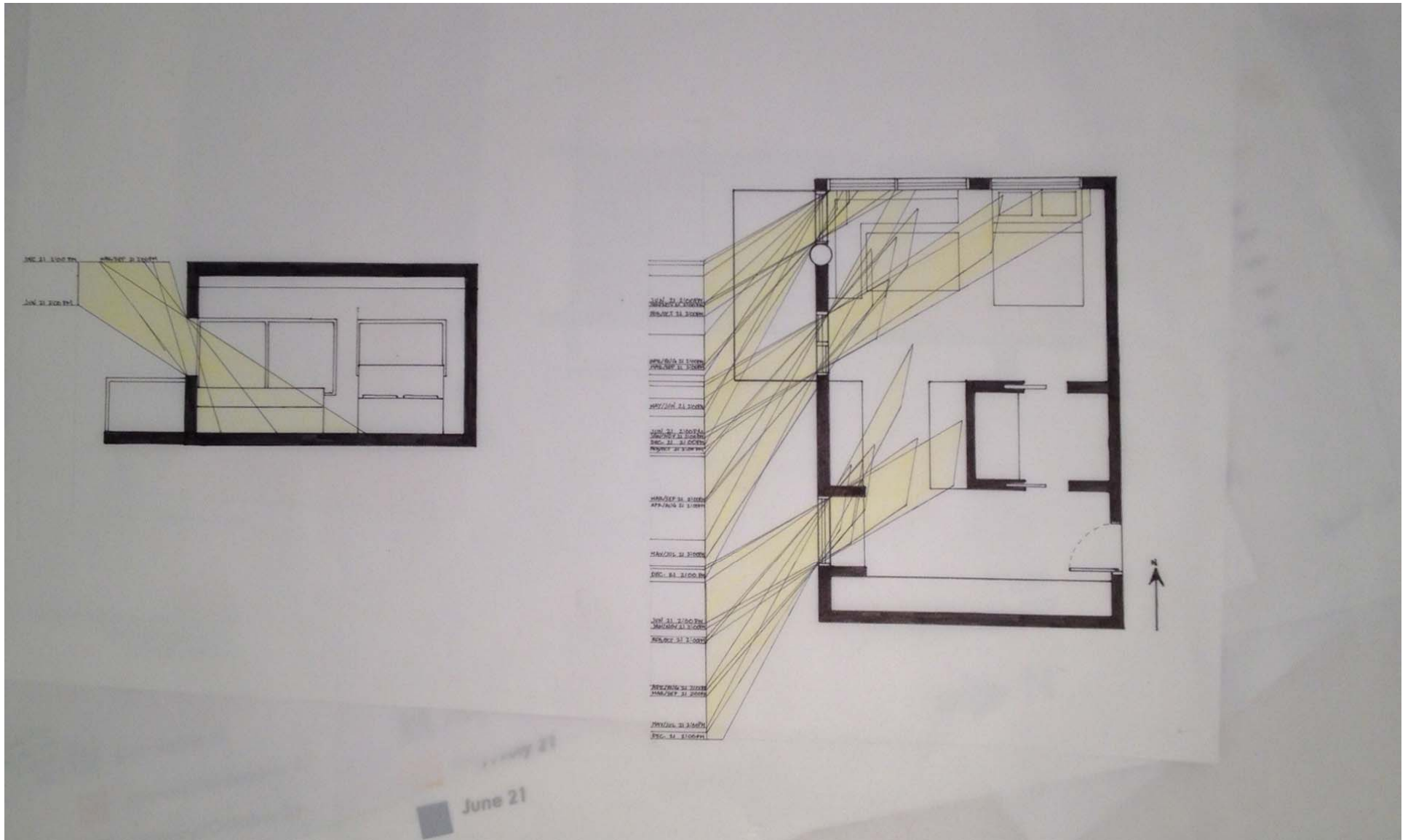
