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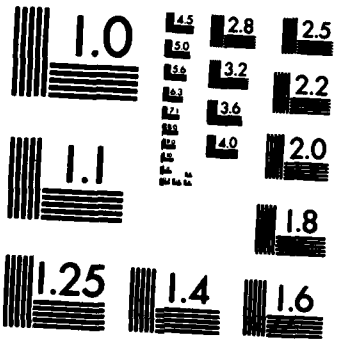

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A method to determine grid azimuths without relying on formulae is put forth as a helpful tool in cases where necessary formulas are not printed directly on the map being used. The method involves tools generally used for map reading, including a map with a declination diagram, a pencil, a straight edge, and a protracter/scale.

Two examples are provided to guide the reader along: converting grid to

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magnetic azimuth and converting magnetic to grid azimuth. Four complex resection problems are provided as a challenge at the end of the article.

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JENS MAP READING HINTS

NO. 1: Quick Compass Conversions

"Now, do I add or subtract the G-M angle from my compass reading to get my grid azimuth?"

Sound familiar? How do you decide if you can't remember the formulas? New edition maps being printed by the Defense Mapping Agency have the formulas printed with the declination diagram. However, most maps currently in use don't have this written aid and will not unless adopted as an international standard. Germany maps are well known examples..

So, you still have to memorize the formulas? Or use the diagram method in FM 21-26, Map Reading? Not so! Here is a simple method which anyone can use and get the right answer. The only tools you need are those normally used for map reading: a map with its declination diagram, a pencil, a straight edge, and a protractor/scale (any of the current GTA 5-2-series will do).

Since this method is best taught by working examples, let's start with any easy one---convert grid to magnetic azimuth.

First, you have to locate the azimuth to be converted on the map by drawing the line with a sharp pencil and a straight edge. You have to draw it long enough to cross the entire protractor/scale. For example, in Fig 1, we'll use 297° grid azimuth (GA).

Second, you position the protractor/scale on a north-south running grid line, with the 0° mark pointing grid-north and with the center cross-hairs on the drawn azimuth line (See Fig 1).

Third, examine the declination diagram to see on which side of grid-north that magnetic-north is located, right or left, and the number of degrees of the G-M angle. In Fig 1 we see that magnetic-north is 7° to the left of grid-north.

Fourth, now, imagine that your protractor/scale becomes the magnetized needle of a compass. Since the magnetized needle will seek magnetic north, pivot the protractor/scale (your imagined compass) about the center cross-hairs in the direction of magnetic-north. The number of degrees pivoted should equal the G-M angle (See Fig 2). In our example, left 7°.

Last, the magnetic azimuth on your compass reading can now be read directly from the protractor/scale where the line you drew in step one intersects the degree marks of the protractor. Does your answer read 304°, as in Fig 2?

See, I told you it was simple! Remember the key to this method is to imagine that when the protractor/scale becomes a compass needle, the 0° mark seeks magnetic north. Once you've practiced several times you'll be ready to try something a little more difficult: converting magnetic to grid azimuth.

The first step in converting magnetic to grid azimuth is to draw a line - any line will do - long enough to pass completely across the protractor/scale. Any grid line can also be substituted for this purpose. The line should then be labeled with the magnetic azimuth (MA) reading. For example, 64° MA as in Fig 3.

Second, position the cross-hair of the protractor/scale on the line so that the line passes through the correct degree marking on the protractor. Your protractor is now acting as a compass and is reading a magnetic azimuth of 64° (See Fig 3).

Third, check the declination diagram to see which side of magnetic-north that the grid-north lies and also the number of degrees in the G-M angle. Again, checking Fig 1 grid-north is 7° to the right of the magnetic-north.

Fourth, now imagine that the compass (protractor/scale) is demagnetized and wants to become a grid-reading device. Pivot the 0° mark in the direction of grid-north the number of degrees of the G-M angle being sure to keep the cross-hair on the line. That is, right 7° (See Fig 4).

Finally, you can now read the correct grid azimuth directly off the protractor degree markings (See Fig 4). You should read 57o as in Fig 4. Then if needed you can plot the correct grid azimuth at your location on the map.

Since in Step 1 you drew your line long enough to pass through the protractor/scale, another plus of this method is that back-azimuths can be read directly by inspection without worrying about adding or subtracting 180o. Such as, in Figure 4, the magnetic back-azimuth of 64o is 224o, and from Figures 1 and 2, the magnetic back-azimuth of a grid azimuth of 297o is 124o. You should now be able to do those seemingly complex resection problems with ease. Orienteering anyone?

