ReenactorPro

PRO TIPS:
Map Reading

# Lesson 3: Map grids and coordinates

References: **FM 21-25; FM 21-26; FM 21-30**

**Study assignment: read FM 21-25 Chapters 5 and 6**, then go through this lesson and take the self-assessment quiz at the end.

**Using a map grid**

As we saw in Lesson 1, a map is a *symbolic representation of an piece of ground*. We've looked briefly at map symbols and what they mean to our understanding of the battlefield. Now we will learn how to locate points on the map with high precision.

**Why use the grid system?**

The map grid allows us to locate ourselves and other important points on the map in a way that can be communicated to anyone else using the map. It allows us to calculate distances with high precision, and to specify targets with enough accuracy to bring fire support to bear, as we do at the Indiantown Gap maneuver through umpires.

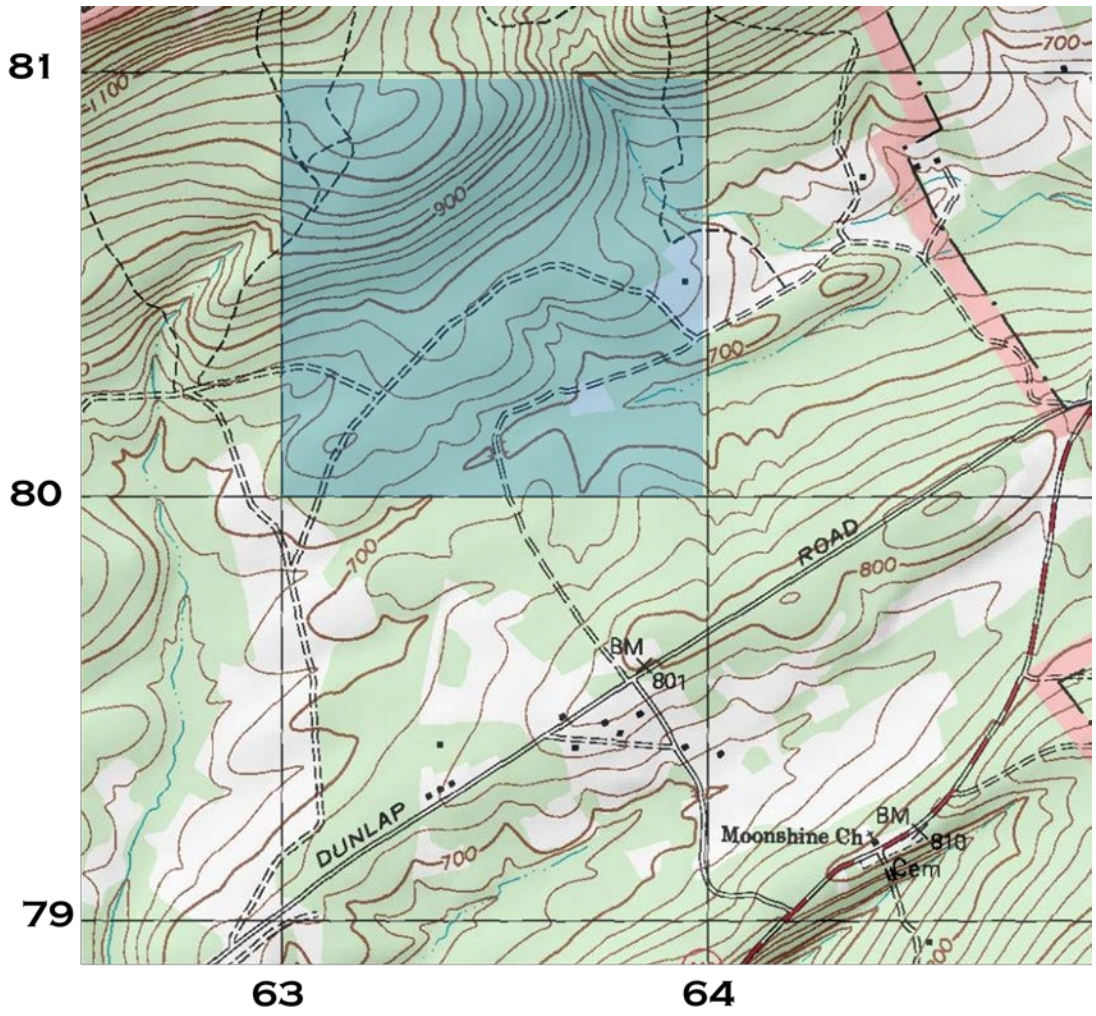
**What is the grid system?**

All the history and complex geometry of the grid system is described in detail in **FM 21-26 Advanced Map and Aerial Photograph Reading**. Put simply, the grids used on maps are derived from bands of latitude parallel to the equator and running north and south and with longitudinal meridians that meet at the north and south poles. To make a common map, this means that the grids on the surface of the earth must be *projected* in some useful way on a flat surface. A military map uses a kind of polyconic projection called the *Universal Transverse Mercator* or UTM. The vertical grid lines are parallel to the meridians of longitude and the horizontal lines of latitude.