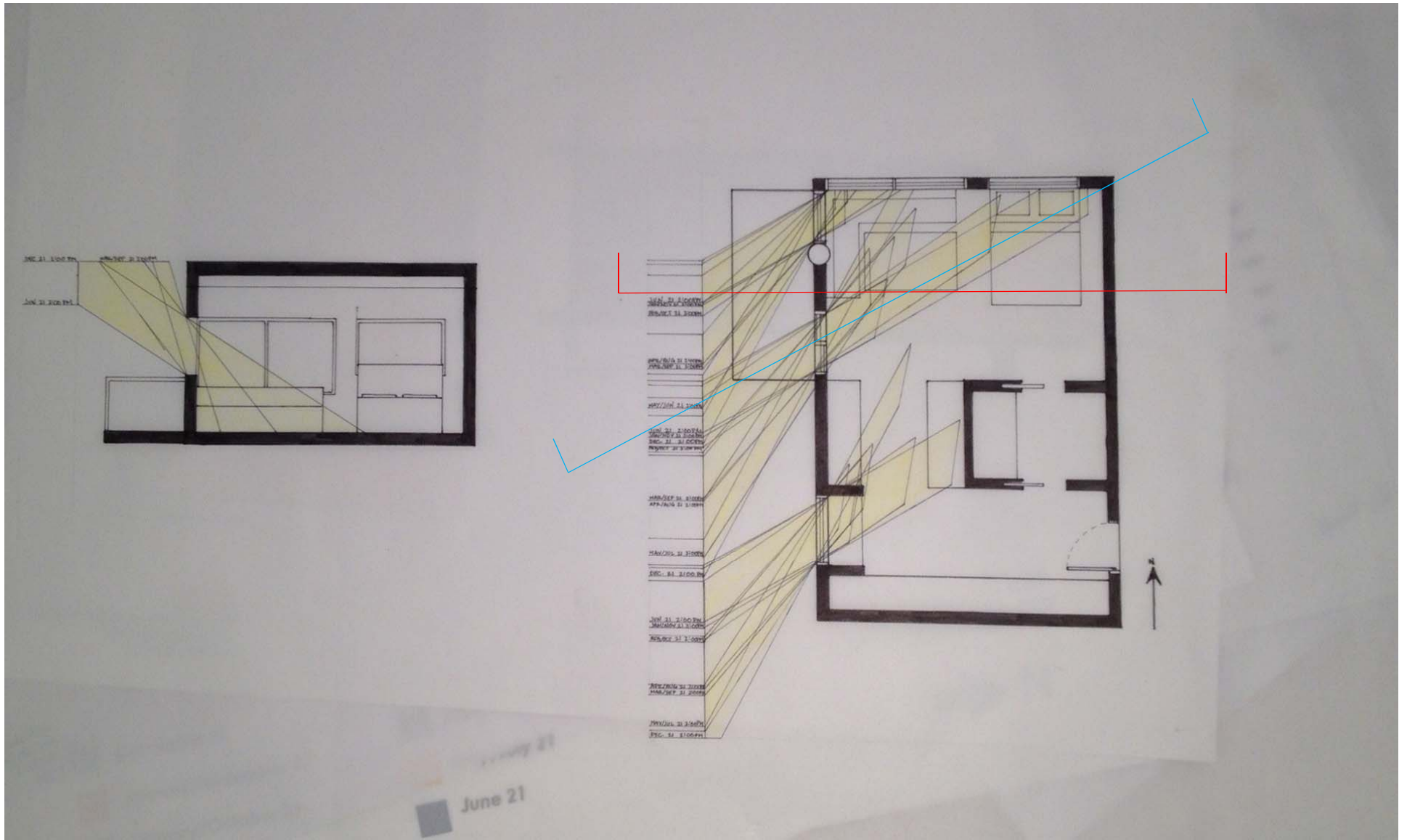


