suggest that you have the students spend two class periods on these activities to gain a functional knowledge of GIS, ArcMap skills, and the geographic inquiry method.

Estimated time

Two to three 45-minute class periods

Materials

✔ Calculator

✔ Student handouts from this lesson to be copied:
  • GIS Investigation sheets (pages 11 to 37)
  • Geographic Inquiry: Thinking Geographically handout (page 9)
  • Student answer sheet (pages 38 to 45)
  • Assessment(s) (pages 46 to 49)

Standards and objectives

National geography standards

<table>
<thead>
<tr>
<th>GEOGRAPHY STANDARD</th>
<th>MIDDLE SCHOOL</th>
<th>HIGH SCHOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective</td>
<td>The student knows how to make and use maps, globes, charts, models, and databases to analyze spatial distributions and patterns.</td>
<td>The student knows how to use technologies to represent and interpret Earth’s physical and human systems.</td>
</tr>
<tr>
<td>3 How to analyze the spatial organization of people, places, and environments on Earth’s surface</td>
<td>The student understands that places and features are distributed spatially across Earth’s surface.</td>
<td>The student understands how spatial features influence human behavior.</td>
</tr>
<tr>
<td>4 The physical and human characteristics of places</td>
<td>The student understands how technology can shape the characteristics of places.</td>
<td>The student understands how the physical and human characteristics of place can change.</td>
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</tbody>
</table>
Objectives
The student is able to:
- Understand the basic concept of a geographic information system (GIS).
- Use a basic ArcMap skill set to build a map.
- Use the five-step geographic inquiry model.
- Print maps.

GIS skills and tools

- Identify a feature on the map
- Zoom in to a desired section of the map or to the center of the map
- Zoom out to a desired section of the map or to the center of the map
- Zoom to the full extent of all layers
- Pan to a different section of the map
- Find a feature in a layer and identify it
- Get help about a button
- Add a layer to the map

- Browse information about map features using MapTips
- Turn layers on and off
- Expand and collapse layers
- Activate a data frame
- Change the order of the table of contents to change the map display
- Create a bookmark for a map extent and return to it later
- Calculate the values for a field

For more on geographic inquiry and these steps, see Geographic Inquiry and GIS (pages xxiii to xxv).
Lesson overview and teacher notes

**Teacher notes**

**Lesson introduction**

Begin this lesson by helping students understand that each map in a GIS has spreadsheet or database information attached to it. There are a number of Adobe® PDF and Microsoft PowerPoint® presentations on the Mapping Our World Web site dealing with this topic.

After completing part 1 of the activity, introduce part 2 by giving students the “Geographic Inquiry: Thinking Geographically” handout or show it to the class on an overhead projector. Have a brief discussion with your students about “thinking geographically.” Refer to the “Geographic Inquiry and GIS” section in this book to familiarize yourself with the geographic inquiry model.

**Student activity**

Before completing this lesson with students, we recommend that you complete it as well. Doing so will allow you to modify the activity to accommodate the specific needs of your students.

Ideally each student should be at an individual computer, but the lesson can be modified to accommodate a variety of instructional settings. On the first day, distribute the GIS Investigation sheets entitled “ArcMap: The Basics, Part 1: Introducing the software.” Explain that in this activity the students will begin to learn the basic ArcMap skills they will need to create GIS maps. The worksheets will provide them with detailed instructions for their investigations. As they navigate through the lesson, they will be asked questions that will help keep them focused on key concepts. Some questions will have specific answers while others will require creative thought.

On the second day, introduce part 2 as described in the lesson introduction, and then distribute the GIS Investigation sheets entitled “ArcMap: The Basics, Part 2: The geographic inquiry model.” Explain to your students that in this lesson they will practice the ArcMap skills they acquired in the first lesson, and be introduced to more advanced skills while exploring the geographic inquiry method.

**Teacher Tip:** In part 1, steps 14–15 and part 2, step 7 of this activity, students are asked to use a calculator to divide two country statistics and come up with a third. Some of the countries have populations with nine or ten digits. If your students have hand-held calculators that only allow them to enter eight-digit numbers, you may want to have them use the calculator accessory on their computer.

**Teacher Tip:** In part 2, step 8 of this activity, students are asked to calculate a field in an attribute table. This action results in permanent changes to the data. In order for this to work properly, each student must have their own copy of the Mod1 folder.

Steps 11 and 12 of part 2 do not involve the computer. You may wish to assign these steps as homework to be completed outside of class.

Things to look for while the students are working on this activity:

- Are students thinking spatially as they work through the procedure?
- Are students answering the questions as they work through the procedure?
- Are students using a variety of menus, buttons, and tools to answer the questions on the handout?
- Are students able to use the legends to interpret the data in the table of contents?
- Are students able to print out a map on the printer?
Conclusion  Before your students complete the assessment, conduct a brief discussion in which you ask them to brainstorm ideas about how GIS can be used in everyday life or how they could use GIS in their daily school assignments or classes. Ask them to describe the geographic inquiry process they learned as well as share how comfortable they are with using ArcMap. This discussion should also include an overview of which buttons they have used to build maps on screen, any ArcMap operations that were confusing, and printer operations.

Assessment  Middle school: Highlights skills appropriate to grades 5 through 8
The middle school “ArcGIS: The Basics” assessment asks students to create and print a map. They will be expected to turn on three layers and zoom in to a location of their choosing, use the Identify tool to obtain three pieces of data about that area, and write a brief paragraph explaining how they created their maps.

High school: Highlights skills appropriate to grades 9 through 12
The high school “ArcGIS: The Basics” assessment asks students to create and print a map. They will be expected to turn on four layers and zoom in to a location of their choosing, use the Identify tool to obtain three pieces of data about that area, write a brief paragraph explaining how they created their maps, and describe what they learned geographically about the area on their map.