Instead of stating the location of a point by latitude and longitude (based on a circle of 360º), we use a more conveniently stated number string in which the first half specifies a longitude and the second half a latitude. The length of this number string (*grid coordinates*) is a measure of its accuracy. Generally we use eight digit coordinates, which specify a point on the map with an accuracy of 10 meters.

**The grid square**

Below is an extract of the map of Fort Indiantown Gap, PA showing grid lines. Two vertical lines (63 and 64) are visible; grid line 65 is just off the right edge of the pap. Horizontal grid lines 79, 80, and 81 are also shown.




The map is divided into "grid squares", each enclosing a rectangle 1,000 meters on a side.

The grid square shaded in blue can be described as "grid square 6380." The reason is fairly simple. Notice that the grid line numbers run left to **right** (63-64) and **up** and down. the junction of lines 63 (vertical) and 80 (horizontal) are the base location of the grid square. This is a basic rule in map grids: READ RIGHT UP—that is, read the locatio ri the right and up.

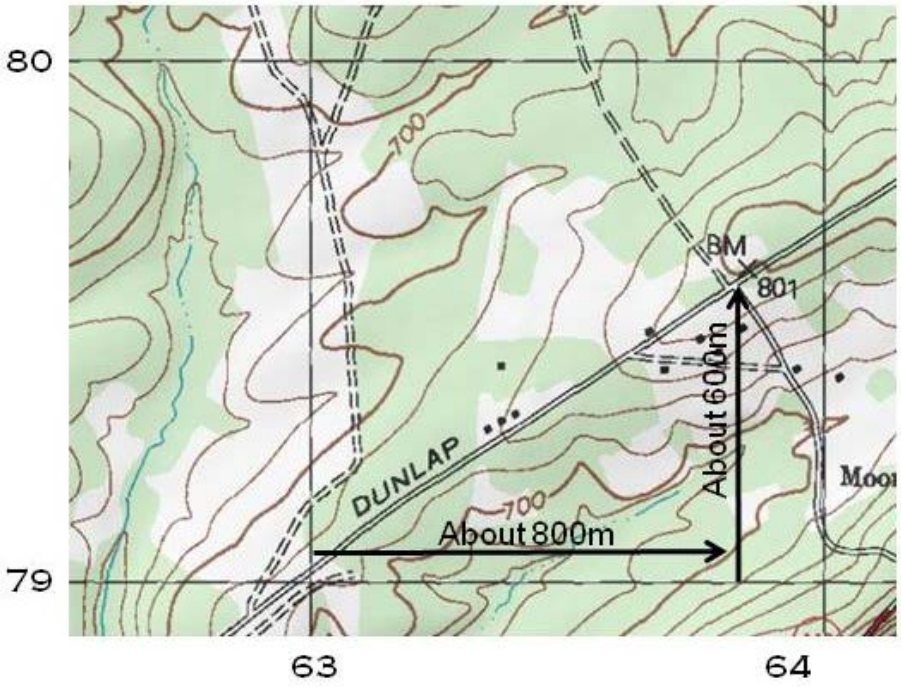
But just knowing which grid square a point of interest lies it doesn't do much good. A kilometer grid square covers 1000x1000 or one million square meters! So we need to get a little more specific (unless we're planning to nuke a grid square).

A single grid square is specified (as above) as "four-digit coordinates." If we go to six digits, we're a little closer—a six-digit grid specification beings it down to within a 100-meter square. If we're doing real work, like calling in an artillery strike, we like to go to eight digits (within a ten meter square). That's about as close as we need to demand as reenactors.

The thing about six digits is that a trained map reader can *interpolate* a specific 100 meter square by eye—that is, look right from the lower left corner of the grid square to the point described by the first three digits, then move up from there based on the last three digits.