Sun Diagram Tutorial

Arch 125



This is sort of what you are trying to create, but with a bit more showing in the variation of the section. Suggest using colour to make the patterns distinct. This student also seems to have their windows all going to the floor on the plan view, so you need to be sure to include the shadow from the portion of the wall below the window.



Technically if you plot your plan you can simply cut your section through it where it seems to make the most graphic or useful sense rather than constructing it. It does not necessarily need to be taken at right angles to the wall if that view does not show anything useful for the nature of the solar penetration.

Sustainable By Design :: Latitude & Longitude - Mozilla Firefox

Google Maps - Mozilla Firefox

https://www.google.ca/maps/@43.7273786,-79.4022175,13z?hl=en

Traffic, Transit, Bicycling, Terrain, Directions

Directions from here
 Directions to here
 What's here?
 Search nearby
 Measure distance

Map data ©2015 Google Terms Privacy maps.google.com Report a problem 1 km

WATERLOO WASHINGTON
 consulting about contact solar cooking

te, time, and location. Please read
 ges before using this tool. Click on

need to calculate sun angle
 SunPosition tool, which outputs
 nto spreadsheets). [hide tip]

[other options] [hide]

AM

A Pacific (GMT - 8:00)

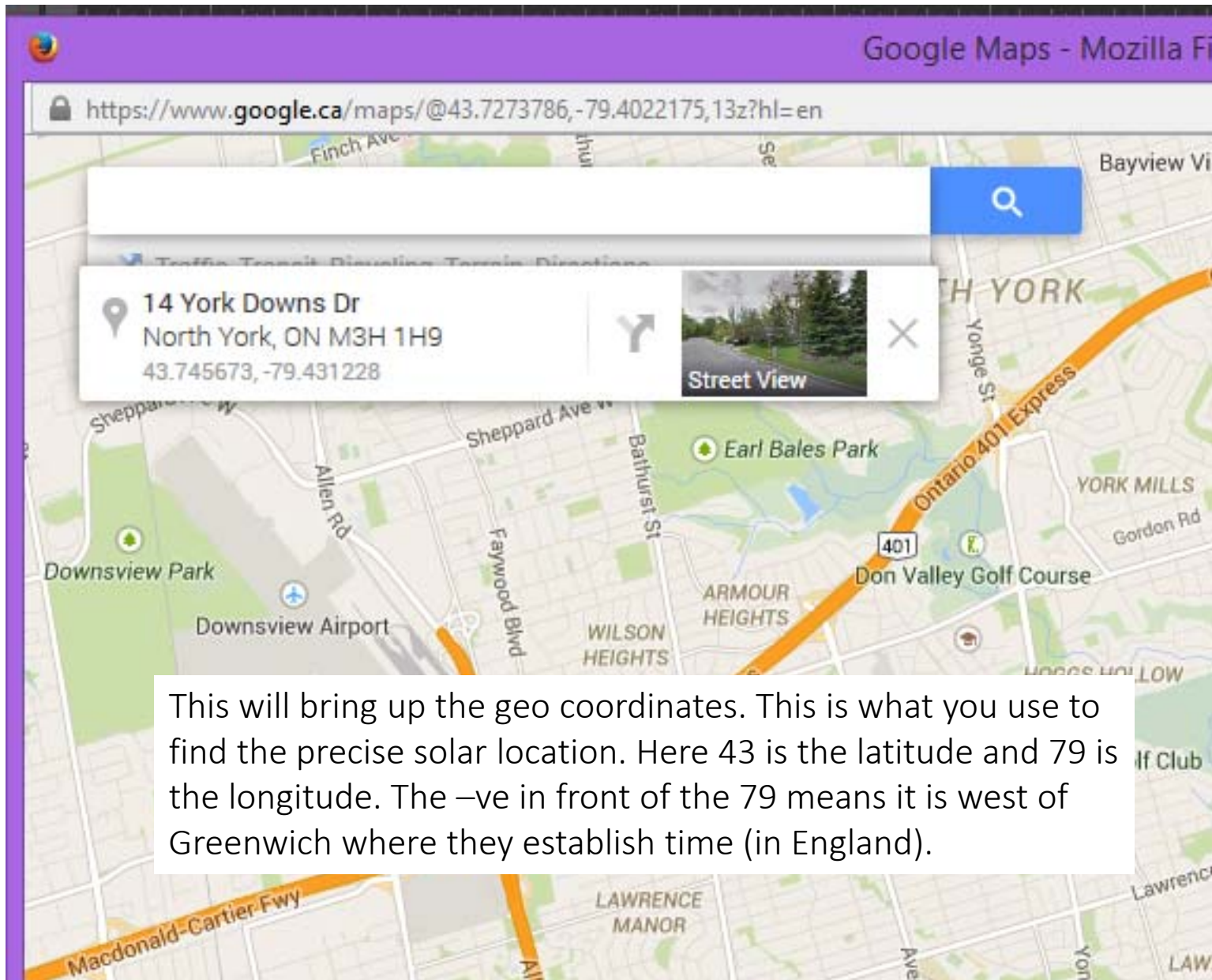
ck time

th

To find the coordinates of your site, go to Google Maps and right click at the building location. Click on “What’s Here?”