Extensions
• Create several views with data from other folders on the data CD to answer a question. Make a connection between the data to make sure that the maps they create are meaningful.
• Have students calculate cell-phone density (the number of people per cell phone) in 1997 and in 2002. Use maps and tables to explore how the use of this technology has changed over this five-year period.
• Students can suggest other layers that might help explain the connection between the technological advances of telephone lines and cellular technology, and such political and social issues as GDP, education, health care, and so on.
• Students can develop a plan or outline for how to use GIS to fulfill a current class assignment.
• Ask students to choose a country in the news and use their GIS skills to find the country and to study the data associated with it.
• Check out the Resources by Module section of this book’s Web site (www.esri.com/mappingourworld) for print, media, and Internet resources that educate the public on the uses of GIS.
## Geographic Inquiry: Thinking Geographically

<table>
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<tr>
<th>GEOGRAPHIC INQUIRY STEP</th>
<th>WHAT TO DO</th>
<th>EXAMPLES FROM THE GIS INVESTIGATION (MODULE 1, PART 2)</th>
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</thead>
</table>
| ASK A GEOGRAPHIC QUESTION         | Think about a topic or place and identify something interesting or significant about it. Turn that observation into a geographic question or hypothesis that you can investigate. Types of geographic questions include:  
  • Where are things located?  
  • How do things change from one place to another?  
  • Why do things change from one place to another? | • What countries have the most and the least phone lines?  
  • Does the number of phone lines vary proportionately with the number of people among the world’s most populous countries?  
  • Why does Pakistan have fewer phone lines per person than India? |
| ACQUIRE GEOGRAPHIC RESOURCES      | Identify the information and data needed to answer your geographic question:  
  • What is the geographic focus of your research?  
  • For what period of time do you need data?  
  • For what subjects and specific topics do you need data? | Use data and maps from the Mod1 Data folder that contains:  
  • World countries  
  • Population data for world countries  
  • Phone lines data for world countries |
| EXPLORE GEOGRAPHIC DATA           | Turn the data into maps, tables, and graphs and look for patterns in the way things change from one place to another. Some ways to explore data in ArcMap include:  
  • Create a map document and add data layers.  
  • Turn layers on and off, and zoom and pan the map. Look at individual features and what surrounds them.  
  • Change the symbols used to represent features.  
  • Look for ways features in one layer relate to features in other layers. | Explore map layers and attribute tables containing population and phone line data for world countries. |
| ANALYZE GEOGRAPHIC INFORMATION    | Focus on the information and maps that most seem to answer your questions. For example:  
  • Find or identify particular features.  
  • Select features with specific attributes to meet specific criteria.  
  • Calculate new attributes from existing ones to get new information.  
 Draw conclusions from what you have seen in the maps, tables, and graphs and answer your geographic question. | • Calculate phone line density for all countries.  
  • Research and record population, phone line, and phone line density information for selected countries.  
  • Rank selected countries by population and phone line density and compare the two lists.  
  • Compare your answer with your initial hypothesis. |
| ACT ON GEOGRAPHIC KNOWLEDGE       | Your conclusions are the result of turning pieces of data into geographic knowledge. Think about how you could share this knowledge, or how you or someone else could use it to make a decision, correct a problem, or help others. | Devise a plan of action for the phone system in one of the countries that you researched. |
ArcMap: The Basics

Answer all questions on the student answer sheet handout

Part 1: Introducing the software

ArcGIS is made up of two programs: ArcMap and ArcCatalog. This computer activity will show you how to start the ArcMap program. You will be guided through the basics of using ArcMap to explore maps. After you do this activity, you will find it much easier to complete the other activities in this book.

Step 1  Start ArcMap
   a  Double-click the ArcMap icon on your computer's desktop. If you do not have the icon on your desktop, click Start, Programs, ArcGIS, and ArcMap.

   b  If the ArcMap start-up dialog box appears, make sure A new empty map is selected.
c Click the OK button.

The ArcMap window opens. Its title contains three pieces of information: the name of the map document (Untitled), the program (ArcMap), and the level of the program (ArcView).

Step 2 Open the Module1.mxd file

a A map document file has been created for you to use in this exercise. To open it, click the File menu and click Open.

b Navigate to the module 1 folder (C:\MapWorld9\Mod1).

Hint: First make sure the correct drive is selected in the “Look in” drop-down list. If the disk drive you need is not listed, click the My Computer or My Network Places icon on the left side of the dialog to access the disk you want. Then double-click folders to open them.
c  Choose **Module1.mxd** from the list.

*Note: If file extensions are turned off (hidden) on your computer, you won’t see .mxd, and you should choose Module1 from the list. Having file extensions turned on (visible) is not required to complete this investigation.*

ArcGIS map document files end with the three-letter extension **.mxd**.

d  Click Open.

When the map document opens, you see a map of the world. The ArcMap window’s title changed to show the name of the map document, Module1.mxd.

*Remember: If file extensions are not visible on your computer, the name of the map document will be Module1.*
Take a closer look at the ArcMap window. On the right side you see a map. On the left side you see a column that contains a list. This column is the table of contents. The items in the list represent the two different maps contained in this map document (World Population and The World). The items listed under The World are the five different layers of information that can be shown on this map.

Look at the top of the ArcMap window and notice the different menus and buttons. The menus and buttons are grouped on different toolbars. Toolbars can be moved around, so your toolbars may not be arranged exactly as pictured below.

Note: The Standard toolbar above shows the map scale (1:256,357,059). Your map scale may be different depending on the size and shape of your ArcMap window.

You will use these menus and buttons to perform the various GIS functions. You might think this is a lot of buttons to learn, but you will not need to learn them all at once.

Locate the Tools toolbar. It may be floating (not attached to the window), or docked (attached to the window).

You can drag toolbars around and put them in a place that you like.

If your Tools toolbar is floating, click on its title and drag the toolbar to the gray area above the map near the other tools. The toolbar docks to the window. Otherwise, if your Tools toolbar is already docked, click on the small gray bar next to the magnifying glass, and drag the toolbar off of the ArcMap window. The toolbar floats.
Now drag your Tools toolbar to the gray line between the map and the table of contents to dock it vertically next to the map. (Hint: If it docks below the table of contents instead, drag it to the bar again until it docks where you want it.)

Step 3 Enlarge the ArcMap window

When the map document first opens, the ArcMap window may be small. If it is, you will want to enlarge it.

a In the upper right corner of your ArcMap window there are three buttons. Click once on the middle button that looks like a box.

The button you clicked is called the Maximize button. Now the ArcMap window fills your whole screen.

b Look again at the three buttons in the upper right corner of your ArcMap window. Now the middle button looks like two boxes. (This is called the Restore Down button.) Click on it.

The window returns to the smaller size. You can also change the size of your ArcMap window by stretching it.

c Place the cursor on any corner of the ArcMap window that is not at the edge of your screen. The cursor changes to a diagonal double-headed arrow.

d Click and drag the window outward until the ArcMap window fills about two-thirds of the screen. Let go of the mouse button.

Note: Enlarging the ArcMap window by stretching it allows you to choose a size that is large but does not cover the entire screen. As you work with ArcMap, other windows and dialog boxes will appear. You will find it useful to move them aside so you can also see the map on your screen.
Step 4  Work with layers

In ArcMap, a map is made up of layers that are grouped into a data frame. This map document has two data frames: World Population and The World.

a Notice that The World data frame is listed in bold letters in the table of contents. The bold letters tell you which data frame is active. The active data frame is displayed in the map area.