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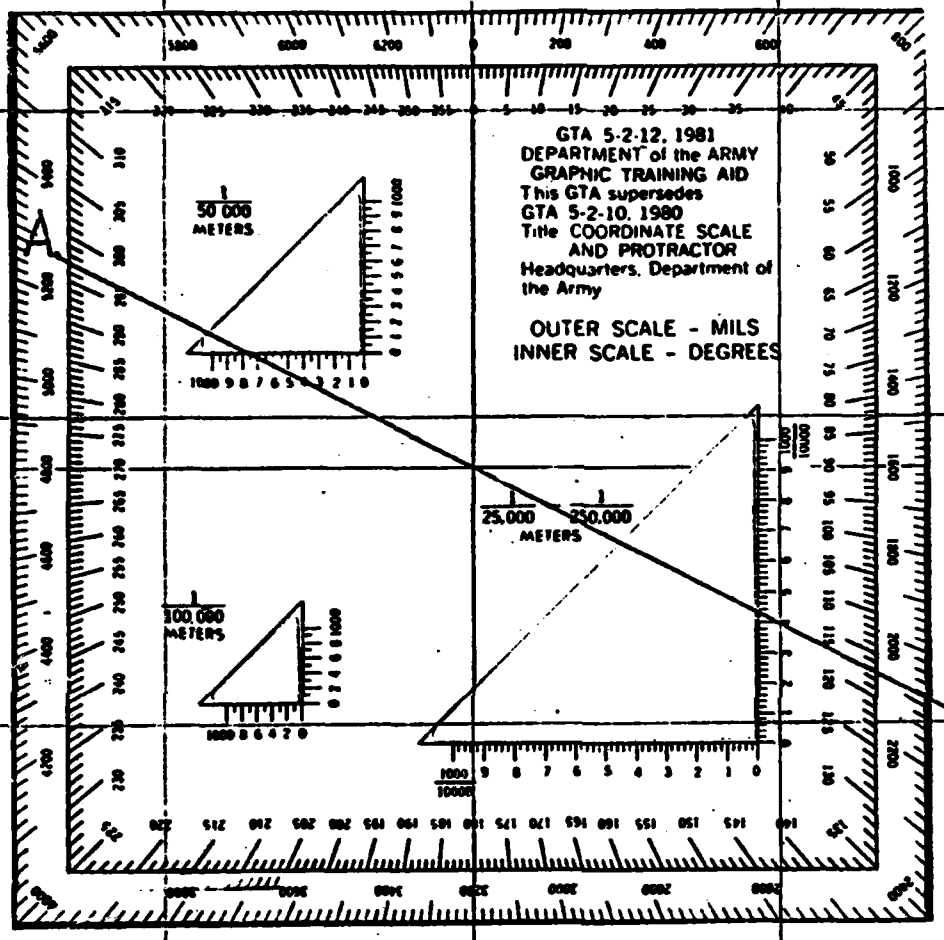
FIGURE 1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GTA 5-2-10, 1980
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INNER SCALE - DEGREES
1/50,000 METERS
1/25,000 METERS
1/250,000 METERS
1/100,000 METERS
A
B

