Grade 6 Geography
Investigating Global Cities

Indicator: Understand the size and spatial pattern of cities of the world related to coasts, mountains, and accessibility.

Learning Outcomes: Students will analyse global cities using web-based mapping tools to:
1– Symbolize and classify a map of the largest global cities based on their population.
2– Sort and examine a table of the largest global cities based on their population.
3– Calculate statistics about the largest global cities by examining their population.
4– Examine the pattern of global cities related to the proximity of coasts, and assess the importance of oceans in the growth and development of cities.
5– Compare the land use, dwelling type, vegetation, and landforms within different cities around the world.
6– Examine the pattern of global cities related to the proximity of mountains, and assess the importance of mountains as a hindrance to the growth and development of cities.
7– Understand what accessibility is, what an accessibility map shows, and understand the relationship of cities to accessibility.

Can you better understand the size and spatial distribution of cities around the world?

Can you better understand the internal structure and land use within a city?

Can you determine the effect of coastlines and mountains on the location and distribution of cities around the world?

Can you understand cities better in the context of accessibility?

Teacher Notes:

This is a discovery type of investigation. Students use live web mapping services in an online Geographic Information System (GIS) and use real data about cities around the world.

Students will investigate six themes of geography in this activity:

2. Latitude and longitude – absolute and relative location.
3. Internal structure of cities: land use, zoning, housing type, vegetation, landforms, transportation, and port facilities.
4. The influence of oceans on the location, growth, and development of cities.
5. The influence of mountains on the location, growth, and development of cities.
6. The relationship between accessibility and city location and size.

Students will use several different scales for their analysis—global, regional, and local.

Required time: 3 hours. 20 questions. Working with web based GIS on a computer comprises the bulk of the work, along with reflecting on the patterns and composing thoughtful answers.

Requirements: Laptop or tablet computer, a web browser, and access to the Internet. Ideally, each student works on his or her own computer with a web browser. Alternatively, students could work in teams of two. Another alternative is for the instructor to use 1 computer with a projector in front of the classroom to engage students in questions and dialogue as the lesson is being taught.
Students have 3 class periods to complete the following investigation. The investigation is ideally to be completed individually.

Open a web browser. Enter the following address in a web browser: [http://bit.ly/16tCZtI](http://bit.ly/16tCZtI). The map is a world map entitled ‘Global Cities, Coastlines, Mountains, and Accessibility’, as follows:

You will use this live web map that is created with a Geographic Information System (GIS). A GIS provides an excellent way to explore the world and to learn geography at the same time. This map is served via a web based GIS called ArcGIS Online.

Use your mouse to move the map by clicking on the map and moving the mouse. Zoom in and out on the map using the slider bar on the left side of the map. You can also zoom in by pressing the Shift key while dragging a box across the map with the mouse, and letting go with the mouse. Use the Bookmarks to zoom to the locations identified there, as follows:
When you are done interacting with the map, use the bookmark titled “World” to zoom back to the whole world.

Cities are a common sight in our modern world, yet cities have existed in some form for thousands of years. Cities have had an enormous impact on the world’s cultural systems, trade, exploration, natural resources, scientific discoveries, and much more. Because cities are located in specific places, are affected by these places, and in turn affect these places, they are geographic phenomena. And because they are geographic phenomena, they can be studied through the use of web maps in a Geographic Information System (GIS).

Chances are, you live in a city or have visited one. Think about the largest city you have been in.

Let’s start your investigation by examining “major” cities around the world; in other words, the largest ones.