100% by voluntary user donations. If you found this program helpful, please consider making a small donation...this can be done quickly and securely by credit card, or you can mail a check. Suggested

[Commercial \(\\$25\)](#)



This will bring up the geo coordinates. This is what you use to find the precise solar location. Here 43 is the latitude and 79 is the longitude. The -ve in front of the 79 means it is west of Greenwich where they establish time (in England).

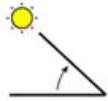


<http://www.susdesign.com/tools.php>

Design Tools

Sustainable By Design provides a suite of shareware design tools on sustainable energy topics:

SUN ANGLE TOOLS



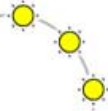
SunAngle

the premiere tool for solar angle calculations



SunPosition

calculates a time series of basic solar angle data



Sol Path

visualization of the path of the sun across the sky

WINDOW TOOLS



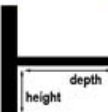
Window Overhang Design

visualization of the shade provided by a window overhang at a given time



Window Overhang Annual Analysis

visualization of window overhang shading performance for an entire year



Overhang Recommendations

suggested climate-specific dimensions for south-facing window overhangs



Light Penetration

visualization of the penetration of sunlight into a room

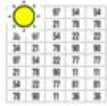


Step 1:
Go to the main
page

We are using the
SunAngle and Sun
Position features
first



<http://www.susdesign.com/sunposition/index.php>



SunPosition

This tool calculates an array of solar angle data that can be copied into spreadsheets and other documents. Please read the important [instructions](#), [notes](#), and [FAQ](#) pages before using this tool. Click on any input label for additional details.

INPUTS

TIME BASIS

solar time clock time [\[what's the difference?\]](#)

DATA TO CALCULATE

[altitude](#) [azimuth](#) [declination](#)
[eq. of time](#) [hour angle](#) [day length](#) [clock time](#)

LOCATION

[latitude](#) degrees North South
[longitude](#) *not required for solar time, when clock time is not being calculated*
[time zone](#) *not required for solar time, when clock time is not being calculated*
[zero azimuth](#)

DATA RESOLUTION

[frequency](#)
[resolution](#) [time](#)

OUTPUT FORMAT

[delimiter](#) [date style](#)
[angle units](#) [time style](#)
[leap year](#) [include header](#)

calculate

Step 2:
On SunPosition

Fill in the sheet but
we will be
modifying the
defaults a bit as
per the next slide

INPUTS

TIME BASIS

solar time clock time [\[what's the difference?\]](#)

DATA TO CALCULATE

altitude **azimuth** **declination**
eq. of time **hour angle** **day length** **clock time**

LOCATION

latitude degrees North South
longitude *not required for solar time, when clock time is not being calculated*
time zone *not required for solar time, when clock time is not being calculated*
zero azimuth

DATA RESOLUTION

frequency **start date**
resolution **time**

OUTPUT FORMAT

delimiter **date style**
angle units **time style**
leap year **include header**

calculate

OUTPUT

```
SunPosition output complete
Latitude is 43 degrees north
Zero azimuth is south
Output angle units are degrees

date      solar time      altitude      azimuth
January 21  00:00      -66.92      -180.00
January 21  01:00      -63.70      -146.69
January 21  02:00      -55.86      -123.10
January 21  03:00      -45.92      -107.11
```

E-mail me these outputs

Support SunPosition!

Step 3:

- Find your latitude
- Change the date to the 21st so you are matching the equinox and solstice dates
- Ask for monthly (you will only be using the data for the 4 months I requested)
- Ask for hourly (you will only need the hours I asked for)
- Calculate

INPUTS

TIME BASIS

solar time clock time [\[what's the difference?\]](#)

DATA TO CALCULATE

altitude **azimuth** **declination**
eq. of time **hour angle** **day length** **clock time**

LOCATION

latitude degrees North South
longitude *not required for solar time, when clock time is not being calculated*
time zone *not required for solar time, when clock time is not being calculated*
zero azimuth

DATA RESOLUTION

frequency **start date**
resolution **time**

OUTPUT FORMAT

delimiter **date style**
angle units **time style**
leap year **include header**

calculate

OUTPUT

```
SunPosition output complete
Latitude is 43 degrees north
Zero azimuth is south
Output angle units are degrees

date      solar time      altitude      azimuth
January 21  00:00      -66.92      -180.00
January 21  01:00      -63.70      -146.69
January 21  02:00      -55.86      -123.10
January 21  03:00      -45.92      -107.11
```

E-mail me these outputs

Support SunPosition!