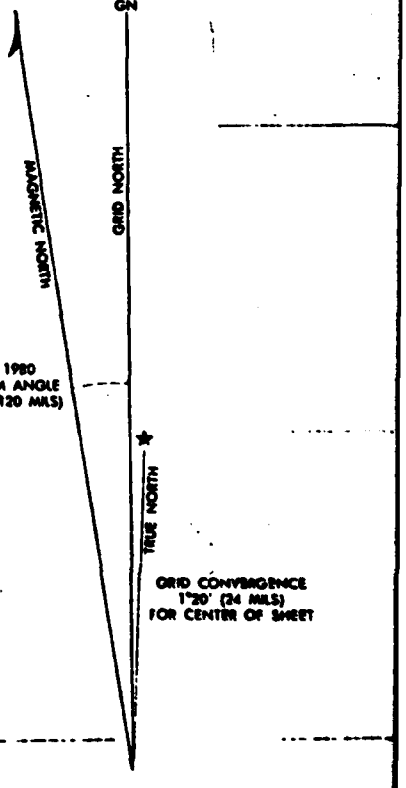
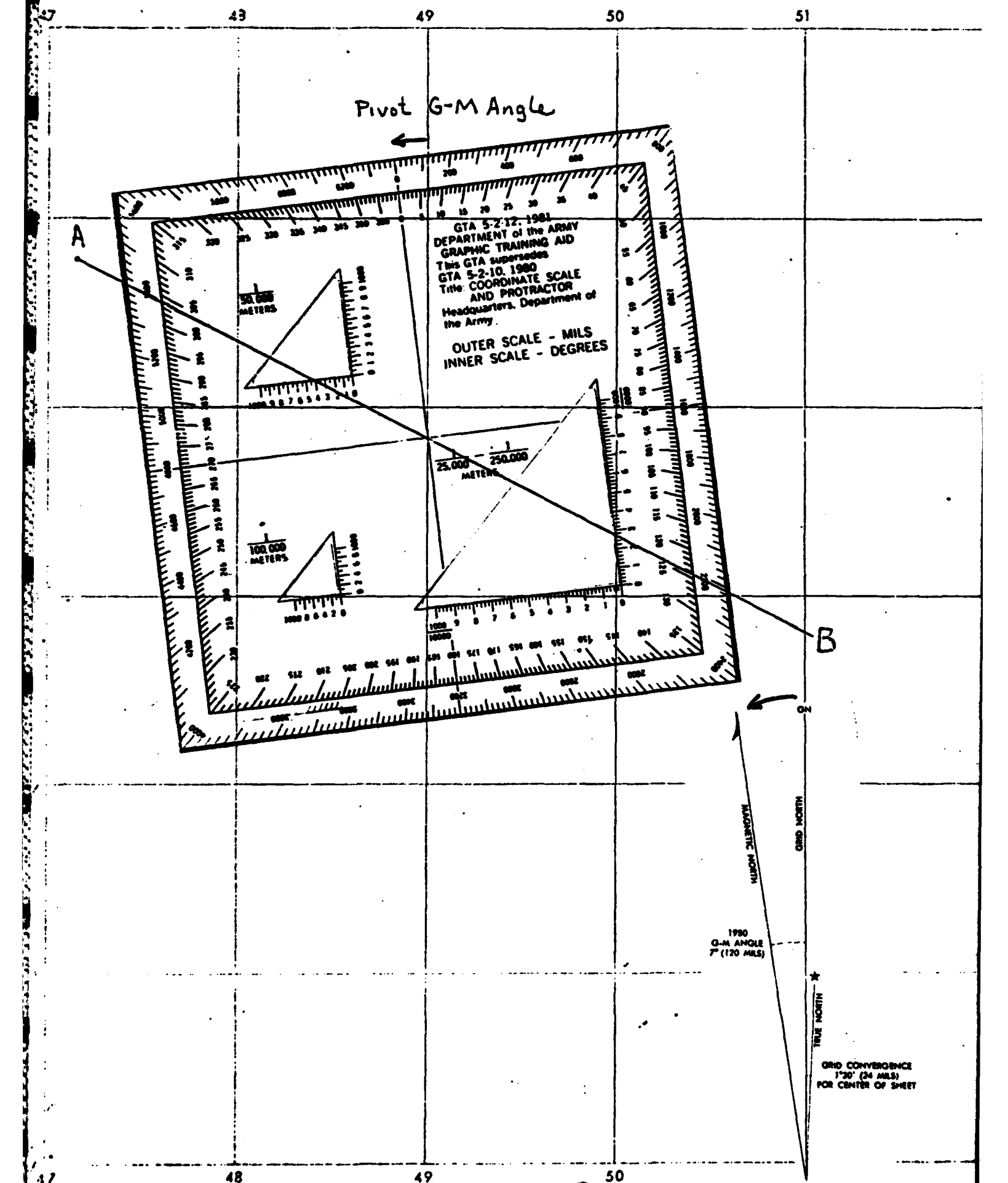

GN
MAGNETIC NORTH
GRID NORTH
1980
G-M ANGLE
7° (120 MILS)
TRUE NORTH
GRID CONVERGENCE
1°20' (24 MILS)
FOR CENTER OF SHEET

