Basic Cave Mathematics.

Preface.

These measurements were taken during the summer of 2012 , on a few occasions with spirit level and a builder's tape by three people working together and interpeted at the level of a graduate of a Irish secondary school system.

Please help to answer the questions raised by the answers to the questions posed in this section , also to question the answers deduced , and debunk any of their conclusions.

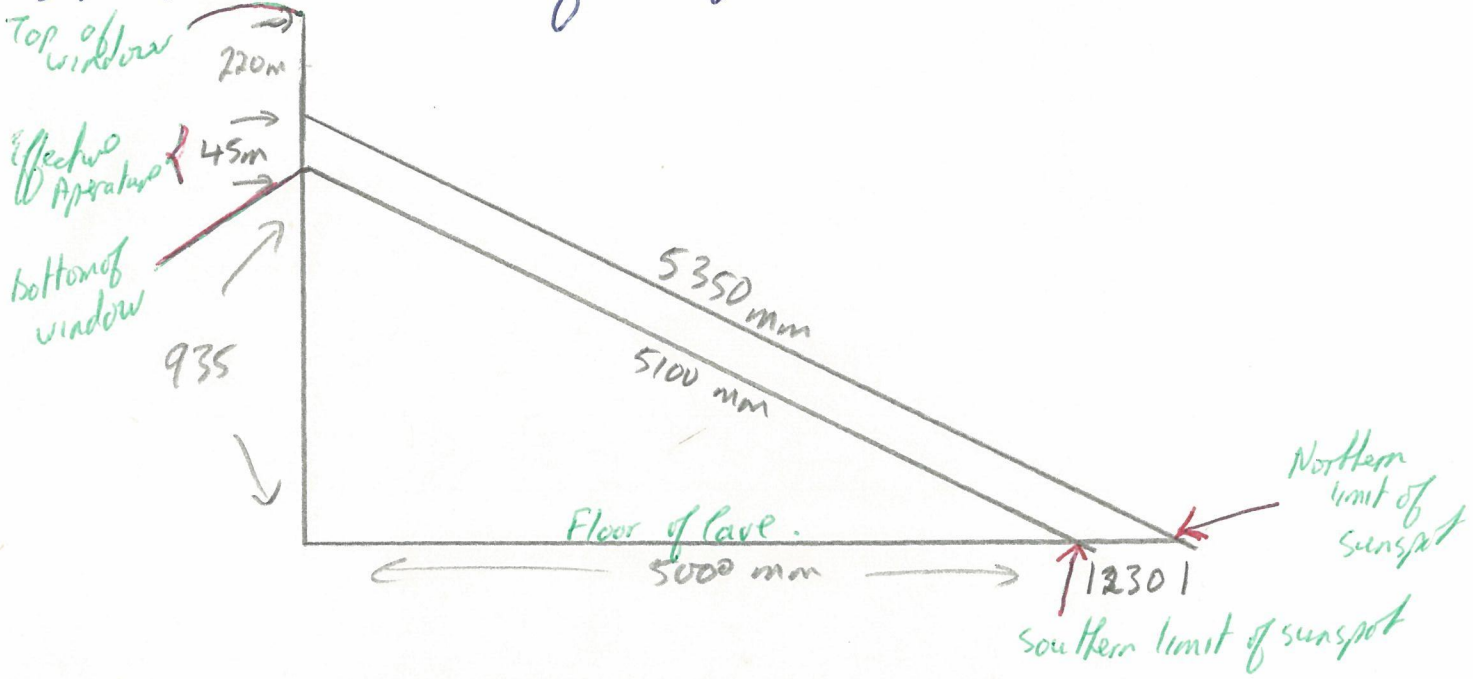
The Light enters the Cave through an aperature defined on the outside by the undersurface of the stone at the surface and below by the horizon, ie the clay in the field which looks like a bank of clay from the inside of the Cave.When this clay horizon is aligned with the underside of the window inside [looking out] the upper extent of the aperature is is still defined by the undersurface of the outside stone,

The aperature is no wider than 45mm at any point, and is higher on the east side than the west.

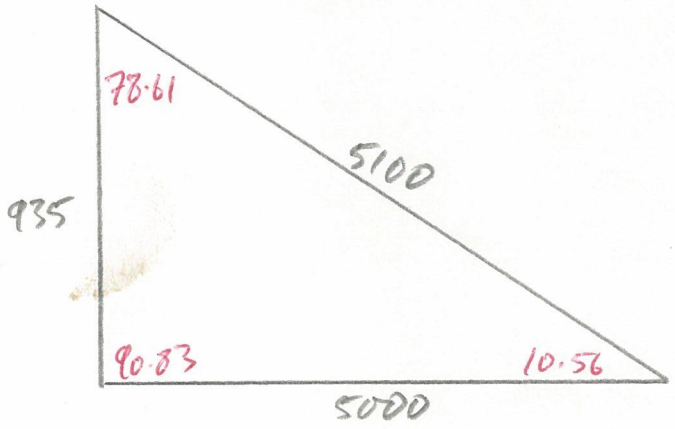
To see INTO the sun click on the last picture on the second row of images 5 [dscf 0341. Jpg] and rotate the screen gently from side to side until the Corona comes into veiw.

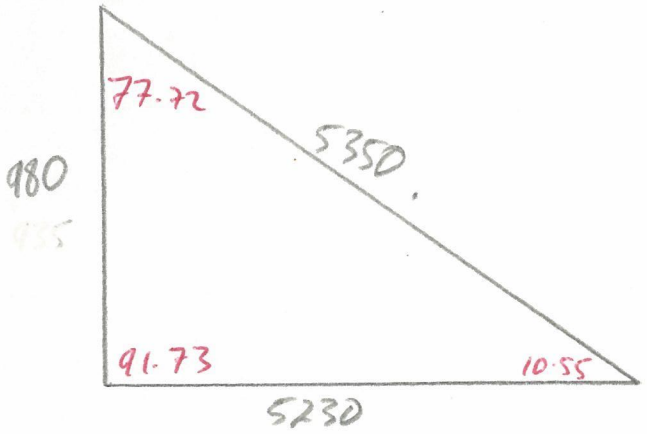
Question 1

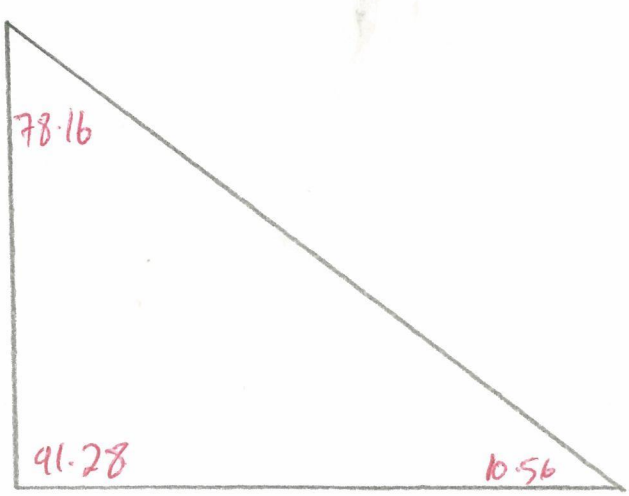
Given the measurements below find the angle of declination of the Sun relative to the floor of the cave Winter Solstice 2011



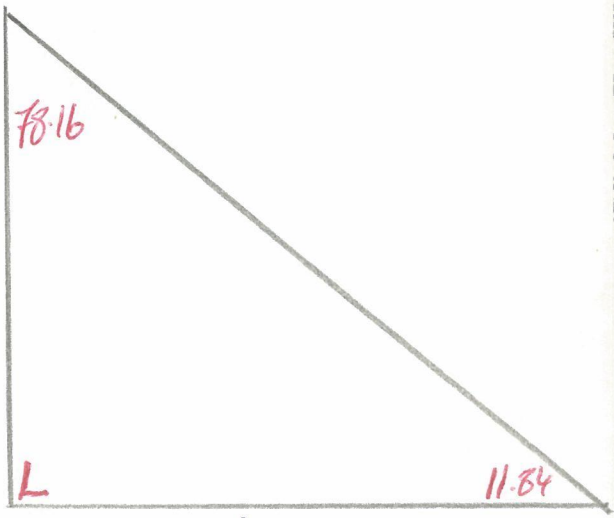
Solutions







= best approximation of angles.



adjusted to ecliptic.

