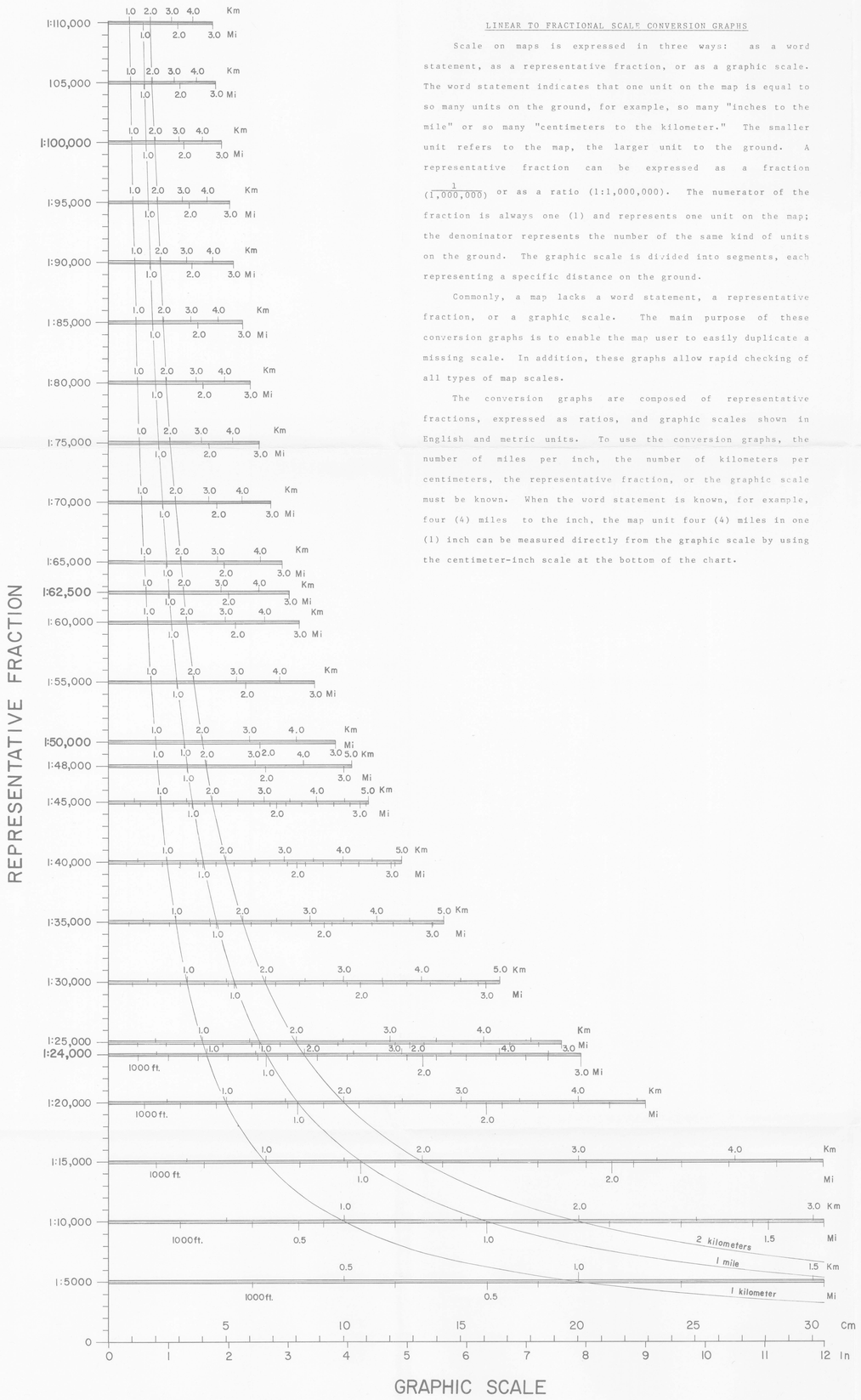
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1141