The World data frame contains five layers. These are Large Cities, Land Areas, Rivers, Lakes, and Country Outlines. Next you will learn how to turn layers off and on and change their order.

b Notice that each layer in the table of contents has a small box in front of it. Only the box for Country Outlines has a check mark in it.

c Click the check mark next to Country Outlines. The check mark goes away. The display of Country Outlines in the map area also disappears.

d Click the box next to the Land Areas layer. The green land areas layer is displayed. This is called turning on a layer.

e Click the box next to the Large Cities layer to turn it on.

f Turn on the Rivers and Lakes layers.

g Answer the following question on your answer sheet:

Which layers are not visible on the map but are turned on in the table of contents?
Next you will change the order of the layers.

h Notice that each layer in the table of contents has a name and a symbol. In the table of contents, place your cursor on the Rivers name.

i Click and hold the mouse button. Drag the Rivers layer up above the Land Areas layer. Let go of the mouse button.

What happened on your map?

j Drag the Lakes layer above the Land Areas layer.

(1) What happened on your map?

(2) What would happen if you dragged the Lakes under Land Areas?

Note: Whenever your maps don’t appear as you think they should, check the following things:

1. Check to see if the layer you want is turned on.

2. Check the order of the layers in the table of contents. Layers that are represented by lines and points (streets, rivers, cities, etc.) will be covered up by layers that are represented by polygons (countries, states, etc.). You may need to drag line or point layers above the polygon layers in order to see them.

Step 5 Change the active data frame

In this step you will make the World Population data frame active to display the other map.

Note: So far you have always clicked the mouse using the left mouse button. Some menus in ArcMap are accessed by clicking the right mouse button. The instructions use the words “right-click” when you need to use the right mouse button.

a Right-click the World Population data frame title in the table of contents. On the menu that appears, drag the mouse down and click Activate (with the left mouse button). The World Population data frame becomes bold and displays in the map area.
Click the plus sign next to World Population in the table of contents. The table of contents expands to show the layers in the World Population data frame.

**World Population**

*What is the name of the layer that is turned on in the World Population data frame?*

**Step 6**  **Widen the table of contents**

Now you will widen the table of contents so that the World Countries layer legend is not cut off.

a  Move your cursor to the edge of the table of contents, in between the scroll bar and the Tools toolbar. When it is in the right place, it should look like this: ← →

b  Click and hold the mouse button. Drag the cursor to the right until you can see the full legend descriptions. Release the mouse button.

The table of contents becomes wider and the map becomes smaller.

**Step 7**  **Identify a country and record country data**

The value of GIS comes from the data (information) that is attached to each map. You will see how this works by using one of the tools to access data about countries.

a  Move your cursor over the map and pause on any country (don’t click). Notice that as your cursor pauses over different countries, the name of each country displays. This information display is called a MapTip.

b  The Identify tool lets you see more data about your map by clicking on places you are interested in. Locate the Identify tool in the Tools toolbar.

*Hint: To display a “tool tip” with a tool’s name, pause your cursor over a tool without clicking. At the same time, a description of the tool appears at the bottom left corner of the ArcMap window.*
When a tool is selected, it looks like the button is pushed in. If your Identify tool already looks pushed in, proceed to step 6e. Otherwise, click to select it.

d The Identify Results window appears. Click the title bar of the Identify Results window and move the window so that it doesn’t cover the map.

e Move your cursor over the map without clicking. Notice it changes to an arrow with an “i” next to it.

f Click on the United States on your map.

The Identify Results window displays information about the United States. The information you see is all the data that is available about the United States in the World Countries layer.

g In the Identify Results window, scan down the column labeled Field that begins with the word OBJECTID. Answer the following questions:

(1) What is the fourth listing in this column?
(2) What is the fifth listing in this column?
(3) What is the final listing in this column? (Hint: You will need to scroll down.)

These words are names describing a characteristic, or attribute, of the United States. Another word for attributes is fields. Field names are often abbreviated.

(1) What do you guess the field entitled “SQMI” stands for?
(2) What is the number to the right of the field “SQMI”?

Step 8 Compare the Identify Results data with the table data

a The picture below shows part of the table that contains the data attached to the World Countries layer. Answer the following question using the picture.

Which row in this table has the attributes for the United States?
b  Compare the information in the Identify Results window with the information in the table shown above, and answer these questions:

(1) The field names in the Identify Results window display in the column starting with the word OBJECTID. Where are these field names displayed in the table?

(2) Find the field in the table that represents square miles of land. How many square miles of land are in the United States?

(3) Give a brief explanation of the relationship between the Identify Results window and the table.

c  Click the Close button that looks like an × at the top right corner of the Identify Results window.

Caution: Be careful not to click the Close button on the ArcMap window by mistake. If you close ArcMap, the map document will close without saving your work.

Step 9  Explore city data on the world map

a  Turn on the World Cities >100,000 layer.

b  Click the plus sign next to the World Cities >100,000 layer to expand its legend.

-  World Population
  -  World Cities >100,000
    -  Population
      -  5,000,001 and greater
      -  1,000,001 to 5,000,000
      -  500,001 to 1,000,000
      -  250,001 to 500,000
      -  100,000 to 250,000

Your map displays all the world cities with populations greater than 100,000. There are so many cities that they are all jumbled together on this small map. You need to zoom in to a smaller portion of the world to see distinctions between the cities.

c  Click the Zoom In tool to select it. Remember, the button looks pushed in when it is selected.

The Zoom In tool can be used two different ways. One way to zoom in is to drag a box around the area you want to display. You will zoom in on Europe and Africa.

d  Place your cursor on Greenland. (Hint: To find Greenland move your cursor over the map so the country names display.)

e  Click and hold down the mouse button. Drag the cursor down and to the right. When your cursor is near Australia, release the mouse button.
Another way to zoom in is to click on the place you want to be in the center of your map. Now you will zoom in closer to Europe.

f Click slowly three times on the yellow dots clustered around Europe.

Caution: Make sure to keep the mouse very still as you click. Otherwise, you may accidentally drag a tiny box and the map will zoom in too much. If this happens, go to the toolbar and click once on the Previous Extent button and do this step again.

You will use the Identify tool to get information about the cities.

g Click the Identify tool. Click the Layers box in the Identify Results window and select World Cities > 100,000.

h Click on a red or pink country area that is away from a yellow dot. Notice that the Identify Results window reports Nothing Found. This is because the Identify tool gets information only for the layer you selected in the Layers list.

Using what you learned in steps g and h, use the Identify tool to find the name and country of any two cities you choose.

i Click the Close button on the Identify Results window.