Question 2

Given the measurements below find

I an estimate of the angle of declination of the sun relative to the floor of the cave,

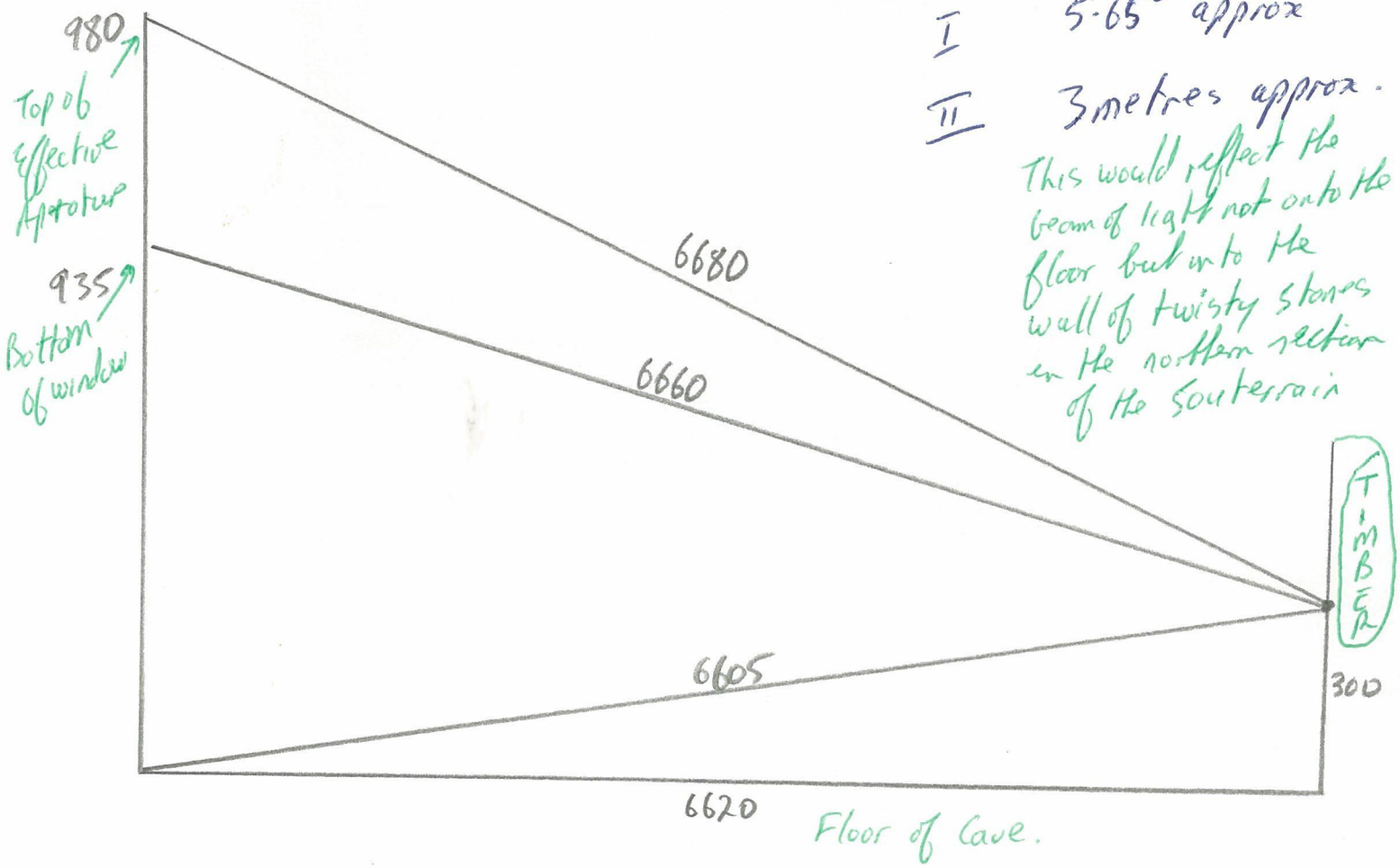
II an estimate of how far the shaft of light might have penetrated into the northern (now filled in with clay) section of the cave

at the time it was built / functioning optimally, assuming that the beam of light passed through the creep passage at a level halfway up at the end, ie halfway up where the timber is now.

Answers from next pages

I 5·65° approx

II 3 metres approx. This would reflect the beam of light not onto the floor but into the wall of twisty stones in the northern section of the Souterrain



Question 3

Given the 2011 observations (Q_1) and the determinations of what might have been observed at the time of optimal Souterrain function (Q_2), quantify the differences between the two and propose explanation of these differences.

Answer

The Sun would have appeared 3.84° (or more) LOWER in the SKY at Winter Solstice at the time the SOUTERRAIN was constructed than it does now, if the hypothesis THAT THE SOUTERRAIN WAS BUILT IN ORDER TO PROJECT A SHAFT OF LIGHT AT WINTER SOLSTICE INTO THE NORTHERN (now filled in) SECTION OF THE CAVE AND ONTO ITS WESTERN WALL applies.

Explanations!

This Difference of 3.84° is Greater than what can be accounted for by changes in Axial tilt of the Earth, ie even if the Souterrain was built over 10,000 years ago when the Earth was tilted at 24.5° relative to the Sun rather than the 23.44° it is tilted at now, we are still left with $3.84° - (24.5° - 23.44°) = 2.78°$ of a discrepancy;

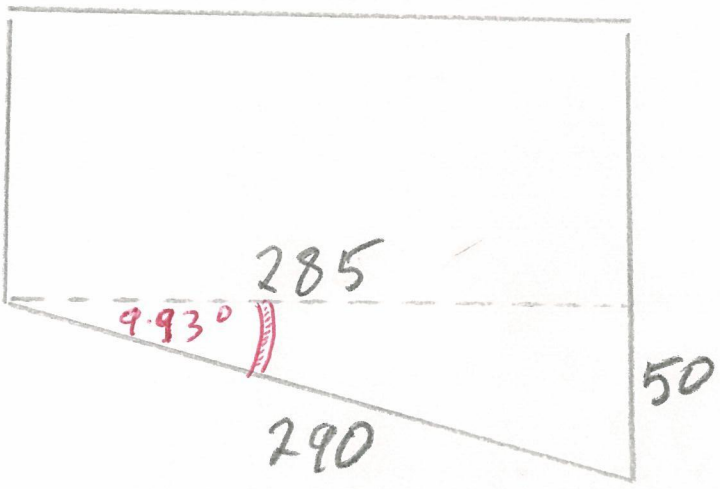
Either

(i) The hypothesis is incorrect, or

(ii) Some other factor(s), which we hope to explore in the "Astronomy" section, can account for this discrepancy

Question 4

Given the measurements below of the inside of the window of the cave is it fair to conclude that the window is designed to accomadate the declining Sun?