1. Make 2 observations about the pattern of the location of major cities across the world.

2. Use Bookmarks to zoom back to the whole world. Note the major lines of latitude on your map: Latitude lines run east-west across the map. These include the Arctic Circle (66.5 degrees north latitude), the Topic of Cancer (23.5 degrees north latitude), Equator (0 degrees latitude), the Topic of Capricorn (23.5 degrees south latitude), and the Antarctic Circle (66.5 degrees south latitude). Between which 2 lines of latitude shown on the map are more major world cities located than any other?
3. Once again looking at the whole world: Note the major lines of **longitude** on your map: The Prime Meridian (0 degrees longitude) and the International Date Line (which runs largely on top of 180 degrees east longitude (or 180 degrees west longitude). (You may have to pan or move the map to see the International Date Line). Between which 2 lines of longitude are more major world cities located than any other?

| Note that if you zoom in, you will see additional lines of latitude and longitude. |

4. Name 3 factors that you believe are important in determining why cities are located where they are.

| Cities differ in many ways. Name 3 ways in which cities around the world differ from each other. |

5. Cities differ in many ways. Name 3 ways in which cities around the world differ from each other.

| Cities are similar in many ways. Name 3 ways in which cities around the world are similar to each other. |

| Two ways in which cities differ is in terms of their population—the characteristics of the population (age, ethnicity, education level) and their total population. To visualize world city populations, hover your mouse over the Major World Cities layer, select “Change Symbols”, select size, population, and Quantile with 5 classes, for a 5 class map of world cities. Make the largest city an oversize symbol, by clicking on it, selecting Apply and Done Changing Symbols when finished, as follows. |
Select the Show Map Legend button to show the legend:

7. What is the population range of the largest class in the “largest cities” map layer? Give 2 observations about the pattern of the largest cities. Then indicate 3 areas on the planet that have no cities in this largest class.

8. Use the button “Show Contents of Map” to see the map layers again. Using the arrow to the right of Major World Cities again, select “Show Table” to show the table behind the layer of Major World Cities. Think of the table as the “I” or “Information” part of the GIS, with the map being the “G” and the “S” being the behind-the-scenes technology that brings the “G” and the “I” together. In the table, select the field “Population” and then “Sort Descending”. You will see a few cities where the population is not provided. Find the first three cities where population is provided, and indicate the city name, population, country, and continent below. You may have to check the map
Which of these three cities is not a capital city? Why are some large cities not the capital of the country, while other large cities are capital cities?

10. Use the arrow again to the right of Major World Cities and select Filter. Filtering your data is a way for you to select only those map features that meet your criteria. Use the criteria “CAPITAL IS Y” as follows:

How many records meet your criteria; that is, how many major world cities are capital cities?
11. Access filter again and remove filter. How many total records are in the table of major world cities? What **percentage** of major world cities are capital cities, according to this data set? Show your work.

Remove your filter.

Say that the UNEP (United Nations Environment Programme) has heard of your excellent GIS skills and has hired you to create an environmental education program for cities at least 10 million in size. To maximize the effectiveness of this program, and to minimize travel costs, cities chosen should be on a single continent and your program should impact as many cities as possible. Your task is to determine which continent has the largest number of large cities. These will be the cities that will be chosen for your program.

To begin, apply another filter: This time, find the cities that are over 10,000,000 in population (10 million), as follows:

12. Examine your table. How many cities met your criterion? Examine your map. On which continent are more of your cities than any other continent? Which continent will you recommend to the UNEP where you will start your program? Which continents have no cities that meet the criteria? (Don't forget the continent at the bottom of your map which is only partly visible!)

13. How many of these largest world cities are on a coast or within 50 km of a coast? You can use the measure tool to check
distances. Which cities are not on or near a coast?

14. Name 2 reasons why being on a coast was an important reason why cities grew and flourished over the centuries, right up through modern times.

15. Click in the table on the most populous city, Tokyo. Under Table Options, select Center on Selection. Your map will be centered on Tokyo and you should see Tokyo highlighted on the map as well. Change the basemap to Imagery. Zoom in to Tokyo. For faster zooming, use the Shift key and drag a box around Tokyo, and then let go of each. You will now be zoomed in on the extent of your box. You can always use the Bookmarks to go back to World.

Observe the port facilities in Tokyo. This will be the area full of docks, railroads, highways, and buildings in close proximity to the water. Select the second most populous city, New York. Under Table Options, select Center on Selection. Your map will be centered on New York and you should see New York highlighted on the map as well. Zoom in to New York and observe the port facilities there. Based on observing these two cities, describe the importance you think being a port is to these two cities. Include in your description what you think everyday life is like on the ground in these ports.