Conversions for Large-Scale Maps

LINEAR TO FRACTIONAL SCALE CONVERSION GRAPHS

Scale on maps is expressed in three ways: as a word statement, as a representative fraction, or as a graphic scale. The word statement indicates that one unit on the map is equal to so many units on the ground, for example, so many "inches to the mile" or so many "centimeters to the kilometer." The smaller unit refers to the map, the larger unit to the ground. A representative fraction can be expressed as a fraction ($\frac{1}{1,000,000}$) or as a ratio (1:1,000,000). The numerator of the fraction is always one (1) and represents one unit on the map; the denominator represents the number of the same kind of units on the ground. The graphic scale is divided into segments, each representing a specific distance on the ground.

Commonly, a map lacks a word statement, a representative fraction, or a graphic scale. The main purpose of these conversion graphs is to enable the map user to easily duplicate a missing scale. In addition, these graphs allow rapid checking of all types of map scales.

The conversion graphs are composed of representative fractions, expressed as ratios, and graphic scales shown in English and metric units. To use the conversion graphs, the number of miles per inch, the number of kilometers per centimeters, the representative fraction, or the graphic scale must be known. When the word statement is known, for example, four (4) miles to the inch, the map unit four (4) miles in one (1) inch can be measured directly from the graphic scale by using the centimeter-inch scale at the bottom of the chart.

If the representative fraction is known, the correct graphic scale is the horizontal scale directly to the right of the representative fraction. If the graphic scale is known, the appropriate representative fraction is the ratio located at the left end of the scale. Curves connect common divisions of the graphic scales, facilitating the interpretation of scales between those printed on the conversion chart.

To convert from representative fraction to graphic scale, or vice versa, without the use of these conversion graphs, make all units the same, for example, one inch on the map to so many inches on the ground, or one centimeter on the map to so many centimeters on the ground. When converting from a known graphic scale to a representative fraction, make all units the same and divide the graphic scale measurement (distance on map) into the equivalent ground scale (distance on ground). An example in metric units is seen in figure 1; if one kilometer on the graphic scale is a line segment four (4) centimeters long, change the one kilometer to 100,000 centimeters. The kilometer represents the ground distance or denominator, and the four (4) centimeters represents the map distance or nominator: $\frac{4}{100,000}$. By reducing the fraction until the nominator equals one (1), a representative fraction of $\frac{1}{25,000}$ (expressed as a ratio, 1:25,000) is obtained.

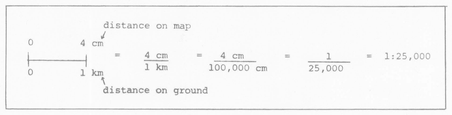


Figure 1. Conversion from a known graphic scale to a representative fraction.

An example in English units: one (1) mile on a given graphic scale is a line segment 2.53 inches long. Change the one mile to inches using the identity 1 mile = 63,360 inches. The 63,360 inches represents the ground distance, or denominator, and 2.53 inches represents the map distance, or the numerator; $\frac{2.53 \text{ map}}{63,360 \text{ ground}}$. The numerator (2.53) divided into the denominator (63,360) gives a representative fraction of $\frac{1}{25,000}$.

When converting from a known representative fraction to a graphic scale, allow one unit on the map to represent the number of units on the ground given by the denominator of the representative fraction. Example: if a known representative fraction is $\frac{1}{25,000}$ and a graphic scale is needed, construct a graphic scale in which 1 (one) unit equals 25,000 units. An example of an English graphic scale is expressed in figure 2; one (1) inch on the map equals 25,000 inches, 2083 feet, or 0.39 miles on the ground.