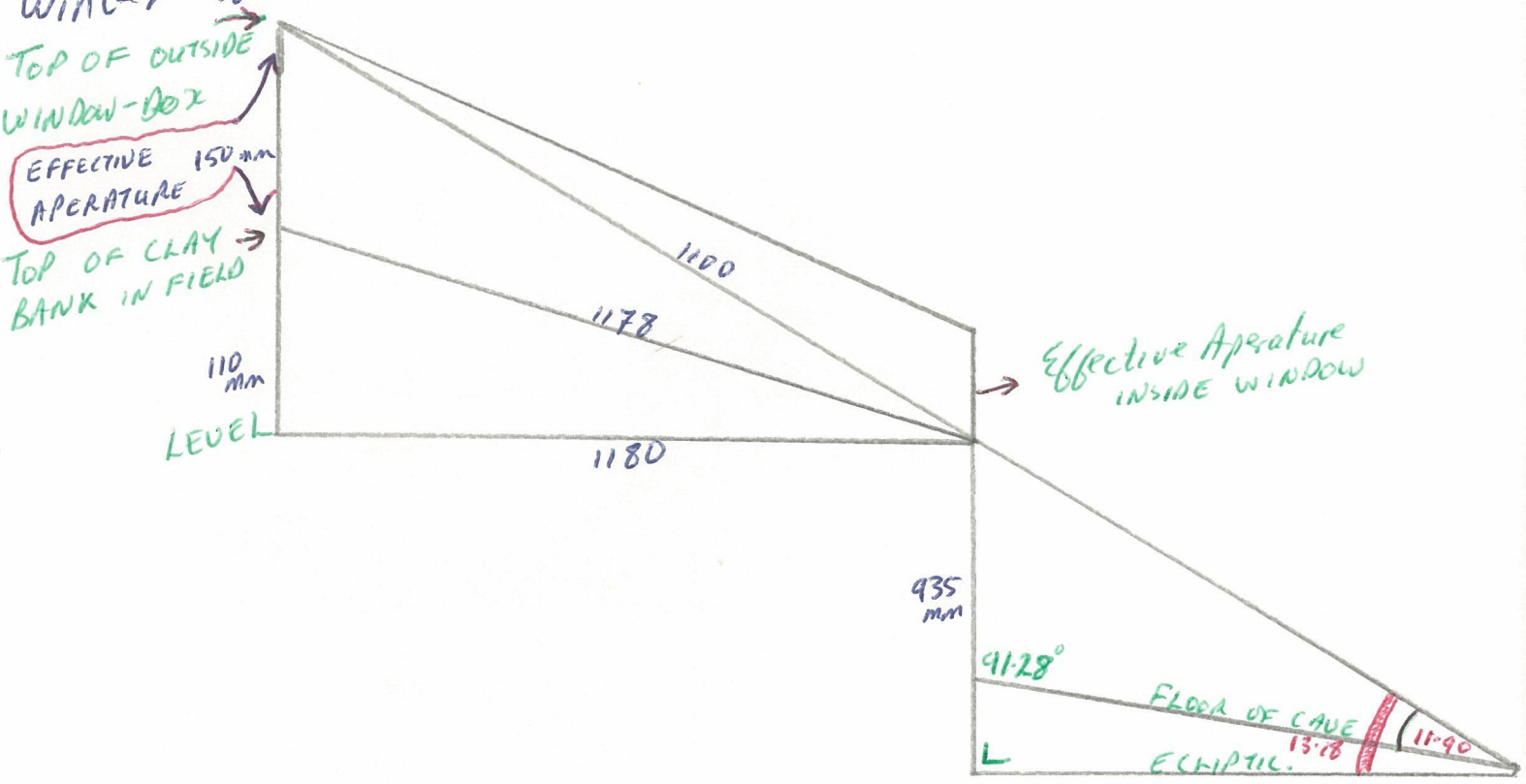
$$a^2 = b^2 + c^2 - 2.b.c.\ \text{Cos}A$$
$$50^2 = 290^2 + 285^2 - 2.290.285\ \text{Cos}A$$
$$2500 = 84100 + 81225 - 165300\ \text{Cos}A$$
$$165300A = 162825$$
$$\text{Cos}A = 0.985027223$$
$$A = 9.927323665$$

Unanswered

Does 9.93^0 approximate the declining Sun between 1.30pm and 2.15pm at latitudes between 53°N and 59°N?

Question 5

Given the measurements below (22/7/12) show that the Sunspot as seen and measured (see Q1) at Winter Solstice 2011 is allowed by the Windox-Box.



ANSWER IS YES

The angle made by the beam of light, when the Sun is at its highest point allowed by the window box for a beam to enter the cave, relative to the floor of the Cave, 11·90° is greater than the angle made by the beam of light wrt the floor of the Cave on Winter Solstice 2011 10·56

Question 6

Calculate the difference between the Noon Sun Angle at Winter Solstice 2011 and the Angle as measured by Tonroesouterrain.

Noon Sun Angle = $90° - (53.780° + 23.439°) = 12.781°$

(53.780° — Latitude of Tonroe Souterrain; 23.439° — Axial tilt of Earth at Winter Solstice; Zenith Angle)

Angle as measured by Tonroe Souterrain from Question 1 adjusted to Ecliptic = $11.84°$

Adjustment is $+0.94°$

At Optimal Souterrain function
Angle as measured by Tonroesouterrain is $8°$
Noon Sun Angle @ Winter Solstice would be $8.94°$