Clear your Filter.

As mentioned earlier, total population and coastlines are not the only things that make cities different and similar. These include the way that they are structured, including how people live, and their land use patterns (how land is used).

16. Sort your table on NAME (Name of city). Scroll through the table to Ufa, Russia. As you did earlier, use Table Options, Center on Selection, and then zoom to the city. Observe the large apartment block buildings. How much land is devoted to parks in Ufa? What is the vegetation like there? Now select and zoom to Abu Dhabi, UAE (listed as Abu Zaby in the table).
Observe the land use, parks, and vegetation to Ufa. Observe Manaus, Brazil. Compare the land use, housing type, parks, and vegetation among all three cities.

Change the basemap back to Topographic. Turn on the layer “Mountains of the World.” Use Bookmarks and select “Central Europe.”

17. Are any major cities actually in the mountains in central Europe? Name 2 of them. Why are most cities here outside the mountains? Examine some other bookmarked areas such as India-Nepal. What effect do mountains have on the location of cities? Why?

Turn off the Mountains of the World layer. Turn on the Global Accessibility Map. How easy is it to reach different places around the world? This map layer indicates travel time to major cities, developed by the European Commission and the World Bank. This map includes economic, physical, and social connectivity and takes into account shipping, air travel, railroads, and road networks. The blue red and blue colors on the map have a high accessibility value, which means they are NOT very accessible. Conversely, the yellow colored areas have a low value and are VERY accessible.

18. Describe 2 characteristics of the accessibility map. Do the accessibility patterns surprise you? Why or why not?

Now let’s consider accessibility and world cities.

19. Describe the relationship between the presence of major world cities and global accessibility. Does this relationship make sense? Why or why not?
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<thead>
<tr>
<th>20. What is the most significant thing that you have learned from this lesson?</th>
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Answer Key. Answers in blue.

1. Make observations about the pattern of the location of cities across the world. Answers may vary, but could include that major cities are not evenly grouped or spaced; they are clustered in certain locations, such as Europe, South Asia, East Asia, coastal Eastern South America, eastern North America, and the northern Middle East.

2. Use Bookmarks to zoom back to the whole world. Note the major lines of latitude on your map: These include the Arctic Circle (66.5 degrees north latitude), Topic of Cancer (23.5 degrees north latitude), the Equator (0 degrees latitude), the Topic of Capricorn (23.5 degrees south latitude), and the Antarctic Circle (66.5 degrees south latitude). Between which 2 lines of latitude are more major world cities located than any other? Between the Arctic Circle and the Topic of Cancer.

3. Once again looking at the whole world: Note the major lines of longitude on your map: The Prime Meridian (0 degrees longitude) and the International Date Line (which runs largely on top of 180 degrees east longitude (or 180 degrees west longitude). (You may have to pan or move the map to see the International Date Line). Between which 2 lines of longitude are more major world cities located than any other? Between the Prime Meridian east to 180 degrees east longitude.

4. Name 3 factors that you believe are important in determining why cities are located where they are. Answers may vary but look for geographic based thoughts that have to do with observing the map or drawing on prior knowledge. Answers may include: proximity to coastlines, favourable climate, historical reasons for settlement, accessible port or hinterlands, proximity to water sources and food sources; global trade and finances; presence of natural resources, good employment opportunities; tourism destinations, and so on.

5. Cities differ in many ways. Name 3 ways in which cities around the world differ from each other. Answers will vary but could include climate, vegetation, land use, presence of ocean, planning, historical development, age of city, diversity of population, economic base, perception, and so on.

6. Cities are similar in many ways. Name 3 ways in which cities around the world are similar to each other. Answers will vary but could include: presence of parks, traffic, high population density, major airports; major highways and railroads, newspapers and other media outlets, centers of culture; presence of national capitals, important buildings, and so on.