FIGURE 2


47
48
49
50
51
Pivot G-M Angle
A
B
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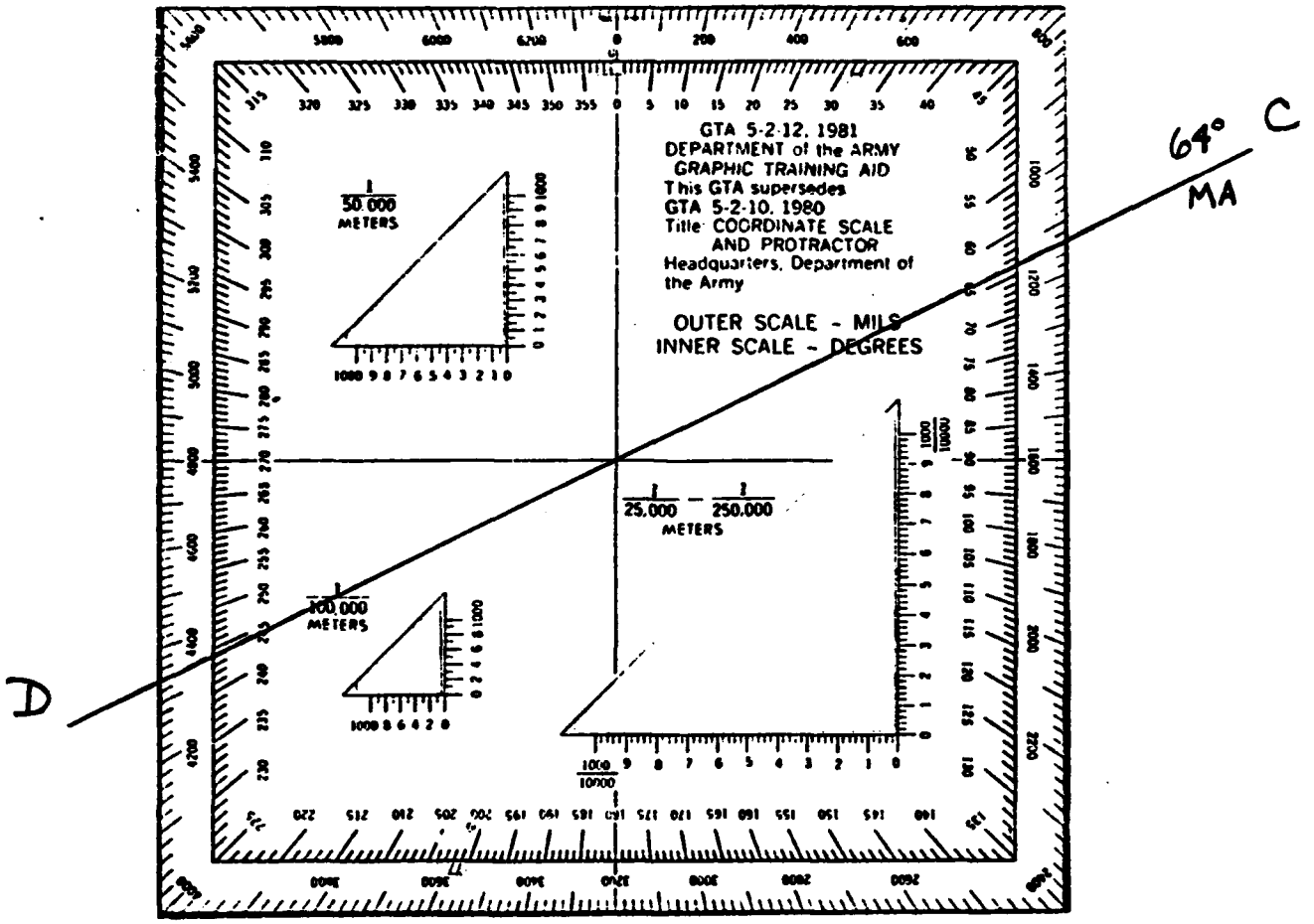
50,000 METERS
25,000
250,000
METERS
100,000 METERS
GN
MAGNETIC NORTH
GRID NORTH
1980 G-M ANGLE 7° (120 MILS)
TRUE NORTH
GRID CONVERGENCE 1°30' (24 MILS) FOR CENTER OF SHEET

FIGURE 3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OUTER SCALE - MILS
INNER SCALE - DEGREES
1/50,000
METERS
1/25,000 - 1/250,000
METERS
1/100,000
METERS
64° C
MA
D

FIGURE 4

Pivot G-M Angle to GN From Fig 2