$90° - \text{Zenith Angle} = 8.94$

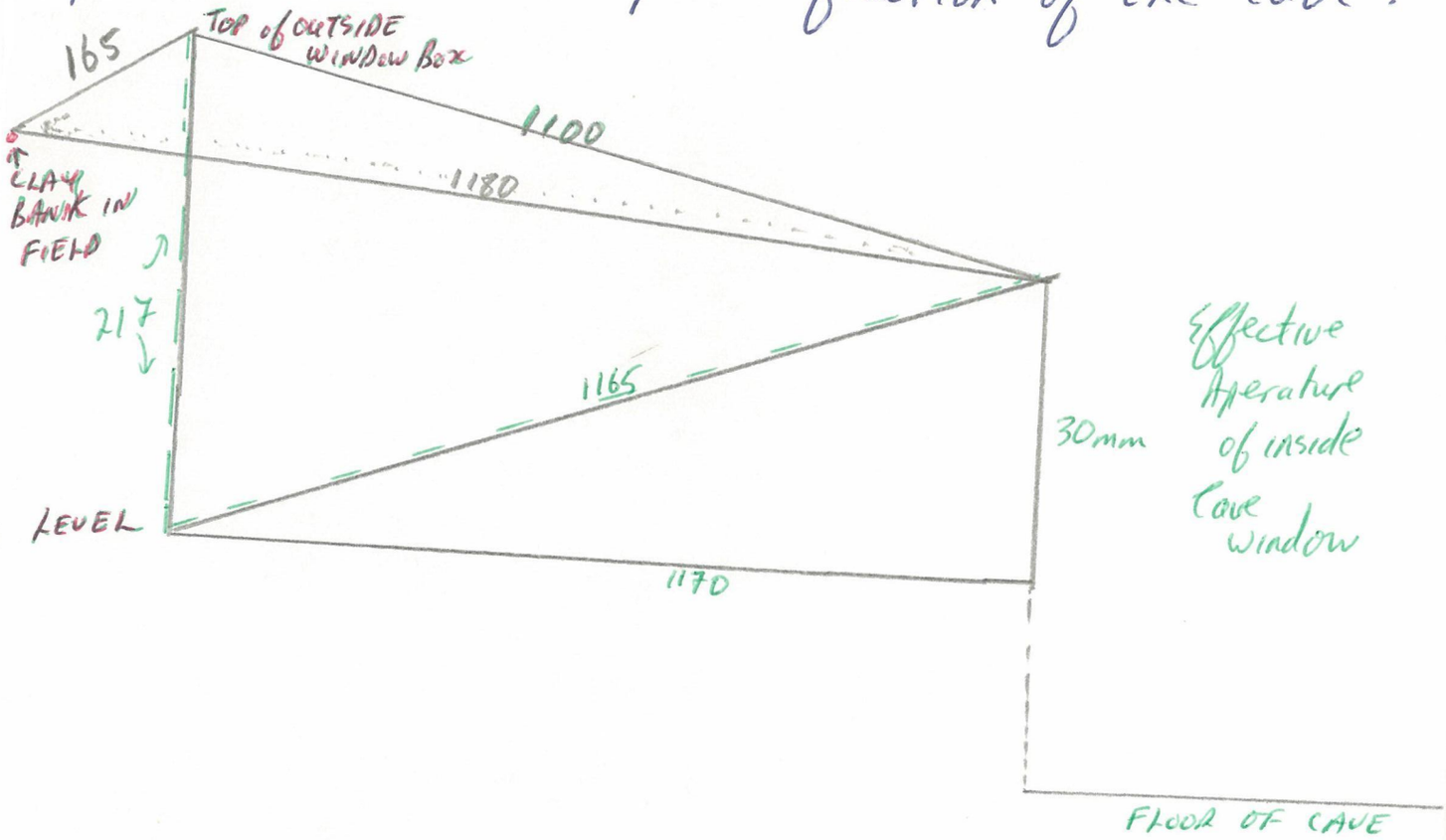
$\text{Zenith Angle} = 81.06$

Latitude of Tonroesouterrain at
Maximum Earth Axial tilt of $24.5°$ would be $56.56°$
over 10,000 years ago
Minimum Earth Axial tilt of $22.1°$ would be $58.96°$
over 20,000 years ago

ALL OTHER THINGS BEING EQUAL!!!

Question 7

Given the following measurements (3/08/2012) show that the Window-box accomodates the Sunspot postulated by Q2 ie at the optimal function of the Cave.

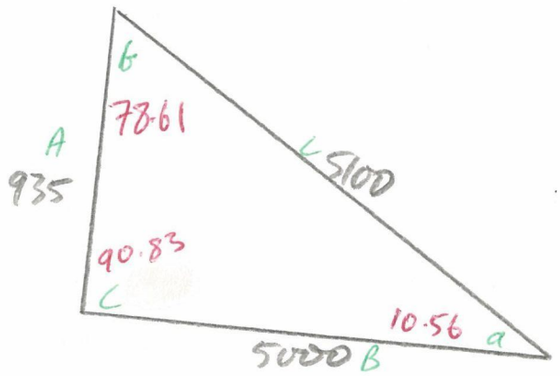


Answer is Yes.

The angle deduced (1·78°) which would be made between the beam of light and the level/ecliptic is less than that at optimal Cave function (8°) - again relative to ecliptic.

When this angle is adjusted to be relative to the floor of the Cave it becomes (−0·57°), 1·78° minus 2·35°. What this means is that at maximum penetration of a beam of light into the Cave, ie when the Sun is at its lowest possible declination allowing a beam into the Cave, the beam never touches the floor, it would be risen up from it.

Proof for Q1 (i)



$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$935^2 = 5000^2 + 5100^2 - 2.5000.5100.\cos A.$$

$$874225 = 25000000 + 26010000 - 51000000\cos A$$

$$51,000,000\cos A = 50,135,775$$

$$\cos A = 0.983054411$$

$$A = 10.56285092$$

$$\frac{A}{\sin A} = \frac{B}{\sin B} = \frac{C}{\sin C}$$

$$\frac{935}{0.183314002} = \frac{5000}{\sin B} = \frac{5100}{\sin C}$$

$$\sin B = 0.980288783$$

$$B = 78.60510547$$

$$\sin C = 0.999894556$$

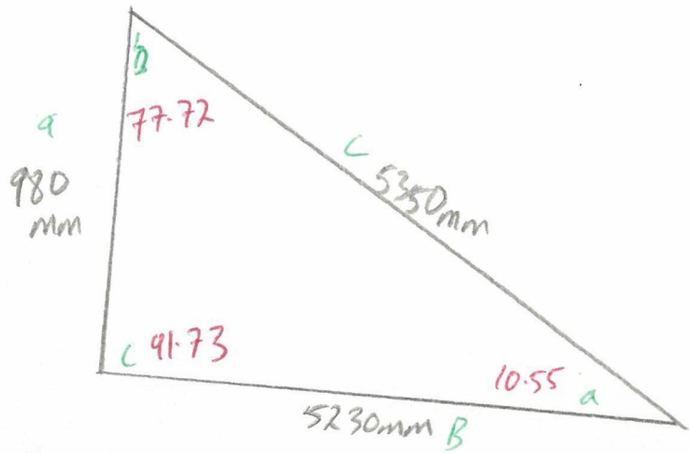
$$C = 89.16794577$$

or

$$(90 - 89.16794577) + 90$$

$$C = 90.83205423$$

Proof for Q.1 (ii)



$a^2 = b^2 + c^2 - 2bc \cos A$

$980^2 = 5230^2 + 5350^2 - 2.5230.5350 \cos A$

$960,400 = 27,352,900 + 28,622,500 - 55,961,000 \cos A$

$55,961,000 \cos A = 55,015,000$

$\cos A = 0.98309537$

$A = 10.550041153$

$$\frac{a}{\sin A} = \frac{b}{\sin b} = \frac{c}{\sin c}$$

$$\frac{980}{0.18309422} = \frac{5230}{\sin b} = \frac{5350}{\sin c}$$

$\sin b = 0.977125276$

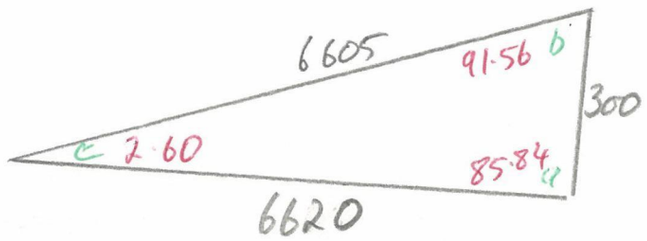
$b = 77.721454466$

$\sin c = 0.999544976$

$c = 88.271449357$

or 91.728506443

Proof of Q2 (i)



$a^2 = b^2 + c^2 - 2bc \cos A$

$6605^2 = 6620^2 + 300^2 - 2.6620.300.\cos A$

$43,626,025 = 43,824,400 + 90,000 - 3,972,000 \cos A$

$+3,972,000 \cos A = +288,375$

$\cos A = 0.072601963$

$A = 85.838655079$

$\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin c}$

$\frac{6605}{0.997363661} = \frac{6620}{\sin b} = \frac{300}{\sin c}$

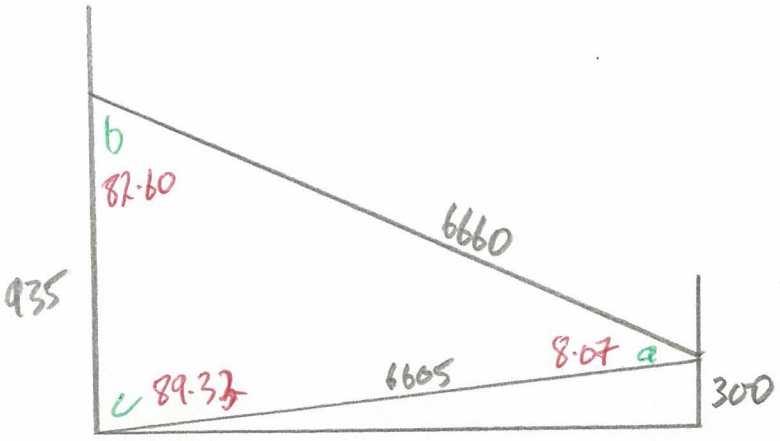
$\sin b = 0.99962868$

$B = 88.43856162$ or $91.561438 38$

$\sin c = 0.045300393$

$c = 2.596409895$

Proof of Q2(ii)