Here's an example: within grid square 6379 there is a road junction near a marking "BM 801" [this locates a surveyer's bench mark, by the way].

Finding the six-digit coordinates of the road junction is an "eyeball" task.

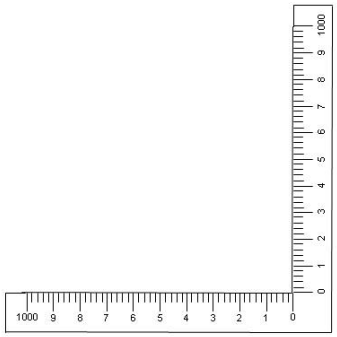



Remember to READ RIGHT UP, starting at the origin at 6379. Read RIGHT along the base line untilyou are directly below the road junction. [From now on, we will use the abbreviation RJ.] Now, from that point, read UP until you arrive at the RJ, and estimate the distance—my practices eye makes it about 600 meters. (Actually, it's about 570.)

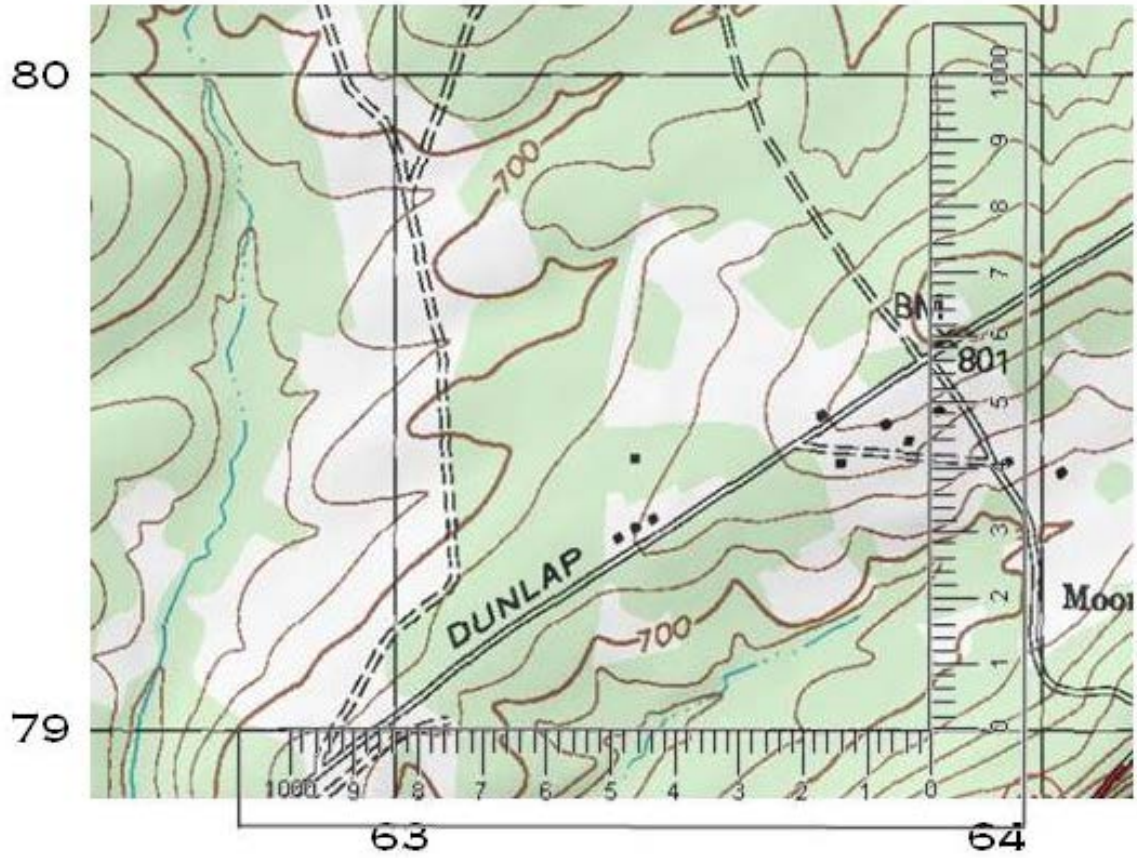
Now, by magic! The RJ is at **638796**.

But that's usually considered sloppy. For general use in reenacting, six-digit is enough, but we might want to be a little more precise.

You can probably search EBay and find an old plastic map protractor that will let you be more precise. Unfortunately, the maps we often us (as at Indiantown Gap) are an off scale. For that event we generally issue temporary paper scales like this:



Uring this scale makes it easy to specify up to 10-digit coordinates.