Step 10 Explore Europe with an attribute table

When you used the Identify tool in step 7, you saw that a country on the map (the United States) was connected to attribute information about that country. The attributes were displayed in the Identify Results window.

In GIS, each object on your map is called a feature. For example, the United States is a feature in the World Countries Population layer, and Paris is a feature in the World Cities >100,000 layer. In this step, you will find out more about the connection between features and their attributes.

a Right-click the World Countries layer in the table of contents and choose Open Attribute Table. If your table is large, drag the right side of the table to the left to make it smaller, like the one pictured below. If your table is covering the map, click on its title bar and drag it out of the way until you can see all of Europe.
(1) What is the name of the table you opened?
(2) What country is listed in the first row of the table?

b Scroll down to the end of the table.
What country is listed in the last row of the table?

c Click the Options button at the bottom of the table and click Find & Replace.

d Type Poland in the “Find what:” box in the Find and Replace dialog. Then click the Find Next button.

e Click the Close button to close the Find and Replace dialog.

f Click on the gray rectangle with the arrow at the beginning of the row for Poland.

Notice that the row in the table turns blue to show that it is selected and so does the outline of Poland on the map.

g Hold down the Ctrl key on your keyboard. In the table, click the gray boxes for these rows: Slovakia, Belgium, and Germany.
What happens to the map when you click on these rows in the table?

h Click the gray box for the United States row. (You may need to scroll down a few rows.)

(1) What happens to Poland and the other countries that were highlighted?
(2) Did you see the United States become outlined in blue on the map? If not, why not?

i Click the Close button on the table.

j Click the Full Extent button. The map displays the whole world.

Remember: Sometimes you may zoom in so close or zoom out so far that you lose your map entirely or can’t tell where you are. You can always click the Full Extent button to get back to a map you can recognize.

Why can you see the United States now when you couldn’t see it in the previous step?

k Right-click World Countries in the table of contents, point to Selection, and click Clear Selected Features.
Whenever you select a feature on your map, it will be outlined in blue to indicate that feature has been selected. If you want to turn the blue outlines off, you need to clear the selected features.

**Step 11  Practice identifying features**

a Click the Zoom In tool.

b Click and drag a box around the continent of South America.  
_What do you see on your map?_

c Click the Identify tool. In the Identify Results window click the Layers drop-down list and choose <Top-most layer>. Now you can use the tool to identify either a country or a city.

_\textbf{Note: If the Identify Results window is covering the map, click on its title bar and drag it out of the way.}\_

d Identify the large South American country that is dark red.

(1) _What country is it?_

(2) _What is this country’s total population?_

e Identify the large city in the northwest part of this country.

(1) _What city is it?_

(2) _What population class is this city in?_

f Look on the map for two cities in Brazil that are in a higher population range. (Hint: the yellow symbol for those two cities will be larger than the one for the city you just identified.)

g Zoom in closer to the two cities to separate them from surrounding cities for identification purposes.

h Use the Identify tool to answer these questions:

(1) _What are the names of these two large cities?_

(2) _What population class are these cities in?_

i Close the Identify Results window.

**Step 12  Practice zooming out**

a Click the Zoom Out tool.

b Drag a two-inch box anywhere on your map.

c Drag another two-inch box anywhere on your map.

(1) _What does your map look like?_

(2) _Which button could you use to return your map to full size?_

d Zoom your map back to its original full extent.
Step 13  Practice finding a feature

In an earlier step you found a country by looking for it in the attribute table. In this step, you will find a country by looking for it on the map.

a  Turn off the World Cities >100,000 layer.

b  Click the Find button.

You will find the country of Sudan.

c  Click in the white Find box. Type Sudan.

d  Click the In drop-down list, scroll down, and click World Countries.

e  Under Search, click the white circle next to In fields.

f  Click the In fields drop-down list and select CNTRY_NAME. You want ArcMap to search for Sudan in the country name attribute field in the World Countries layer.

g  Click Find.

h  Notice that a results list appears at the bottom of the Find window and Sudan is listed. At the bottom of the window there is a message telling you “One object found.”

i  Move the Find window off the map.

j  Right-click on Sudan in the results list and click Flash feature. The country of Sudan flashes on and off in the map. (If you didn’t see it flash, repeat this step and watch Africa on the map.)
Right-click Sudan in the results list again and click Identify feature(s). Look at the Identify Results window and answer the questions below.

Note: All or part of the Identify Results window may be hidden behind the Find dialog. If so, move the Find dialog out of the way.

(1) How many tourists arrive in Sudan each year?
(2) How many people live in Sudan?
(3) Does this seem like a low or high number of tourists for this population?

Close the Identify Results window.

Step 14 Zoom to a feature and create a bookmark

a. Click the New Search button in the Find window.
b. Type Qatar in the Find box.
c. Click Find.
d. Right-click Qatar in the results list. Click Select feature(s).
   Qatar is outlined in blue on the map. Is Qatar a large country or a small one?
e. Right-click Qatar in the results list and choose Zoom to feature(s).
f. Close the Find window.
g. Click three times on the Fixed Zoom Out button. (Its arrows point outward.)
   The Fixed Zoom Out button is different from the Zoom Out tool. Clicking the Fixed Zoom Out button always zooms out from the center of the map.
   Remember: Zooming with the Find tool placed Qatar in the middle of the map area. When you click the Fixed Zoom Out button, the map stays centered on Qatar.

Next you will create a bookmark for Qatar. Later in the activity you will use the bookmark to quickly return to this map extent.

h. Click the View menu, point to Bookmarks, then click Create.
i. Press the Delete key to delete the bookmark name, Bookmark 1. Type Qatar for the new bookmark name.

j. Click OK.

Use the Identify tool to answer the following questions:

(1) How many people live in Qatar?
(2) How many cell phones do they have?
(3) Divide the population of Qatar by the number of cell phones in Qatar. How many people are there for every cell phone in Qatar?
Step 15  Continue to explore the World Population map
Whenever you wish to center the map differently, you can use the Pan tool to move the map around.

a  Click the Pan tool.

b  Use the MapTips to locate the country of Egypt at the left edge of the map.

c  Click and hold on Egypt. Drag the hand diagonally to the bottom right corner of the map area. Let the mouse button go. Answer the questions below:

(1)  What boot-shaped country do you see on the map?

(2)  What is the population of that country?

(3)  How many cell phones does that country have?

(4)  Divide the answer to question 2 by the answer to question 3. How many people are there for every cell phone in this country?

Note: If your calculator does not let you type in these long numbers, use the calculator on your computer. (Click Start, Programs, Accessories, Calculator.)

d  Pan east to Japan and answer the following questions:

(1)  What is the population of Japan?