$$a^2 = b^2 + c^2 - 2.b.c.\cos A$$

$$935^2 = 6605^2 + 6660^2 - 2.6605.6660.\cos A$$

$$874225 = 43,626,025 + 44,355,600 + 87,978,600 \cos A$$

$$87978600\ \cos A = 87107400$$

$$\cos A = 0.990097591$$

$$A = 8.069879925$$

$$\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin c}$$

$$\frac{935}{0.140380762} = \frac{6605}{\sin b} = \frac{6660}{\sin c}$$

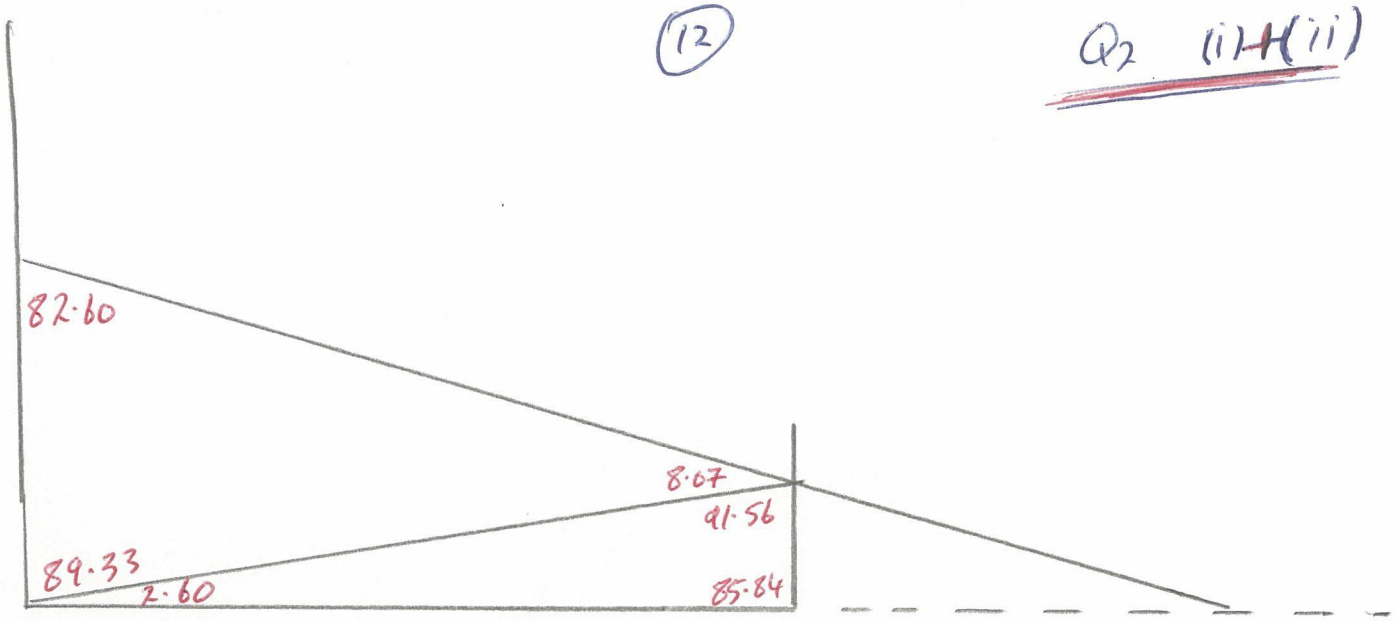
$$\sin b = 0.991673728$$

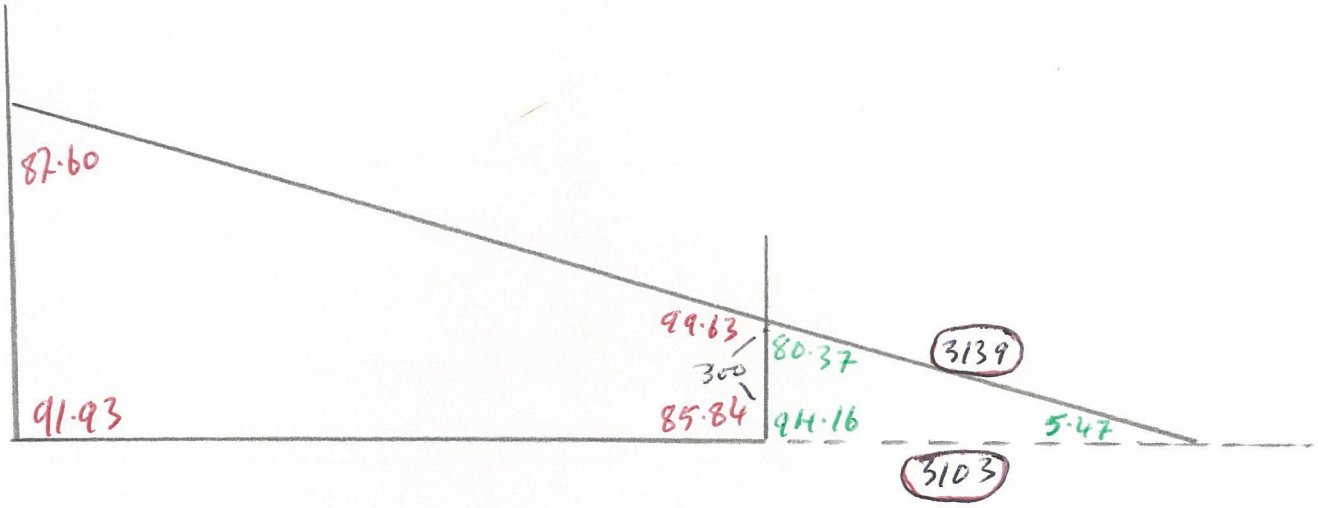
$$b = 82.60114179$$

$$\sin c = 0.999931417$$

$$c = 89.32896022$$

Q2 (i) & (ii)