7. What is the population range of the largest class in the “largest cities” layer? Give 2 observations about the pattern of the largest cities. Then indicate 3 areas on the planet that have no cities in this largest class. Largest class population range is 1,775,000 to 23,620,000. Three areas on the planet with no cities in the largest class include but are not limited to the Arctic, East Africa, western Australia, Siberia, Scandinavia, central South America, northern Canada, and the Pacific Islands.

8. Use the button “Show Contents of Map” to see the map layers again. Using the arrow to the right of Major World Cities again, select “Show Table” to show the table behind the layer of Major World Cities. Think of the table as the “I” or “Information” part of the GIS, with the map being the “G” and the “S” being the behind-the-scenes technology that brings the “G” and the “I” together. In the table, select the field “Population” and then “Sort Descending”. You will see a few cities where the population was not entered. Find the first three cities where population is provided, and indicate the city name, population, country, and continent below. You may have to check the map to find out the continent.

<table>
<thead>
<tr>
<th>Rank</th>
<th>City Name</th>
<th>Country</th>
<th>Population</th>
<th>Continent</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Tokyo</td>
<td>Japan</td>
<td>23,620,000</td>
<td>Asia</td>
</tr>
<tr>
<td>2</td>
<td>New York</td>
<td>US</td>
<td>16,472,000</td>
<td>North America</td>
</tr>
</tbody>
</table>
9. Which of these three cities is not a capital city? Why are some large cities not the capital of the country, while other large cities are capital cities? **New York is not a capital city. Some large cities are not the capital for historical or political reasons, or perhaps because the country they are in have numerous large cities (and only 1 can be the capital!).**

10. How many records meet your criteria; that is, how many major world cities are capital cities? **161 major world cities are capital cities.**

11. Access filter again and remove filter. How many total records are in the table of major world cities? What percentage of major world cities are capital cities, according to this data set? Show your work. **161 of 656 major world cities are capital cities. 161/656 = 24.6%.**

12. Examine your table. How many cities met your criterion? Examine your map. On which continent are more of your cities than any other continent? Which continent will you recommend to the UNEP for starting your program? Which continents have no cities that meet the criteria? (Don't forget the continent at the bottom of your map which is only partly visible!). **12 cities met the criteria. Asia contains 5 of the 12 largest cities. Asia is the continent to recommend to the UNEP to start the program. Africa, Antarctica, and Australia have no cities that meet the criteria.**

13. How many of these most populous world cities are on a coast or within 50 km of a coast? You can use the measure tool to check distances. Which cities are **not** on or near a coast? **10 of the 12 major cities are on or near a coast. The only major world cities not on or near a coast are Moskva (Moscow) and Mexico City.**

14. Name 2 reasons why being on a coast was an important reason why cities grew and flourished over the centuries, right up through modern times. **Answers may vary somewhat, but should include the fact that water led to shipping of goods, and that shipping had roots in antiquity and remains important through modern times. Cities adjacent to the ports could serve those ports through physical infrastructure such as docks, but also furnish workers for those docks.**

15. Observe the port facilities in Tokyo. This will be the area full of docks, railroads, highways, and buildings in close proximity to the water. Select the second most populous city, New York. Under Table Options, select Center on Selection. Your map will be centered on New York and you should see New York highlighted on the map as well. Zoom in to New York and observe the port facilities there. Based on observing these two cities, describe the importance you think being a port is to these two cities. Include in your description what you think everyday life is like on the ground in these ports. **Observations may vary somewhat, but the student should indicate that ports take up an enormous amount of space, including the docks and necessary infrastructure such as buildings, railroads, warehouses, and docks. This is due in part to the size of ships today, but also because of the amount of goods that are loaded onto and taken off of each of the ships through containers and other objects. The description of everyday life there should include the fact that ports are very busy and noisy places, where goods are loaded and unloaded 24 hours a day, and transportation is always heavy. The port is an important and critical part of both cities.**