(2)  How many cell phones does Japan have?

(3)  Divide the population of Japan by the number of cell phones in Japan. How many people are there for every cell phone in Japan?

e  Close the Identify Results window.

f  Click the View menu. Point to Bookmarks and click Qatar. The map returns to Qatar using the bookmark you saved.
Right-click World Countries in the table of contents and point to Selection. Click Clear Selected Features.

What happened to Qatar?

**Step 16  Get help from the “What’s This?” tool**
If you forget what a particular button is for or how to use a tool, you can ask ArcMap to help you.

a Click the What’s This? tool on the Standard toolbar.

Notice your cursor turns into an arrow with a question mark.

b Click the Find button.

A help message box is displayed that tells you about the Find button.

c Click anywhere inside the pop-up message box to make it disappear.

You can use the What’s This? button to help you use most ArcMap buttons.

d Click the What’s This? button.

e Click any other button you want to know about.

f When you are finished looking at the help, click the pop-up message box to close it.

**Step 17  Label and print a map**
In this step you will learn an easy way to label the countries and to print the map on your screen.

a Use the Pan and Zoom tools to focus the map on a location of your choice.

b Right-click World Countries and choose Label Features. Country names are added to the map.

Where do you think these labels come from?

c Click the File menu, then click Print.
In the Print dialog, click the Setup button.

Ask your teacher which printer you should use. Select its name from the drop-down list under Printer Setup in the Page and Print Setup dialog.

Under Map Page Size, check the box next to Use Printer Paper Settings.

Under Paper (the section above Map Page Size), make sure the paper size is set to “Letter.” You may need to select it from the drop-down list.

Decide how you want the map to be placed on the paper. Click Portrait if you want the top to be a short side of the paper. Click Landscape if you want the top to be a long side.

At the bottom of the dialog, check the box next to “Scale Map Elements proportionally to changes in Page Size.” Your dialog should look similar to the one pictured below.

Click OK on both the Page and Print Setup window and the Print window.

Your map should print after a few moments.

Step 18  Close the map document and exit ArcMap

Click the File menu.

Click Exit.

Click No in the box that asks whether you want to save changes.
Part 2: The geographic inquiry model

Much like scientific analysis, geographic inquiry involves a process of asking questions and looking for answers. The geographic inquiry model is made up of the following five steps:

1. **ACQUIRE**
2. **ASK**
3. **EXPLORE**
4. **ACT**
5. **ANALYZE**

In this activity you will learn how maps and GIS can help you in the geographic inquiry process. At the same time, you will be practicing the ArcGIS skills you learned in part 1 and learning some new ones.

**Step 1  Start ArcMap**

- **a** Double-click the ArcMap icon on your computer's desktop.

- **b** If the ArcMap start-up dialog appears, click **An existing map** and click OK. Then go to step 2b.
Module 1 - ArcMap: The Basics

Step 2 Open the module1.mxd file

- You will use the same ArcMap map document that you used in part 1 for this exercise. To open it, go to the File menu and choose **Open**.

- Navigate to the module 1 folder (C:\MapWorld9\Mod1) and choose **Module1.mxd** (or **Module1**) from the list.

Step 3 Adjust your window and activate the World Population data frame

- Enlarge the ArcMap window by stretching it.

- In the table of contents, click the minus sign next to The World data frame to collapse it.

- Click the plus sign next to World Population. The table of contents expands to show the layers in the World Population data frame.

- Right-click World Population and left-click Activate. The World Population data frame becomes bold and displays in the map area. (Hint: You may need to widen the table of contents so that the World Countries legend is not cut off.)

Step 4 Ask a geographic question and develop a hypothesis

It’s important to think about the information on your maps both as you create them and when they’ve been completed. You might look at a map and then think of a question that it might help you answer. Or you might think of the question first, and then look for maps, or GIS layers, that might help you answer the question.

In this activity you will try to answer the following geographic question:

**Geographic Question:** Do the number of phone lines vary proportionately with the number of people among the world’s most populous countries?

- What makes this a geographic question?

- Just as with scientific inquiry, you’ll begin by constructing a hypothesis. Write a hypothesis that answers the geographic question stated above.
Remember: A hypothesis is an educated guess. Your hypothesis may be right or wrong in the end. The goal is not to know the answer before you start your research, but to have a kind of “ballpark idea” or hunch about what the answer might be. Then you will set about supporting or rejecting it.

Step 5 Add a layer to your map

Next, you need to identify the kind of information that will help you explore your question. You want to display this data as layers in your ArcGIS map.

a Your map already has a layer with world countries and their population. What other attribute of countries do you need in order to investigate your hypothesis?

b Click the Add Data button.

An Add Data dialog appears. It works similar to the Open dialog you used at the beginning of this activity.

c Click the Connect to Folder button. Navigate to the MapWorld9 folder (C:\MapWorld9). Click OK. The connection is added to the list of locations in the Add Data dialog.

Note: If a folder connection to the MapWorld9 folder already exists on your computer, you may skip this step.

d Navigate to the Module1 layer files folder (C:\MapWorld9\Mod1\Data\LayerFiles). Click World Phone Lines.lyr.

e Click Add.

What is the name of the layer that has been added to your table of contents?

Note: An ArcMap layer file contains the complete definition of a layer including its name, data source, symbology, and other properties. You can save a layer outside a map document as a layer file so it can be reused in other maps.
Step 6  Explore the World Phone Lines map

Now it’s time to look at the World Phone Lines layer and think about what the map tells you.

a  Turn off the World Countries layer.

b  Look at the legend for the World Phone Lines layer and answer the following questions:

(1) What color in the legend indicates countries with the fewest phone lines?
(2) What color indicates countries with the most phone lines?
(3) What color indicates countries with no data available for this layer?

c  Notice that the colors in the legend change gradually from the lightest color to the darkest. The name for this type of legend is a graduated color legend.

What other layer in your map has a graduated color legend?

d  Look at the map to answer the following questions. You may need to turn layers on or off. You may need to use MapTips or the Identify tool to find out a country’s name. Answer the following questions:

(1) Which two countries had the most phone lines in 2002?
(2) On which continent are most of the countries with the fewest phone lines?
(3) Which two countries have the largest populations?
(4) Name three countries that are in the same population class (color) as the United States.
(5) Which of these three countries, if any, are in the same phone line class (color) as the United States?

e  Turn off World Countries and turn on World Phone Lines.

f  With the Identify tool, click on the United States.

g  Read the geographic question again.

Geographic Question: Do the number of phone lines vary proportionately with the number of people among the world’s most populous countries?

h  Scroll down slowly in the Identify Results window and look at the different fields.