$$\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin c}$$

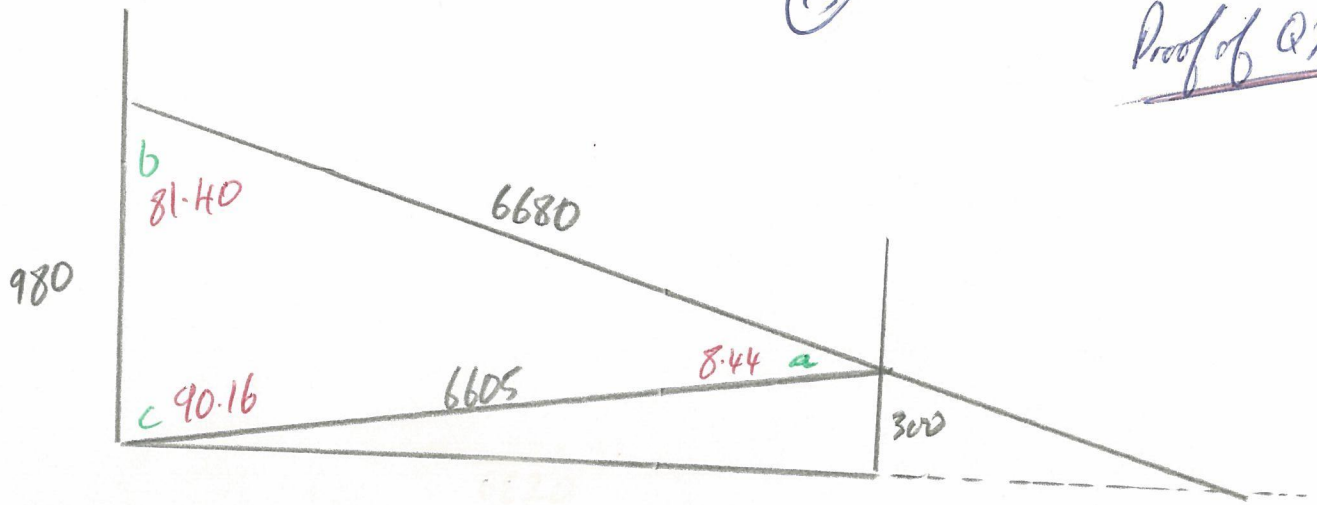
$$\frac{300}{\sin 5{\cdot}47} = \frac{b}{\sin 80{\cdot}37} = \frac{c}{\sin 94{\cdot}16}$$

$$\frac{300}{0{\cdot}095324551} = \frac{b}{0{\cdot}985908582} = \frac{c}{0{\cdot}994736536}$$

$b = 3102{\cdot}79$

$c = 3138{\cdot}85$

Proof of Q2 (iii)



$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$980^2 = 6605^2 + 6680^2 - 2.6605.6680.\cos A$$

$$960400 = 43,626,025 + 44,622,400 - 88,242,800\cos A$$

$$88,242,800\cos A = 87,288,025$$

$$\cos A = 0.989180137$$

$$A = 8.436083556$$

$$\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin C}.$$

$$\frac{980}{0.14670602} = \frac{6605}{\sin b} = \frac{6680}{\sin C}$$

$$\sin b = 0.988768637$$

$$b = 81.40469737$$

$$\sin c = 0.99996136$$

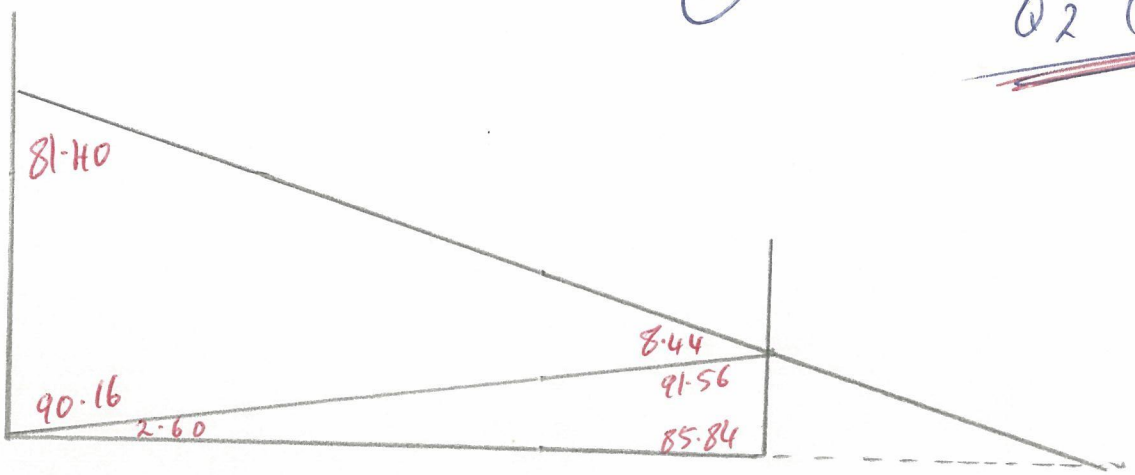
$$c = 89.84072853$$

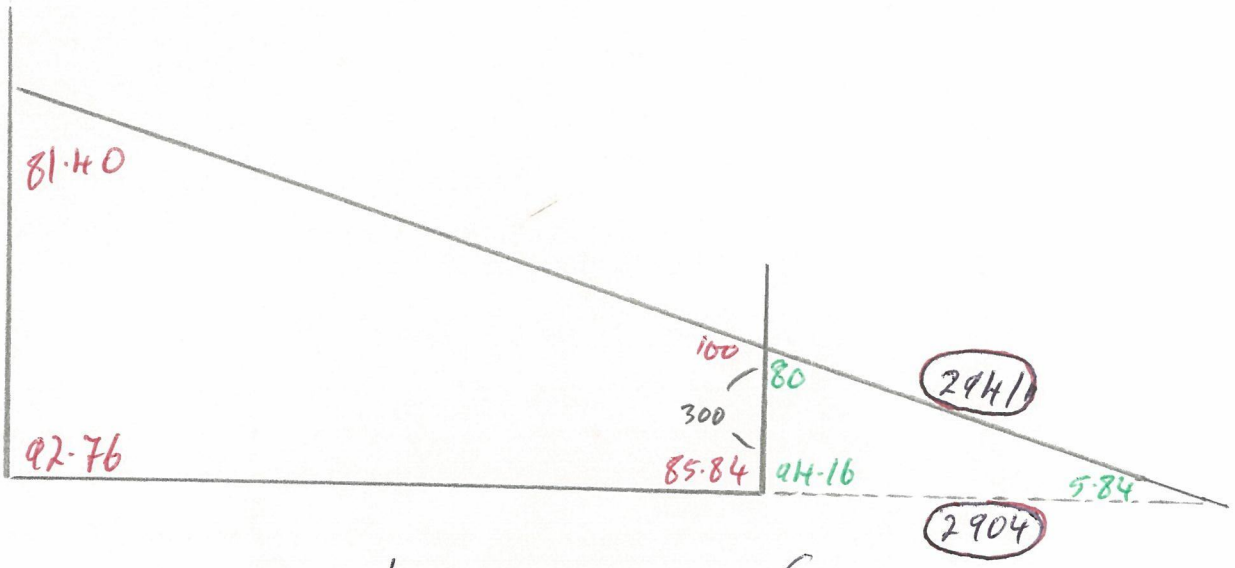
or

$$90.15927147$$

(14)

Q2 (i) + (iii)