Step 4:

- Select the data you will be working with
- So pick the hours and dates and discard the rest
- If you email it to yourself it might be easier to work with
- Note that you get negative altitude angles for times before the sun comes up as it is just generating numbers and is not very sensible!

LOCATION

latitude 47.45 degrees North South

longitude *not required for solar time, when clock time is not being calculated*

time zone *not required for solar time, when clock time is not being calculated*

zero azimuth South ▾

DATA RESOLUTION

frequency monthly ▾

start date January ▾ 21 ▾

resolution every hour ▾

time 00 ▾ 00 ▾

OUTPUT FORMAT

delimiter tab ▾

date style January 21 ▾

angle units degrees ▾

time style 14:00 ▾

leap year

include header

calculate

Solar time Altitude Azimuth

OUTPUT			
January 21	08:00	3.90	-54.73
January 21	09:00	11.53	-42.75
January 21	10:00	17.52	-29.55
January 21	11:00	21.39	-15.16
January 21	12:00	22.74	0.00
January 21	13:00	21.41	15.16
January 21	14:00	17.56	29.57
January 21	15:00	11.58	42.78
January 21	16:00	3.96	54.78
January 21	17:00	-4.84	65.83
January 21	18:00	-14.41	76.35

E-mail me these outputs

Step 5:

- The altitude angle is the angle the sun makes with the earth
- The azimuth is the deviation from due south in degrees



Light Penetration



This tool lets you calculate and visualize the extent to which direct sunlight penetrates into the interior of a room through a vertical window. Please read the important [instructions](#), [notes](#), and [FAQ](#) pages before using this tool.

LOCATION

latitude °

window faces

DATE & TIME

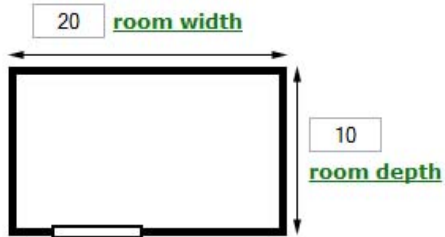
date

time

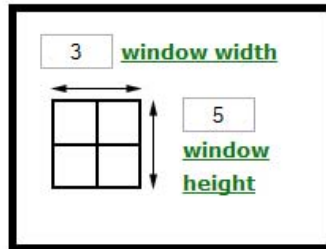
OUTPUTS



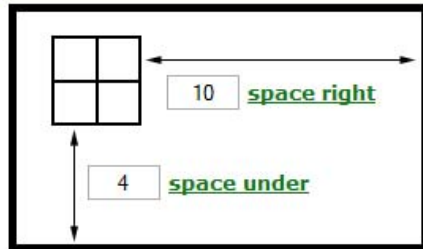
ROOM DIMENSIONS



WINDOW DIMENSIONS



WINDOW POSITION



In plan what we are trying to get is a set of these for the 4 times of year and multiple times of day to see the path and penetration of the sun. You can input your latitude and window and room sizes to see what this looks like to check if you are correct in what you are plotting.