What two fields might help in answering the geographic question?

i  Close the Identify Results window.
Step 7  Research and record phone line and population data for China

Now it’s time to locate China and record the population and phone lines in the appropriate columns on your answer sheet.

a  Click the Full Extent button on the Tools toolbar. This will return the map to its original size if you have zoomed or panned the map.

b  To unselect (turn the blue outline off) any countries that might be selected, click the Selection menu at the top of the ArcMap window, and click Clear Selected Features. If the menu choice is disabled (grayed out), it means that there are no features currently selected in the World Population data frame.

c  Click the Find button and type **China** in the Find box.

d  Click Find.

e  China appears in the results list at the bottom of the Find window.

f  Right-click on China in the results list and click Identify feature(s).

**: Note: If you get more than one result for China, right-click on the row for World Phone Lines.**
Find the POP_2000 attribute in the Identify Results window. Record the number in the
Country Population column for China.

Note: All or part of the Identify Results window may be hidden behind
the Find dialog. If so, move the Find dialog out of the way.

Scroll down in the Identify Results window and find the LINES_2002 attribute. Record
the number in the Phone Lines 2002 column for China.

Close the Find and Identify Results windows.

Now you will use your calculator to figure out the number of people per phone line
for China.

Enter into your calculator the population figure for China.

Note: If your calculator does not let you type in a number as large as
the one for China’s population, use the calculator on your computer.
(Click Start, Programs, Accessories, Calculator.)

Divide it by the number of phone lines for China.

Round off the result to the nearest two decimal places and record it in the last column
on the answer sheet.

Step 8 Calculate the number of people per phone line for all countries

Now you will use ArcMap to calculate the number of people per phone line for all
the countries in the World Phone Lines layer.

In the table of contents, right-click World Phone Lines and click Open Attribute Table.

Scroll all the way to the right until you see the last field in the table, PHONE_DENS
(for phone density). Notice that the values in this field are Null, indicating that no
value has been assigned.

Right-click on the PHONE_DENS field heading and click Calculate Values.
In the Field Calculator message box, click Yes to continue. The Field Calculator displays.

You want to divide the population values in the POP_2000 field by the number of phone lines in the LINES_2002 field.

In the Fields list, click POP_2000. It now appears in the white text box below.

Click the division button.

In the Fields list, find LINES_2002 and click it.

Note: If you make a mistake, highlight and delete any text in the white box. Then, repeat steps 8e–8g above.

Click OK. The field calculator calculates the number of people per phone line and places the values in the PHONE_DENS field in the attribute table.

Scroll down in the table to see all the PHONE_DENS values.

Close the attribute table.

Step 9 Research and record population, phone line, and phone line density data for all the countries

Click the Find button. China appears in the Find box.

Click Find.

Right-click on China in the results list and click Identify feature(s).

What is the number of people per phone line (PHONE_DENS) for China?

Does this number agree with the value you calculated in step 7?

Use the Find and Identify tools to locate the remaining countries in the table on the answer sheet. Record the country population, phone lines, and the number of people per phone line for each country in the appropriate columns.
Step 10  Close the map document and exit ArcMap

You won’t need to use ArcMap to complete the rest of this activity, so you’ll close your map document at this time.

a  Click the File menu.
b  Click Exit.
c  Click No in the box that asks whether you want to save changes.

Ask your teacher whether you should continue doing steps 11–12 in class, or whether to do them as homework.

Step 11  Analyze results of your research

a  In the table on the answer sheet, the column on the left ranks the countries by population from highest to lowest. In the column on the right, rank the countries from the lowest number of people per phone line to the highest number of people per phone line, using the data you recorded in step 9. Then draw lines connecting the same country in each column.

b  Use the data in your table to answer the following questions:

(1) *Which country has the fewest people per phone line? How many people have to share a phone line in this country?*

(2) *How does the country in question b-1 rank in population size with the other seven countries in your table?*

(3) *Which country has the most people per phone line? How many people have to share a phone line in this country?*

(4) *How does the country in question b-3 rank in population size with the other seven countries in your table?*

(5) *What is the population of Japan? How many people have to share a phone line in Japan?*

(6) *What country has the most phone lines? How does the number of people per phone line in this country compare with the seven other countries in your table?*

(7) *Russia and Pakistan have about the same number of people. Why do you suppose these two countries have such a different number of people who have to share a phone line? What factors do you think contribute to this disparity?*

(8) *Read the geographic question again. What do you think the answer to the geographic question is?*

**Geographic Question:** Do the number of phone lines vary proportionately with the number of people among the world’s most populous countries?

(9) *Compare your initial hypothesis (step 4b) with your answer in question 8. How does your hypothesis compare with your answer to the geographic question?*
Step 12  Develop a plan of action

The last step of the geographic inquiry process is to act on what you have learned. Your action plan might be simply to repeat the process; thinking about what you’ve learned often leads to deeper, more complex, and interesting geographic questions.

For this step, choose one of the following four countries: China, Brazil, Indonesia, or the United States.

Imagine that you are an expert specializing in telecommunications. You need to devise a plan for your chosen country that deals effectively with the basic concern of your original geographic question.

To develop an effective plan, you may need to conduct further research on the phone system within your country. If you decided, for instance, that increasing the number of phone lines operating in your chosen country would improve the quality of life there, you could come up with a written plan of action for telecommunications officials, pointing out areas of strength and weakness, and explaining where and why expansion would be most beneficial.

a Use the information in your table to describe the current phone line situation in your chosen country. Record your chosen country on the answer sheet.

b Do you think that increasing the number of phone lines operating in your chosen country would improve the quality of life there? Why or why not?

c List three concerns you have about increasing the number of phone lines in your chosen country.

d List two new geographic questions that you would like to investigate to help you develop a sound plan.
Student answer sheet

Module 1
ArcMap: The Basics

Part 1: Introducing the software

Step 4  Work with layers

g  Which layers are not visible on the map but are turned on in the table of contents?
___________________________________________________________________________________
___________________________________________________________________________________
i  What happened on your map?
___________________________________________________________________________________
j-1  What happened on your map?
___________________________________________________________________________________
j-2  What would happen if you dragged the Lakes under Land Areas?
___________________________________________________________________________________
___________________________________________________________________________________

Step 5  Change the active data frame

b  What is the name of the layer that is turned on in the World Population data frame?
___________________________________________________________________________________

Step 7  Identify a country and record country data

g-1  What is the fourth listing in this column?  _____________________________________________

g-2  What is the fifth listing in this column?  _____________________________________________

g-3  What is the final listing in this column? (Hint: You will need to scroll down.)
___________________________________________________________________________________

h-1  What do you guess the field entitled “SQMI” stands for?
___________________________________________________________________________________

h-2  What is the number to the right of the field “SQMI”?
___________________________________________________________________________________
**Student answers**

**Step 8  Compare the Identify Results data with the table data**

a  Which row in this table has the attributes for the United States? _______________________________

b-1 Where are these field names displayed in the table?
_____________________________________________________________________________________

b-2 How many square miles of land are in the United States?
_____________________________________________________________________________________

b-3 Give a brief explanation of the relationship between the Identify Results window and the table.
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

**Step 9  Explore city data on the world map**

i  Use the Identify tool to find the name and country of any two cities you choose.