$$\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin c}$$

$$\frac{300}{\sin 5.84} = \frac{b}{\sin 80} = \frac{c}{\sin 94.16}$$

$$\frac{300}{0.10175083} = \frac{b}{0.98480775} = \frac{c}{0.997365364}$$

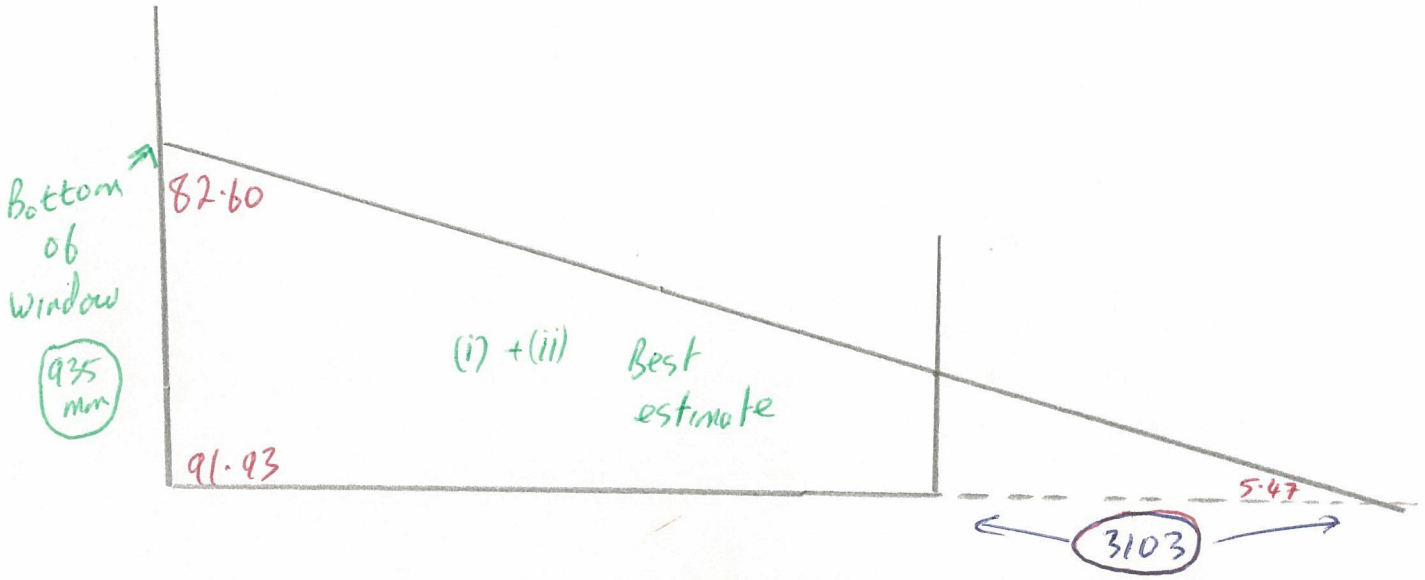
$$b = 2903.586397$$

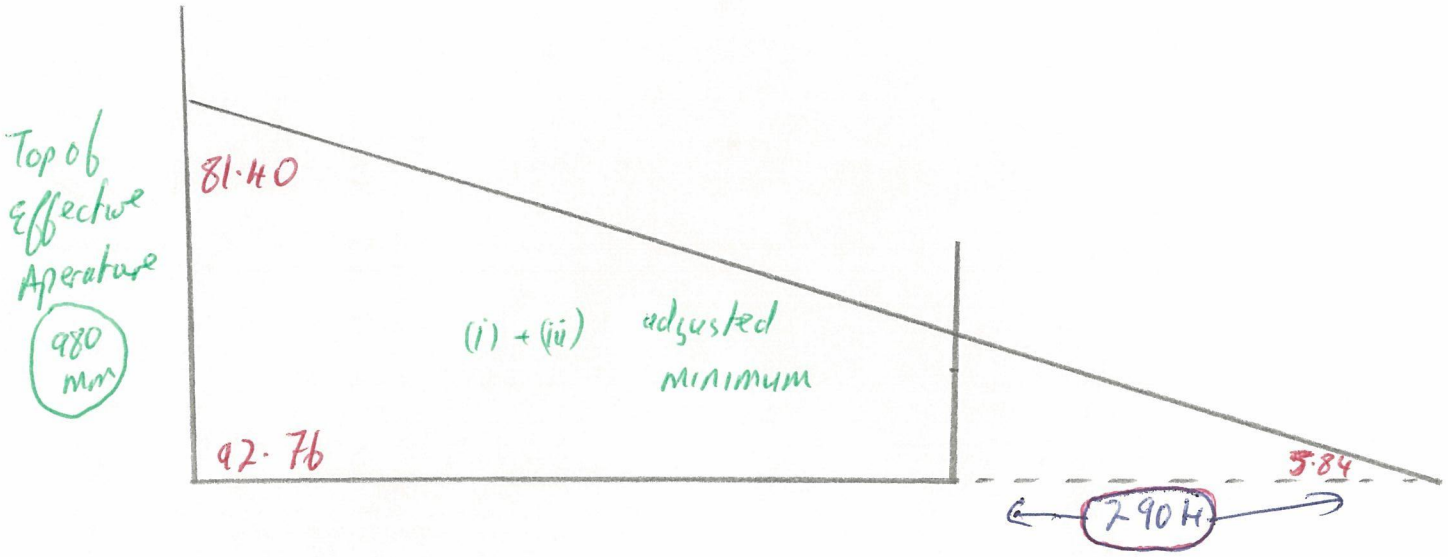
$$c = 2940.610993$$

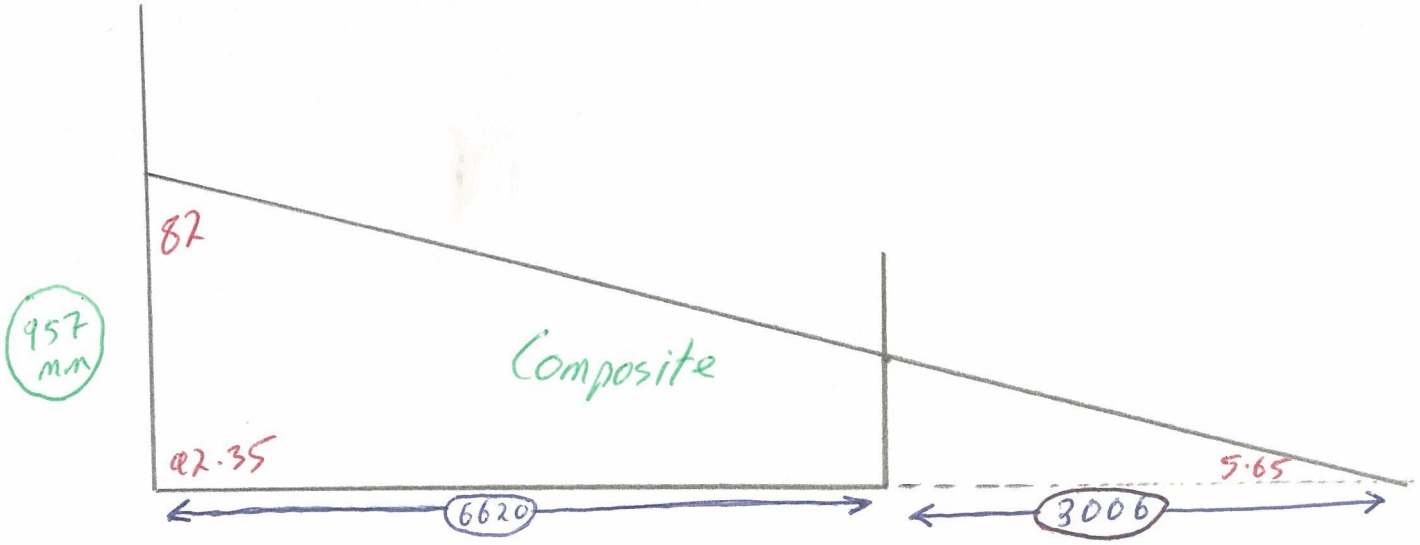
Composite of Proofs Q2

Q2 (i) + (ii)

Q2 (ii) + (iii)



