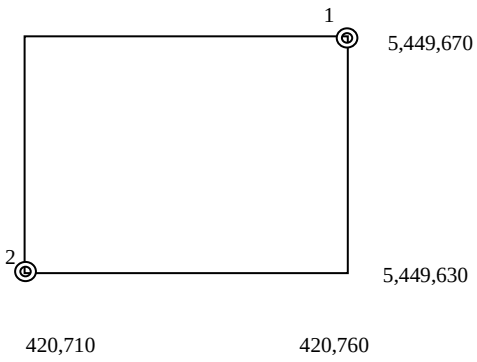
UTM Coordinates
Distance & Bearing

The following outlines how to determine distance and bearing between UTM coordinates.

First, sketch the two UTM coordinates onto a rectangle. As an example let's use …

Coordinate 1: easting = 420,760, northing = 5,449,670

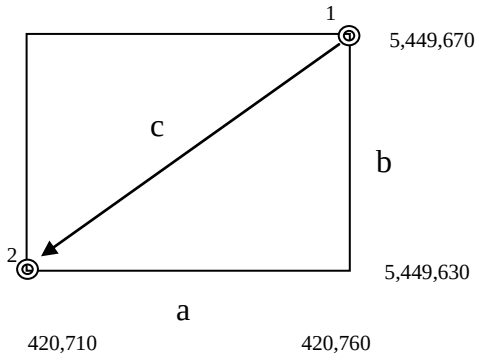
Coordinate 2: easting = 420,710, northing = 5,449,630



Quickly we can see that coordinate 2 is 40m south and 50 m west of coordinate 1. We want to determine the straight line distance and bearing between the two points.

Distance
Distance is a simple procedure that follows Pythagoras Theorem …

$a^2 + b^2 = c^2$
where, in our case:
- a = easting difference
- b = northing difference
- c = direct route

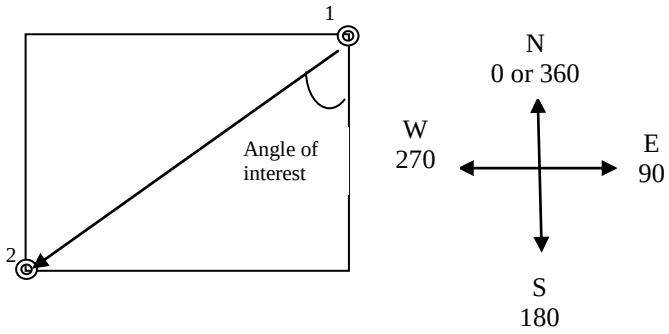


a = 420,760 – 420,710 = 50m
b = 5,449,670 – 5,449,630 = 40m

$50^2 + 40^2 = c^2$
$2500 + 1600 = c^2$
$4100 = c^2$
$64.0 = c$

The distance is 64.0 m between the two points

Bearing



Compare our "line of travel" to the compass rose. A quick look yields an estimated bearing roughly halfway between 180º and 270º (i.e ~225º). To calculate the bearing more accurately we make use of ARCTAN. Remember that …

- TAN = opposite/ adjacent (or rise/run) … and is given as a **ratio**
- TAN button on your calculator **converts angle in degrees to angle as a ratio**
  - If rise & run were equal (i.e. 20m), then rise/run = 1.0 (= 20/20)
  - Thus the TAN = 1.0
- ARCTAN simply **converts angle as a ratio to angle in degrees**
  - ARCTAN of 1.0 = 45º
  - where rise/run = 20m/20m, do the values 1.0 and 45º make sense?

So if we calculate the slope angle as a ratio, then we can convert it to degrees using ARCTAN.

Our example,

- Slope ratio
  - = opp. / adj. = 50 / 40 = 1.25
- To convert to degrees
  - ARCTAN(1.25) = 51.3º, or just 51º

Note that the "angle of interest" (51º) is between the vertical line running south and our "line of travel". Said another way, 51º has to be added to 180º to get the actual bearing.

  - 51º + 180 º = 231º