<table>
<thead>
<tr>
<th>CITY NAME</th>
<th>COUNTRY WHERE THE CITY IS LOCATED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Step 10  Explore Europe with an attribute table**

a-1 What is the name of the table you opened?
_____________________________________________________________________________________

a-2 What country is listed in the first row of the table?
_____________________________________________________________________________________

b  What country is listed in the last row of the table?
_____________________________________________________________________________________

g  What happens to the map when you click on these rows in the table?
_____________________________________________________________________________________
_____________________________________________________________________________________

h-1 What happens to Poland and the other countries that were highlighted?
_____________________________________________________________________________________
_____________________________________________________________________________________

h-2 Did you see the United States become outlined in blue on the map? If not, why not?
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

j  Why can you see the United States now when you couldn’t see it in the previous step?
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

**MODULE 1  •  ARCMAP: THE BASICS**
Step 11  Practice identifying features
b  What do you see on your map?

________________________________________________________________________________________

d-1  What country is it?  ________________________________________________________________

d-2  What is this country’s total population?  _____________________________________________

e-1  What city is it?  ________________________________________________________________

e-2  What population class is this city in?  _____________________________________________

h-1  What are the names of these two large cities?

___________________________________________________________________________________

___________________________________________________________________________________

h-2  What population class are these cities in?  __________________________________________

Step 12  Practice zooming out
c-1  What does your map look like?

________________________________________________________________________________________

c-2  Which button could you use to return your map to full size?

________________________________________________________________________________________

Step 13  Practice finding a feature
k-1  How many tourists arrive in Sudan each year?  _________________________________________

k-2  How many people live in Sudan?  _________________________________________________

k-3  Does this seem like a low or high number of tourists for this population?  ______________

Step 14  Zoom to a feature and create a bookmark
d  Is Qatar a large country or a small one?  ___________________________________________

k-1  How many people live in Qatar?  _________________________________________________

k-2  How many cell phones do they have?  ______________________________________________

k-3  How many people are there for every cell phone in Qatar?  ______________________________

m  What large country is directly west of Qatar?  _________________________________________
Step 15  Continue to explore the World Population map

  c-1 What boot-shaped country do you see on the map? ________________________________
  c-2 What is the population of that country? _________________________________
  c-3 How many cell phones does that country have? ______________________________
  c-4 How many people are there for every cell phone in this country? ______________

  d-1 What is the population of Japan? _________________________________
  d-2 How many cell phones does Japan have? _______________________________
  d-3 How many people are there for every cell phone in Japan? ________________

  g What happened to Qatar?

Step 17  Label and print a map

  b Where do you think these labels come from?

                                ________________________________
                                ________________________________
Part 2: The geographic inquiry model

Step 4  Ask a geographic question and develop a hypothesis
a What makes this a geographic question?
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

b Write a hypothesis that answers the geographic question.
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________

Step 5  Add a layer to your map
a What other attribute of countries do you need in order to investigate your hypothesis?
___________________________________________________________________________________

b What is the name of the layer that has been added to your table of contents?
___________________________________________________________________________________

Step 6  Explore the World Phone Lines map
b-1 What color in the legend indicates countries with the fewest phone lines?
___________________________________________________________________________________

b-2 What color indicates countries with the most phone lines?
___________________________________________________________________________________

b-3 What color indicates countries with no data available for this layer?
___________________________________________________________________________________

c What other layer in your map has a graduated color legend?
___________________________________________________________________________________

d-1 Which two countries had the most phone lines in 2002?
___________________________________________________________________________________

d-2 On which continent are most of the countries with the fewest phone lines?
___________________________________________________________________________________

d-3 Which two countries have the largest populations?
___________________________________________________________________________________
___________________________________________________________________________________

d-4 Name three countries that are in the same population class (color) as the United States.
___________________________________________________________________________________
___________________________________________________________________________________
___________________________________________________________________________________
d-5 Which of these three countries, if any, are in the same phone line class (color) as the United States?

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

h What two fields might help in answering the geographic question?

____________________________________________________________________________________

____________________________________________________________________________________

Step 7 Research and record phone line and population data for China

g, h Use your Find and Identify tools to locate China. Record the population and number of phone lines in the appropriate columns.

<table>
<thead>
<tr>
<th>COUNTRY NAME</th>
<th>COUNTRY POPULATION</th>
<th>PHONE LINES 2002</th>
<th>NUMBER OF PEOPLE PER PHONE LINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1,261,832,000</td>
<td>212,929,439</td>
<td>5.93</td>
</tr>
</tbody>
</table>

i Record the number of people per phone line for China in the last column of the table above.

Step 9 Research and record population, phone line, and phone line density data for all the countries

c-1 What is the number of people per phone line (PHONE_DENS) for China?

____________________________________________________________________________________

____________________________________________________________________________________

c-2 Does this number agree with the value you calculated in step 7?

____________________________________________________________________________________

____________________________________________________________________________________

d Use the Find and Identify tools to locate the countries in the table below. Record the population, phone lines, and number of people per phone line for each country. The first country, China, is already filled in for you.

<table>
<thead>
<tr>
<th>COUNTRY NAME</th>
<th>COUNTRY POPULATION</th>
<th>PHONE LINES</th>
<th>NUMBER OF PEOPLE PER PHONE LINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1,261,832,000</td>
<td>212,929,439</td>
<td>5.93</td>
</tr>
<tr>
<td>India</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pakistan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Step 11 Analyze results of your research

a In the table below, the column on the left ranks the countries by population from highest to lowest. In the column on the right, rank the countries from the lowest number of people per phone line to the highest number of people per phone line, using the data you recorded in step 9. Then draw lines connecting the same country in each column.

