Name: _____

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Map Projections

When you look at a tennis ball, you can only see part of it at a time, even if you turn it around in your hand. To see the entire ball at once, you would have to flatten it by applying enough force so that the sides would split and its round shape would change. It might still be fuzzy and yellow, but it would no longer be a ball. The same thing would happen if you tried to create a map of the world. You must flatten a globe into a flat map to view the entire surface.

Distortion on Flat Maps

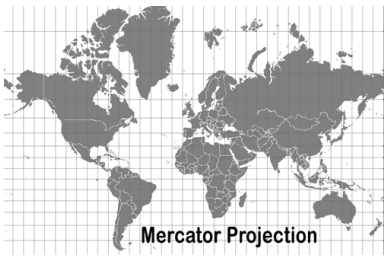
A round globe can accurately show size, shape, distance, and direction, but turning it into a flat map requires stretching some areas of the map. Mapmakers call this stretching distortion.

For over 400 years, mapmakers have used mathematics to develop algorithms that help them project the globe onto a flat surface. An algorithm is simply a set of rules for solving a problem.

Flat world maps use algorithms to produce projections. A map projection is a way to represent the Earth on a flat surface. All flat maps have distortion, so shape, distance, direction, and land area can never be completely accurate. This distortion is a trade-off we accept because different map projections meet different needs.

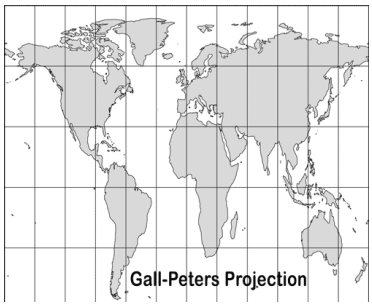
Mercator's Map

In 1569, Gerardus Mercator created a map where parallels and meridians cross at right angles. Mercator's map is excellent for navigation because it clearly shows direction. It is used by Google Maps and is likely the image you have in mind when you think of a world map, but the Mercator Projection introduces significant distortion. This isbecause, to get the parallels and meridians to cross at right angles, Mercator created an algorithm that stretched areas closer to the poles and squeezed those closer to the equator.



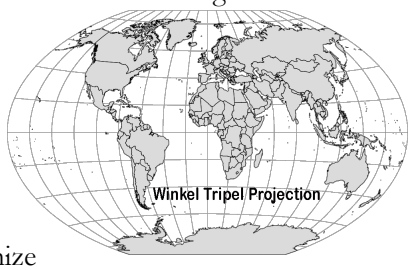
Equal Area Maps

An equal area map displays the sizes of things more accurately than a Mercator Projection. The Gall-Peters Projection is one of several equal-area projections. Gall-Peters sacrifices accuracy of angle and shape to show land area more accurately. Compare Greenland and Africa on the two projections. Africa is fourteen times larger than Greenland. The Gall-Peters map shows this more accurately, but on a Mercator Projection, the two landmasses appear to be about the same size.



The Winkel Tripel Projection

Some maps use very sophisticated mathematics to combine the advantages of the Mercator Projection and equal area maps. The Winkel Tripel Projection attempts to minimize distortion. The German word Tripel, meaning triple, is in the title because the map prioritizes accuracy in area, direction, and distance. The National Geographic Society uses the Winkel Tripel Projection for many of its maps.



Perfect Flat Map

Mapmakers use many projections because all flat maps have some distortion. Some projections are better than others at serving different needs, but because every map is at least a little bit wrong, there is no one best map projection.

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Fill in the Blanks

To see the entire E__r__h at once, mapmakers must f__a__t__n a round g__o__e into a flat map. This creates d__s__o__t__on because s____e, s__a__e, d__s__a__ce, and d__r__c__i__n cannot all remain accurate on a flat surface. Mapmakers use a__g__r__t__ms to create different map projections for different purposes. The Mercator Projection is useful for n__v__g__t__on because parallels and meridians cross at r__g__t a__g__es, but it greatly enlarges areas near the p__l__s. Equal area maps such as the G__ll-P__t__rs Projection show land area more a__c__r__t__ly. The Winkel Tripel Projection attempts to reduce d__s__o__t__on in area, distance, and direction. Because all flat maps contain some di__t__r__i__n, there is no perfect map pr__j__c__i__n.

Answer in Complete Sentences

*1. Explain why it is impossible to display a map of the world on a flat surface without stretching or shrinking some places.

2. What is a map projection?

*3. What part of the earth is "squeezed" into a smaller area by the Mercator Projection? Why?

*4. Compare the image of the Mercator Projection with that of the Gall-Peters projection. What differences do you notice?

*A higher order learning question. Any reasonable answer will be accepted.

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