Here is how to use the grid scale. Place the horizontal scale along the bottom of the grid squareand slide it left until the vertical line passes through the RJ. Now sind the number on the horizintal scale exactly at the left vertical (63) grid line, and read the scale (which is read from right to left): it lies at close to two small tick marks left of the 8. Each number indicates 100 meters, so the reading is "800 plus two tick marks." The tick marks define five intervals over a 100 meter line, so each is 20 meters. The horisontal (east-west) measure is **820**.

Now read up the vertical scale until it crosses the RJ. It lies at 500 meters plus three tick marks (that is, 560 meters).

Since the RJ lies within the 6379 square, the 10-digit coordinates are read as **6382079560**. This is a little fussy fussy for our purposes, so let's reduce it to handy eight-digit form: **63827956**.

**How to measure distance on a military map**

There are two kinds of distances on a map: distance on a straight line, and stumbling across the actual ground. We wish we sould fly like cros and ignore the woods, swamps, and hills. Wishing won't help.

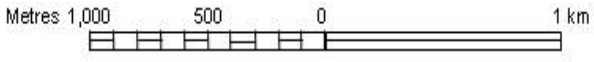
**The map scale**

Any military map has a scale. If a map has a scale of 1:50,000 (a scale commonly used in the military), it means that horizontal and vertical dimensions of the map are exactly 1/500,000th of the actual ground described in the map. If the siaze (not the scale) of the printed map is 1 meter, then line five hundred thousand copies of the map (gridded area only, not the margins) side to side, and they will be as long as the horizontal axis of the actual ground.

A large-scale map covers a relatively large area: the largest we generally use on the ground is 1:100,000; 1:50,000 is often used, and id handy for infantry. Armor tends to "run off the map sheet" too fast to make anything smaller than one over fifty thousand practical.

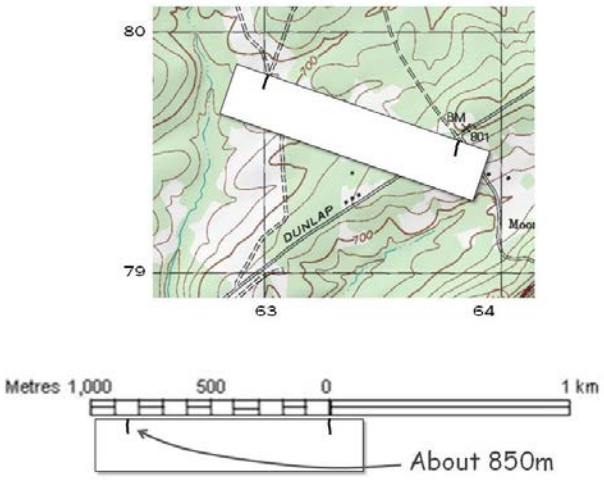
For maneuvers on a smaller post, a map of 1:25,000 is handy for infantry. At Fort Indiantown Gap, we generally use something approximating 1:12,500—though the scale is sort of arbitrary because of the small size of the training area.

Every military map has a scale in the bottom margin for use in estimating distances. Scales are generally in meters, though they may incluse an English measure (yards) scale as well. This scale is part of the map's *marginal information* (see Lesson 1). A typical scale looks like this:




You will use this scale and some ingenuity to measure ground distance.

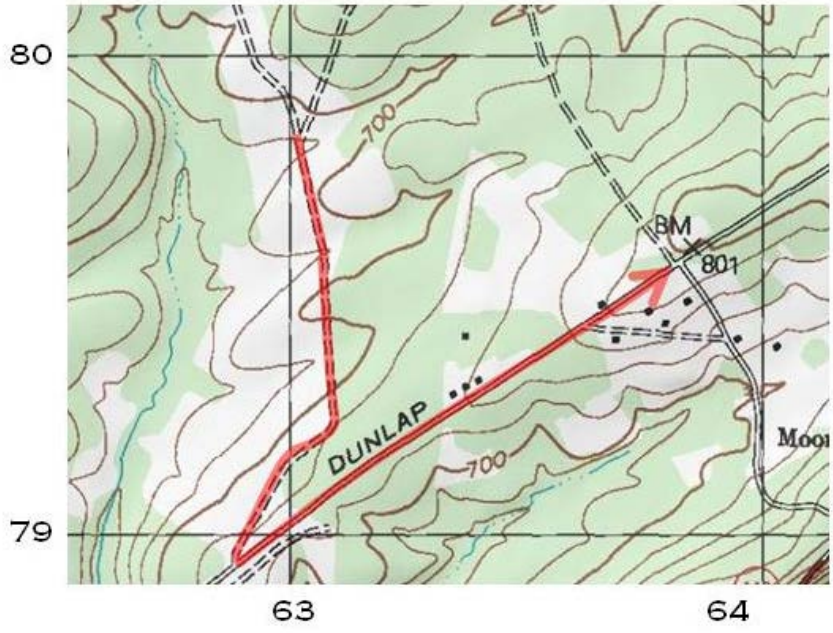
a. *Linear distance*. This is the simplest case, the distance between point A and point B "as the crow flies." Simply use a small piece of scratch paper and a pencil to mark the distance between any two points, as below:




We measure the linear distance between two RJ's: the RJ near the banch mark in the last example **63827956** and a second RJ at **63017982**, placing pencil tick marks on a piece of paper

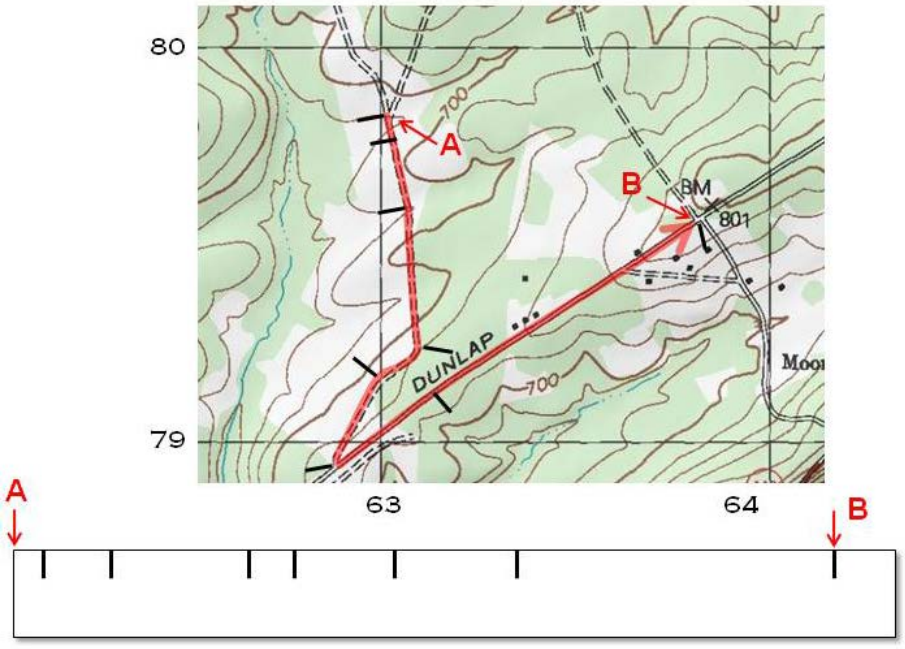
at each to record the map distance. Then move the paper to the map scale on the lower margin and find the distance (in this case approximately 850m).

Let's say, however, that we are moving trucks and the ground is soggy, requiring us to stay on the roads. Here is the shortest road route:




So, how do we change that irregular route into a measurable line to compare to the scale?

Simple: get a longer strip of paper and, starting from one end, tick off shorter distances approximating the iregular route, moving the paper as necessary to be parallel to the road line. Make the tick marks from beginning to end, like this:



Comparing this to the marginal scale (with a little fiddling), we find the road distance is 2,250 m (or 2.25 km).

**LESSON SUMMARY**

**1. A map grid is used to identify and transmit in a standard way the precise locations of any point on a map.**

**2. The grid used on a military topographic map can be used to identify any point in the world using a standard polyconic projection of a spherical surface onto the flat surface of a map.**

**3. Military maps have a standard grid scale of squares 1000m on a side.**

**4. Using handy map scales, we can specify map locations with high precision using cartesian coordinates.**

**5. Distances can be measures with precision on a military map by use of the marginal linear scale on the bottom of the map sheet.**

**6. Distances can be measured straight line ("as the crow flies" or by specified ground routes using a pencil and scrap paper.**

**Take the self-test for this lesson, then go to Lesson 4.**

**LESSON 3 will introduce you angular direction (azimuth), magnetic and grid north, and the use of the compass.**