

## Debrief Math

Note: Observers should be encouraged to only measure N/S and E/W. However the natural tendency will be to measure parallel/perpendicular to the roads. They should also use their compass (or pilot's if they don't have one) to determine direction, since a distance is relatively useless without a direction – although it can sometimes be gotten from a map. The only time a direct measurement works is to a goal intersection.

1. Converting feet and inches (English) to meters (Metric):
  - Convert to decimal feet by dividing inches by 12 [or check accompanying conversion table below].
  - Convert decimal feet to meters by dividing feet by 3.28 or multiplying feet by 0.3048
2. Converting feet (English) or meters (Metric) to map ticks or grid coordinate units:
  - **For feet:** 40 feet equals one coordinate unit on map with 1 grid = 4000 feet. Divide distance by 40 (round to nearest whole number) to get # of coordinate units.
  - **For meters:** 10 meters equals one coordinate unit on map with 1 grid = 1000 meters. Divide distance by 10 (round to the nearest whole number) to get # of coordinate units.
3. Converting distances into an adjustment of the map coordinates:
  - Determine number of grid coordinate units (map ticks) using step 2 above.
  - If distance is toward East/North, add number to starting grid coordinate.
  - If distance is toward West/South, subtract number from starting coordinate.
4. Finding hypotenuse of right triangle for a calculated direct measurement:  
Only useful if the measurements are to a goal intersection and not a reference intersection.
  - Use Pythagorean theorem (sum of squares of both sides of right triangle – square of hypotenuse).
  - Two measurements (sides of triangle) must be at right angles to each other.
    - Square each of both distances, add squares together, take square root of that value.
5. Finding East/West and North/South components of a diagonal measurement:
  - Two measurements (sides of triangle) must be at right angles to each other.
  - Need to know one of the angles other than the right angle of the triangle be either:
    - Using the angle measures with the compass in the field,
    - Laying a compass on the map to measure as best an approximation of angle as you can.
  - Calculate length of triangle sides by:
    - For adjacent side next to angle – multiply hypotenuse length by cosine (cos) of angle.
    - For opposite side across from angle – multiply hypotenuse length by sine (sin) of angle.
6. Developing coordinates measured off a reference point not in an East/West or North/South direction:
  - a. Non-trig method:  
Only useful if the measurements are to a reference intersection, not a goal intersection.
    - Convert distance to map distance by using step 2 above.
    - Lay ruler on map at proper angle, measure map distance.
    - Determine grid coordinates of this new point by eyeballing it.
  - b. Trig method:  
Only useful if the measurements are to a reference intersection, not a goal intersection.
    - Use trig functions of cosine and sine to calculate E/W and N/S distances using step 5 above.
    - Convert this distance to map distance by using step 2 above.
    - Determine new grid coordinates by using step 3 above.

### Inches to Decimal Conversion Table:

|                 |       |       |       |       |       |       |       |       |       |       |       |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Inches:</b>  | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |
| <b>Decimal:</b> | 0.083 | 0.167 | 0.250 | 0.333 | 0.417 | 0.500 | 0.583 | 0.667 | 0.750 | 0.833 | 0.917 |