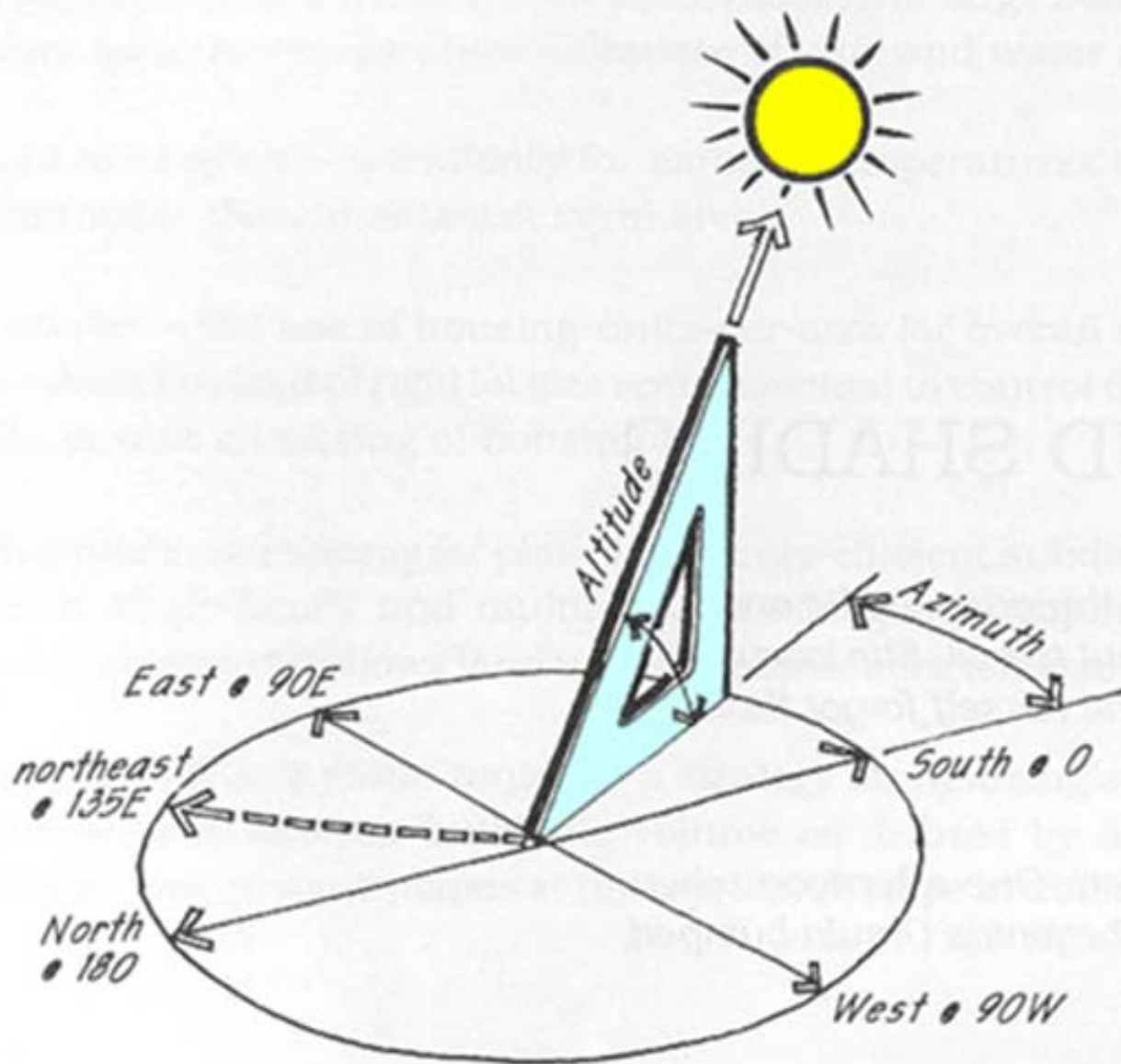
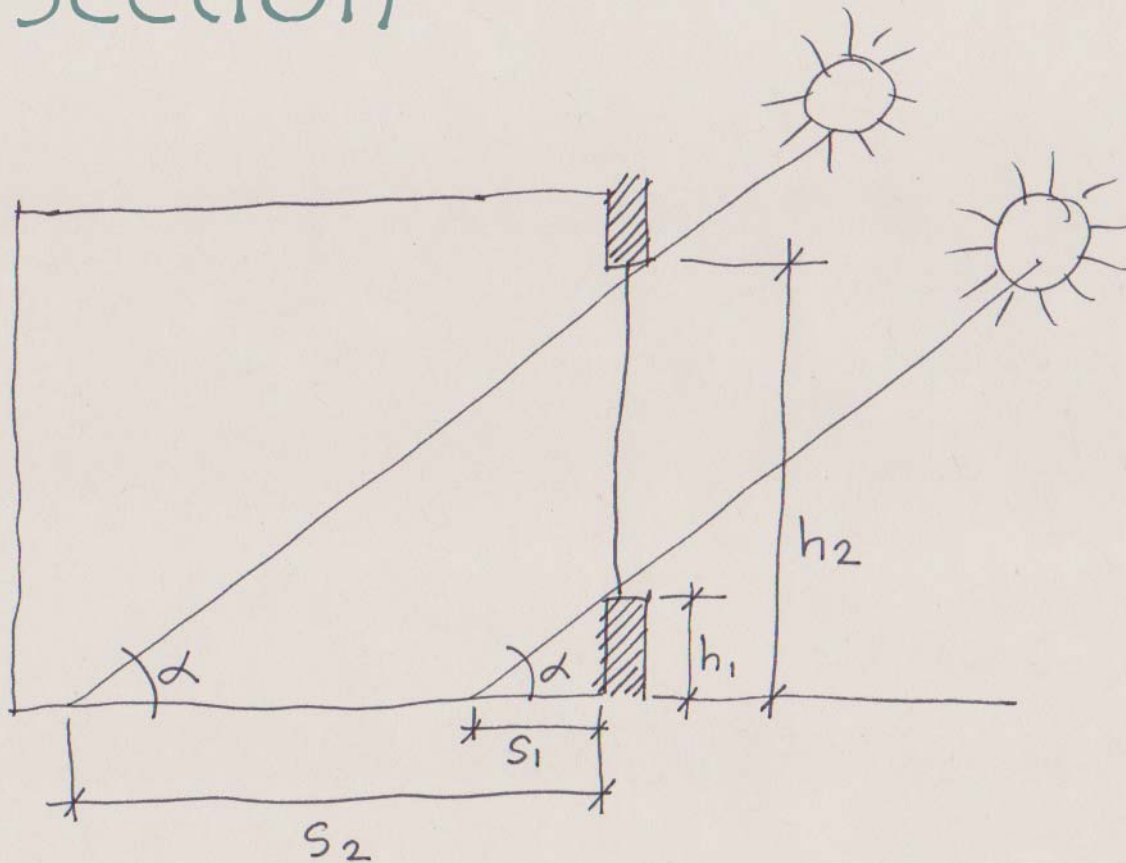