16. Sort your table on NAME (Name of city). Scroll through the table to **Ufa, Russia.** As you did earlier, use Table Options, Center on Selection, and then zoom to the city. Observe the large apartment block buildings. How much land is devoted to parks in Ufa? What is the vegetation like there? **Now select and zoom to Abu**
Dhabi, UAE (listed as Abu Zaby in the table). Observe the land use, parks, and vegetation to Ufa. Observe Manaus, Brazil. Compare the land use, housing type, parks, and vegetation among all three cities. Observations may vary somewhat, but generally, Ufa’s inhabitants live in large rectangular and oblong apartment blocks, whereas the people of Abu Dhabi live in smaller but regularly spaced and evenly sized buildings, whereas the people in Manaus live in a variety of buildings of different sizes, shapes, and colors (although the size is generally small). Planned streets and parks dominate in Ufa and Abu Dhabi. Vegetation is lacking in Abu Dhabi, due to its desert location, and is more plentiful in Ufa and Manaus. The vegetation is of different varieties in Ufa compared to Manaus given the fact that Ufa is in a temperate deciduous and coniferous forest and Manaus is in a tropical rainforest.

17. Are any major cities actually in the mountains in central Europe? Name 2 of them. Why are most cities here outside the mountains? Examine some other bookmarked areas such as India-Nepal. What effect do mountains have on the location of cities? Why? Few cities are actually in the mountains, and those that are tend to be smaller ones, such as Innsbruck, Salzburg, Graz, and Lyon. Mountains have a negative effect on the growth and development of cities for many reasons: Mountains make it difficult for cities to expand; they pose challenges with weather and with transportation (roads and railroads); they pose challenges with climate; and they are generally not where ports are located.

18. Describe 2 characteristics of the accessibility map that you notice. Do the accessibility patterns surprise you? Why or why not? Characteristics could include: the Arctic is cold, roads are few, the population is low, and is difficult to reach—therefore, inaccessible. The Sahara and the Amazon rainforest are also inaccessible relative to their surroundings for reasons of their environments—desert and rainforest. The Gobi Desert, the central Australian desert outback, and the Himalayas are also relatively inaccessible. Most islands are relatively inaccessible as well with the exception of New Zealand, points northeast of New Zealand, Japan, and Iceland. For the second part of this question, answers will vary because the students are asked to reflect upon their learning, but look for thoughtful reflections that include spatial thinking and use of the map.

19. Describe the relationship between the presence of major world cities and global accessibility. Does this relationship make sense? Why or why not? The relationship of major world cities and accessibility is that there are more cities in accessible areas. Conversely, in areas where more major cities are located, that area is more accessible. So, the relationship goes both ways. For the second part of this question, answers will vary because the students are asked to reflect upon whether the relationship makes sense, but look for thoughtful reflections related to cities and accessible. It would be difficult to imagine a major city that was not accessible. This would apply to a small town, or even more likely, a remote rural area, but not a major city. Cities are by their nature accessible places – by rail, road, ship, and air.

20. What is the most significant thing that you have learned from this lesson? Answers will vary because the students are asked to reflect upon their learning, but look for thoughtful reflections related to maps, cities, oceans, mountains, or accessibility.
# ASSESSMENT CRITERIA: INVESTIGATIONS

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<th>Criteria</th>
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<th>2</th>
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<td>Inquiring Experimenting</td>
<td>Following instructions</td>
<td>-</td>
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<td>-</td>
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<tr>
<td>Handling Experimenting</td>
<td>Organising information/data</td>
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<tr>
<td>Understanding Experimenting</td>
<td>Explaining</td>
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<td>Analysing</td>
<td>Making informed judgements/decisions</td>
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<td>Participating</td>
<td>Collaborating with other students</td>
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<td>(Choose the appropriate criterion)</td>
<td>Working independently and persevering</td>
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- **Inquiring**
  - Follows almost all instructions in the task accurately
  - Follows most instructions in the task accurately
  - Follows some instructions in the task accurately
  - Follows few instructions in the task accurately
  - Follows no instructions in the task accurately