<table>
<thead>
<tr>
<th>RANKED BY POPULATION (HIGHEST TO LOWEST)</th>
<th>RANKED BY NUMBER OF PEOPLE PER PHONE LINE (LOWEST NUMBER OF PEOPLE PER PHONE LINE TO HIGHEST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td></td>
</tr>
<tr>
<td>Pakistan</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td></td>
</tr>
</tbody>
</table>

b-1 Which country has the fewest people per phone line? __________________________________________

How many people have to share a phone line in this country? _____________________________________

b-2 How does the country in question b-1 rank in population size with the other seven countries in your table?
___________________________________________________________________________________

b-3 Which country has the most people per phone line? ___________________________________________

How many people have to share a phone line in this country? _____________________________________

b-4 How does the country in question b-3 rank in population size with the other seven countries in your table?
___________________________________________________________________________________

b-5 What is the population of Japan? __________________________________________________________

How many people have to share a phone line in Japan? __________________________________________

b-6 What country has the most phone lines? _____________________________________________________

How does the number of people per phone line in this country compare with the seven other countries in your table?
___________________________________________________________________________________

b-7 Russia and Pakistan have about the same number of people. Why do you suppose these two countries have such a different number of people who have to share a phone line?
___________________________________________________________________________________

What factors do you think contribute to this disparity?
___________________________________________________________________________________
b-8 What do you think the answer to the geographic question is?

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

b-9 How does your initial hypothesis (step 4b) compare with your answer to the geographic question?

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

Step 12 Develop a plan of action

a Name your chosen country. _______________________________________________________________

Use the information in your table to describe the current phone line situation in your chosen country.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

b Do you think that increasing the number of phone lines operating in your chosen country would improve
the quality of life there? Why or why not?

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

c List three concerns you have about increasing the number of phone lines in your chosen country.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

d List two new geographic questions that you would like to investigate to help you develop a sound plan.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
ArcMap: The Basics

Middle school assessment

Open the ArcMap document Module1.mxd (or Module1). Use the ArcMap skills you have learned in this module to do the following things:

1. Create a map with at least three different layers.
2. Zoom in on the map to an area of the world of your choosing.
3. Find out three pieces of specific information about the area you chose. (Hint: Use the Identify button.)
4. Write a geographic question that involves one of the pieces of information that you listed in question 3.
5. Print the map and attach it to this page.
### ArcMap: The Basics

#### Assessment rubric

**Middle school**

<table>
<thead>
<tr>
<th>STANDARD</th>
<th>EXEMPLARY</th>
<th>MASTERY</th>
<th>INTRODUCTORY</th>
<th>DOES NOT MEET REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student knows how to make and use maps, globes, graphs, charts,</td>
<td>Creates and prints a map with more than three themes and focused on a portion of the world using a GIS.</td>
<td>Creates and prints a map with three different themes and focused on a portion of the world using a GIS.</td>
<td>Creates and prints a map with one or two different themes using a GIS.</td>
<td>Has difficulty creating the map without assistance and does not print it out.</td>
</tr>
<tr>
<td>models, and databases to analyze spatial distributions and patterns.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The student knows and understands that places and features are</td>
<td>Identifies more than three pieces of information about the area of the world covered by his or her map and develops a geographic question based on that information.</td>
<td>Identifies three pieces of information about a particular area of the world and develops a geographic question based on that information.</td>
<td>Identifies one or two pieces of information about a particular area of the world and attempts to create a geographic question based on that information.</td>
<td>Identifies some information about a place, but does not create a geographic question based on the information gathered.</td>
</tr>
<tr>
<td>understands that places and features are distributed spatially across</td>
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<td></td>
<td></td>
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<tr>
<td>Earth’s surface.</td>
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<tr>
<td>The student knows the role of technology in shaping the characteristics</td>
<td>Successfully completes the assessment and develops a plan in step 11 of the lesson that illustrates an understanding of the importance of GIS technologies in analyzing the aspects of a region or place and solving geographic problems and questions.</td>
<td>Successfully completes the assessment and develops a clear and concise plan in step 11 of the lesson that illustrates an understanding of how GIS technologies contribute to geographic understanding of places and development of plans for changing them.</td>
<td>The student has a beginning understanding of the importance of GIS and related technologies in solving geographic questions.</td>
<td>The student does not see the relationship between GIS and related technologies in solving geographic questions.</td>
</tr>
<tr>
<td>of places.</td>
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</tbody>
</table>

This is a four-point rubric based on the National Standards for Geographic Education. The “Mastery” level meets the target objective for grades 5–8.
ArcMap: The Basics
High school assessment

Open the ArcMap document Module1.mxd (or Module1). Use the ArcMap skills you have learned in this module to do the following things:
1. Create a map with at least three different layers.
2. Zoom in on the map to an area of the world of your choosing.
3. Find out three pieces of specific information about the area you chose. (Hint: Use the Identify button.)
4. Write a geographic question that involves one of the pieces of information that you listed in question 3.
5. Write a brief paragraph explaining what you learned geographically about the area you zoomed to on your map.
6. Print the map and attach it to this page.
### ArcMap: The Basics

#### Assessment rubric

**High school**

<table>
<thead>
<tr>
<th>STANDARD</th>
<th>EXEMPLARY</th>
<th>MASTERY</th>
<th>INTRODUCTORY</th>
<th>DOES NOT MEET REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>The student knows how to use technologies to represent and interpret Earth's physical and human systems.</td>
<td>Creates and prints a map with more than three themes and focused on a portion of the world using a GIS.</td>
<td>Creates and prints a map with three different themes and focused on a portion of the world using a GIS.</td>
<td>Creates and prints a map with one or two different themes using a GIS.</td>
<td>Has difficulty creating the map without assistance and does not print it out.</td>
</tr>
<tr>
<td>The student knows and understands the spatial behavior of people.</td>
<td>Identifies more than three pieces of information about the area of the world covered by his or her map and develops a geographic question about the human impact to that place, based on the information.</td>
<td>Identifies three pieces of information about a particular area of the world and develops a geographic question about the human impact to that place based on the information.</td>
<td>Identifies one or two pieces of information about a particular area of the world and attempts to create a geographic question based on that information.</td>
<td>Identifies some information about a place, but does not create a geographic question based on the information gathered.</td>
</tr>
<tr>
<td>The student knows and understands the changing physical and human characteristics of place.</td>
<td>In step 11 of the lesson, writes a clear and concise plan of action that takes into account the physical and human characteristics of a place or places.</td>
<td>In step 11 of the lesson, writes a clear and concise paragraph on the geographic characteristics of a particular place.</td>
<td>In step 11 of the lesson, identifies some physical and human characteristics of a place and attempts to formalize understanding in paragraph form.</td>
<td>In step 11 of the lesson, lists one or two characteristics of a place but does not show geographic understanding of the place.</td>
</tr>
</tbody>
</table>

This is a four-point rubric based on the National Standards for Geographic Education. The “Mastery” level meets the target objective for grades 9–12.