CONCEPT Scale refers to the ratio of the size of an object or quantity in a drawing or model to the actual size of the object or quantity in the real world. This is often expressed as a scale factor or a scale ratio. Scales are commonly used in various fields of mathematics, such as geometry, mapping, and engineering, to represent objects and quantities at different magnitudes or levels of detail.

Scale 1:32,000,000
Mercator Projection
0   500 kilometers
0   500 miles

APPLICATION

Maps are scaled representations of geographic features, and cartographers use different scales to represent different levels of detail. For example, a small-scale map shows a large area but with less detail, while a large-scale map shows a smaller area but with more detail.

When creating a map, cartographers use a scale ratio to determine how much to reduce or enlarge the features of the geographic area being represented. For instance, if the scale ratio is 1:50,000, this means that one unit on the map represents 50,000 units in the actual geographic area.

The use of scale in cartography allows help with visualizing and understanding complex geographic information. It is also essential for navigation, urban planning, and environmental studies.

BACKGROUND

During the construction of the Great Pyramid of Giza, which is estimated to have been built around 2550 BCE, the ancient Egyptians used a scale ratio of about 1:50, which means that each unit of length on the building site corresponded to 50 units of length in the finished structure. This allowed the builders to construct the pyramid with great precision, despite the enormous size of the structure. The scale ratio was also used to ensure that the pyramid's angles and proportions were accurate, creating a symmetrical and visually striking monument that has endured for thousands of years.

Make sure it measures up

EXAMPLES

SCALE FACTOR OR RATIO: The ratio of the size of an object or quantity in a drawing or model to the actual size of the object or quantity in the real world

UNITS OF MEASUREMENT: The units used to measure the size or distance of an object or quantity, such as centimeters, meters, feet, or miles

PROPORTIONS: The relationship between different parts of an object or quantity, which can be represented using ratios or fractions

GRAPHICAL REPRESENTATION: The use of graphs, charts, and diagrams to represent data and quantities at different scales, such as a map or a bar chart

GEOMETRIC TRANSFORMATIONS: The use of transformations such as dilation and similarity to change the scale of geometric figures while preserving their shape and proportions

FORMULA

SCALE FACTOR: the ratio of the size of an object on a scale drawing or model to the size of the actual object. It is calculated by dividing the length or dimension of the drawing or model by the corresponding length or dimension of the actual object.

ENLARGEMENT AND REDUCTION: the processes of increasing or decreasing the size of an object on a scale drawing or model. The scale factor is used to calculate the new size of the object.

AREA AND VOLUME SCALING: When an object is scaled, its area and volume change by the square and cube of the scale factor, respectively. The formulas for the area and volume scaling are:
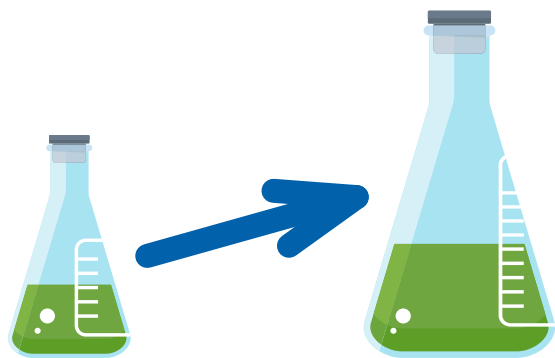
AREA SCALING:

New Area = (scale factor)^2 x original area

VOLUME SCALING:

New Volume = (scale factor)^3 x original volume

REAL WORLD CONNECTIONS

Engineers and architects in Nebraska use scale drawings and models to plan and visualize the layout of interchanges and their associated roadways, ramps, and bridges. They use a scale such as 1:100 or 1:200 to represent the actual size of an interchange on the drawings. The scale drawings allow the engineers and architects to test different design options and ensure that an interchange would function efficiently and safely for motorists. Once the design is finalized, the scale drawings would be used to guide the construction of a designated interchange.

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