Figure 5.1: Solar azimuth and altitude angles. Azimuth angles are measured in each direction from south (for example, northeast = 135° E). Altitude angles are measured vertically from the horizon. (Reproduced from Moore, 1985, by permission.)

Section



α = altitude angle

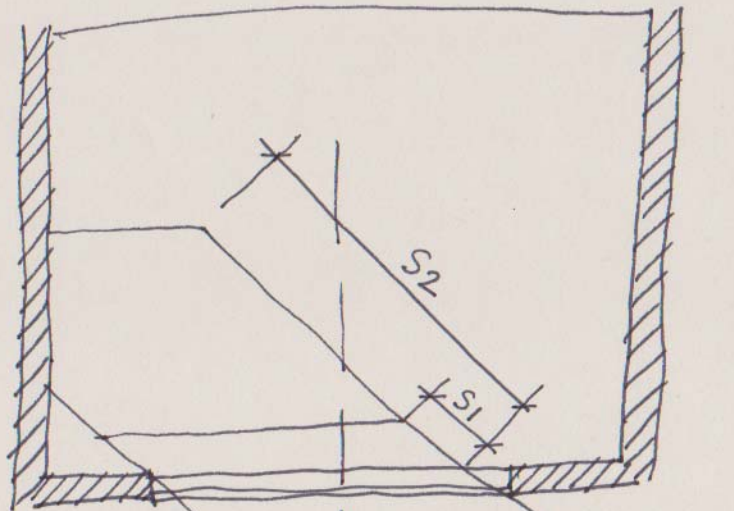
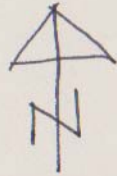
$$\tan \alpha = \frac{\text{height}}{\text{shadow length}}$$

$$\Rightarrow \text{shadow} = \frac{\text{height}}{\tan \alpha}$$

You need to create your own co-efficients as you are not likely able to use the charts I supplied in class as they are only for 43 north latitude.

Use basic Trig to get the values.

Plan



α
azimuth = deviation from due south

The previous section diagram for the geometry applies ALONG the shadow line.

So use the azimuth angle to set out the line of the shadow, and its length corresponds to the line you found in the previous section.