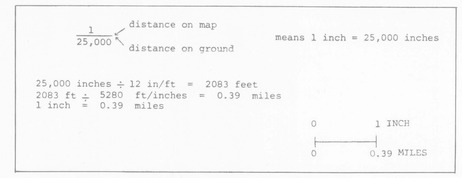
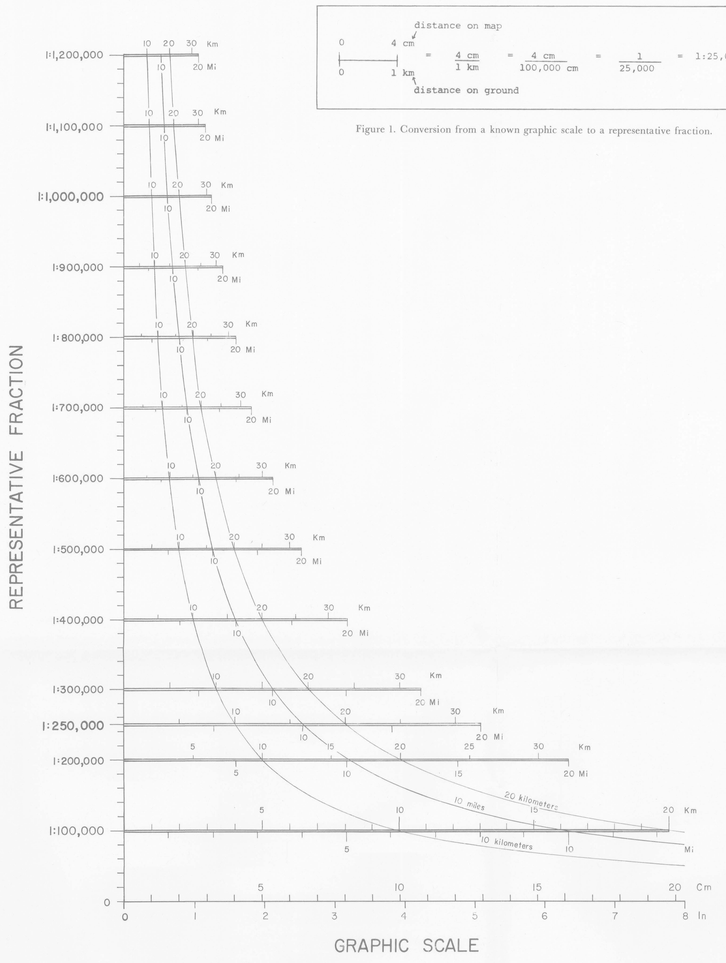
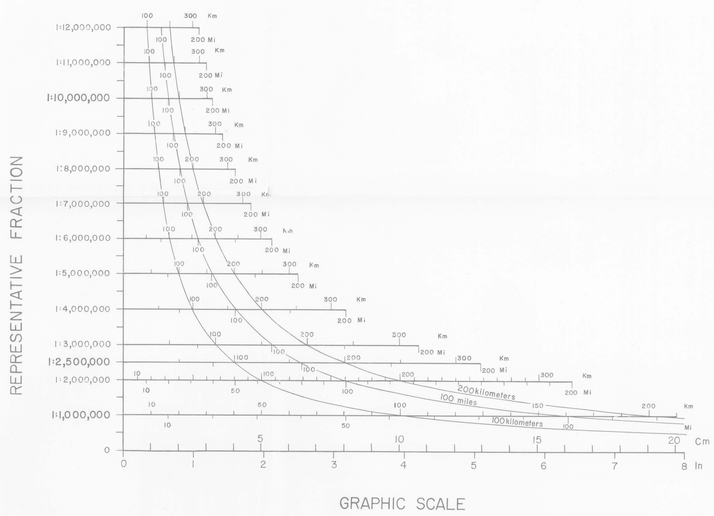


Figure 2. Conversion from a known representative fraction to a graphic scale.



Conversions for Medium-Scale Maps



Conversions for Small-Scale Maps

GRAPHS SHOWING LINEAR TO FRACTIONAL SCALE CONVERSIONS FOR MAPS

BY

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