- **Handling**
  - Organises all information accurately
  - Includes all necessary features
  - Organises most information accurately
  - Includes most necessary features
  - Organises some information accurately
  - Includes some necessary features
  - Organises little information accurately
  - Includes few necessary features
  - Organises no information accurately

- **Understanding**
  - Gives complete and accurate descriptions and reasons for results
  - Gives complete and accurate descriptions and partly complete and accurate reasons for results
  - Gives complete and accurate descriptions
  - Gives partly complete and accurate descriptions
  - Gives no accurate descriptions

- **Analysing**
  - Forms an opinion that is supported entirely by the evidence available
  - Forms an opinion that is supported mostly by the evidence available
  - Forms an opinion that uses some evidence
  - Forms an opinion
  - Forms no opinion

- **Evaluating**
  - Contributes fully to the group's work
  - Understands the group's results completely
  - Contributes partly to the group's work
  - Understands most of the group's results
  - Contributes little to the group's work
  - Understands little of the group's results
  - Makes no contribution

- **Reflecting**
  - Requires almost no supervision or encouragement
  - Tries to complete almost all task activities
  - Requires some supervision or encouragement
  - Tries to complete most task activities
  - Requires regular supervision or encouragement
  - Tries to complete some task activities
  - Requires frequent supervision or encouragement
  - Tries to complete few task activities
  - Seeks immediate help

- **Participating**
  - Requires constant supervision to complete any task activities
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</tr>
<tr>
<td>1</td>
<td>يحتاج إشرافًا متكررًا.</td>
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<td>2</td>
<td>يحتاج إشرافًا متكررًا.</td>
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<tr>
<td>3</td>
<td>يحتاج إشرافًا متكررًا.</td>
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<tr>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>المعيار</th>
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</tr>
</tbody>
</table>

**الاستفسار**

- لا ينظم أيًا من المعلومات بدقة.
- ينظم القليل من المعلومات بدقة.
- ينظم بعض المعلومات بدقة.
- ينظم معظم المعلومات بدقة.
- ينظم جميع المعلومات بدقة.

**التجربة**

- يختبر بعض المميزات والخصائص الضرورية.
- يختبر بعض المميزات والخصائص الضرورية.
- يختبر جميع المميزات والخصائص الضرورية.

**طرق المعالجة**

- يُشرِّك مشاركة كاملة بعمل المجموعة وفهم نتائج المجموعة بشكل كامل.
- يُشرِّك مشاركة كاملة بعمل المجموعة وفهم نتائج المجموعة بشكل كامل.
- يُشرِّك مشاركة كاملة بعمل المجموعة وفهم نتائج المجموعة بشكل كامل.
- يُشرِّك مشاركة كاملة بعمل المجموعة وفهم نتائج المجموعة بشكل كامل.

**البحث**

- يُشرِّك مشاركة كاملة بعمل المجموعة وفهم نتائج المجموعة بشكل كامل.
- يُشرِّك مشاركة كاملة بعمل المجموعة وفهم نتائج المجموعة بشكل كامل.
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- يُشرِّك مشاركة كاملة بعمل المجموعة وفهم نتائج المجموعة بشكل كامل.

**الفهم**

- لا يشرِّك رأيا.
- يشرِّك رأيا مدعما بالدليل المتوفر.
- يشرِّك رأيا مدعما بالدليل المتوفر.
- يشرِّك رأيا مدعما بالدليل المتوفر.

**التوضيح**

- لا يشرِّك رأيا.
- يشرِّك رأيا مدعما بالدليل المتوفر.
- يشرِّك رأيا مدعما بالدليل المتوفر.
- يشرِّك رأيا مدعما بالدليل المتوفر.

**التحليل**

- لا يشرِّك رأيا.
- يشرِّك رأيا مدعما بالدليل المتوفر.
- يشرِّك رأيا مدعما بالدليل المتوفر.
- يشرِّك رأيا مدعما بالدليل المتوفر.

**التفصيل**

- لا يشرِّك رأيا.
- يشرِّك رأيا مدعما بالدليل المتوفر.
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