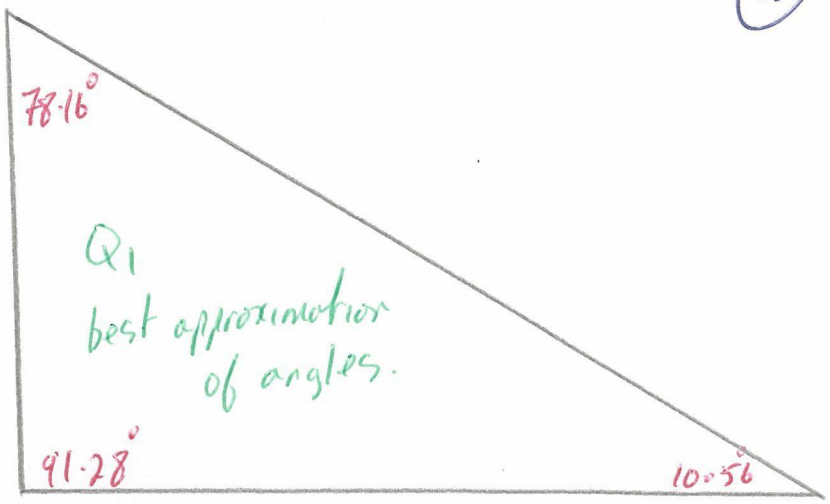


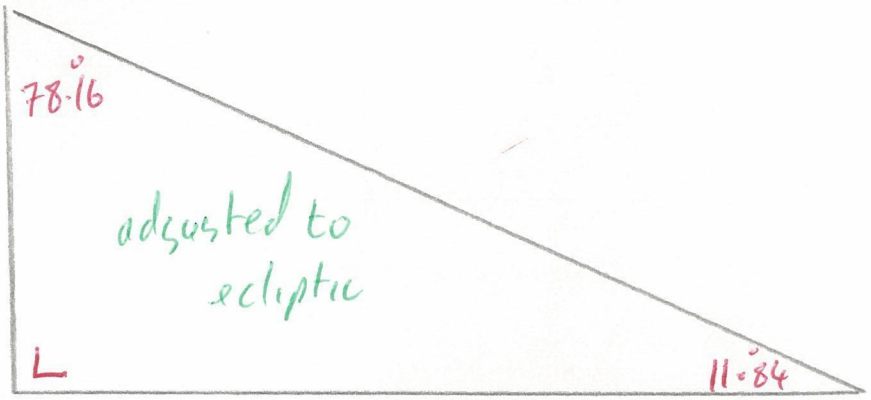


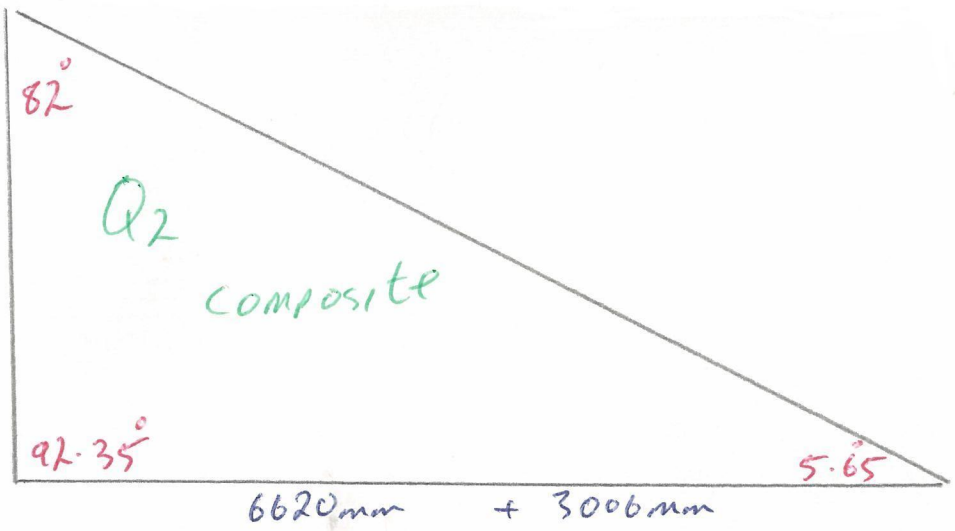
$$\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin c}$$

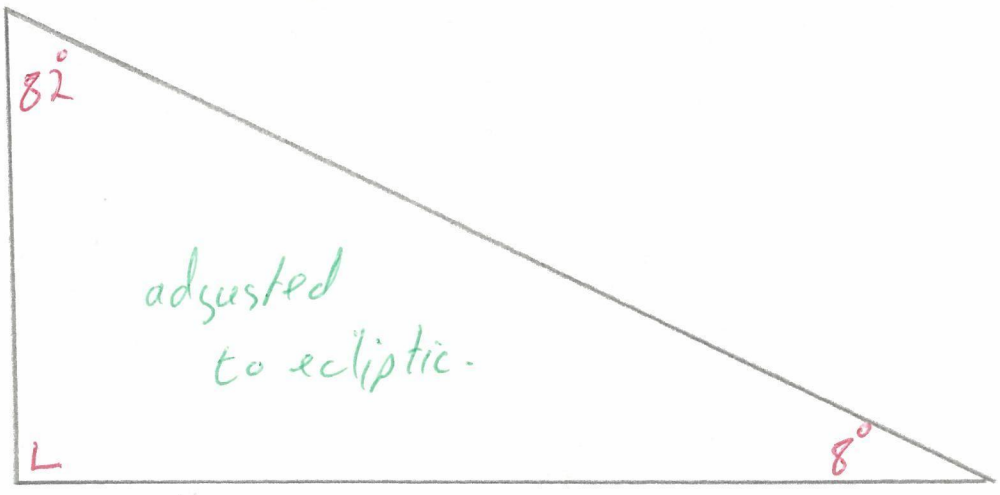
$$\frac{957}{\sin 5.65} = \frac{b}{\sin 82} \Rightarrow b = 9625.936326$$

Proof of Q3 (1)


78·16°
Q1
best approximation
of angles.
91·28°
10·56°


78·16°
adjusted to
ecliptic
L
11·84°


82°
Q2
composite
92·35°
5·65°
6620mm + 3006mm


82°
adjusted
to ecliptic.
L
8°

Proof of Question 3 (ii)

Adjusted to ecliptic $Q_1 - Q_2 =$

$11.84^\circ - 8^\circ =$ **3.84°**

Q_1 (best approximation) $-$ Q_2 (composite)

$10.56^\circ - 5.65^\circ = 4.91^\circ$

However if we rather unfairly adjust the Q_2 composite of the Pave so that its largest angle becomes 91.28° and apply this adjustment in full to the angle which measures the declination of the Sun our calculation becomes

$10.56 - 6.72 =$ **3.84**

$92.35 \Leftrightarrow Q_2$ composite

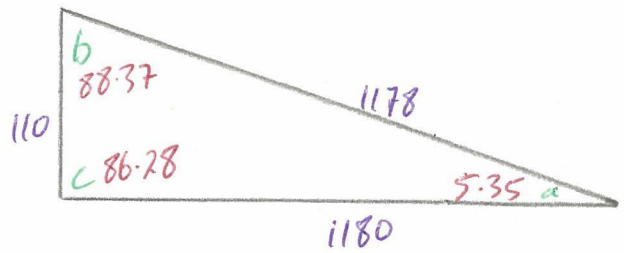
$91.28 \Leftrightarrow Q_1$ Approx $\longleftrightarrow 5.65$

$1.07 \Leftrightarrow$ Adjustment $\Leftrightarrow 1007$

6.72

We can conclude therefore that if the hypothesis is correct, the Sun would have appeared 3.84° lower in the sky (or greater) when the Souterrain was constructed than it does now.

Proof of Q5 (i)



$a^2 = b^2 + c^2 - 2.b.c.\cos A$

$110^2 = 1180^2 + 1178^2 - 2.1180.1178\cos A$

$12100 = 1392400 + 1387684 - 2780080\cos A$

$2780080\cos A = 2767984$

$\cos A = 0.995649046$

$A = 5.346720287$

$\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin c}$

$\frac{110}{\sin 5.346720287} = \frac{1180}{\sin b} = \frac{1178}{\sin c}$

$\frac{110}{0.093182493} = \frac{1180}{\sin b} = \frac{1178}{\sin c}$

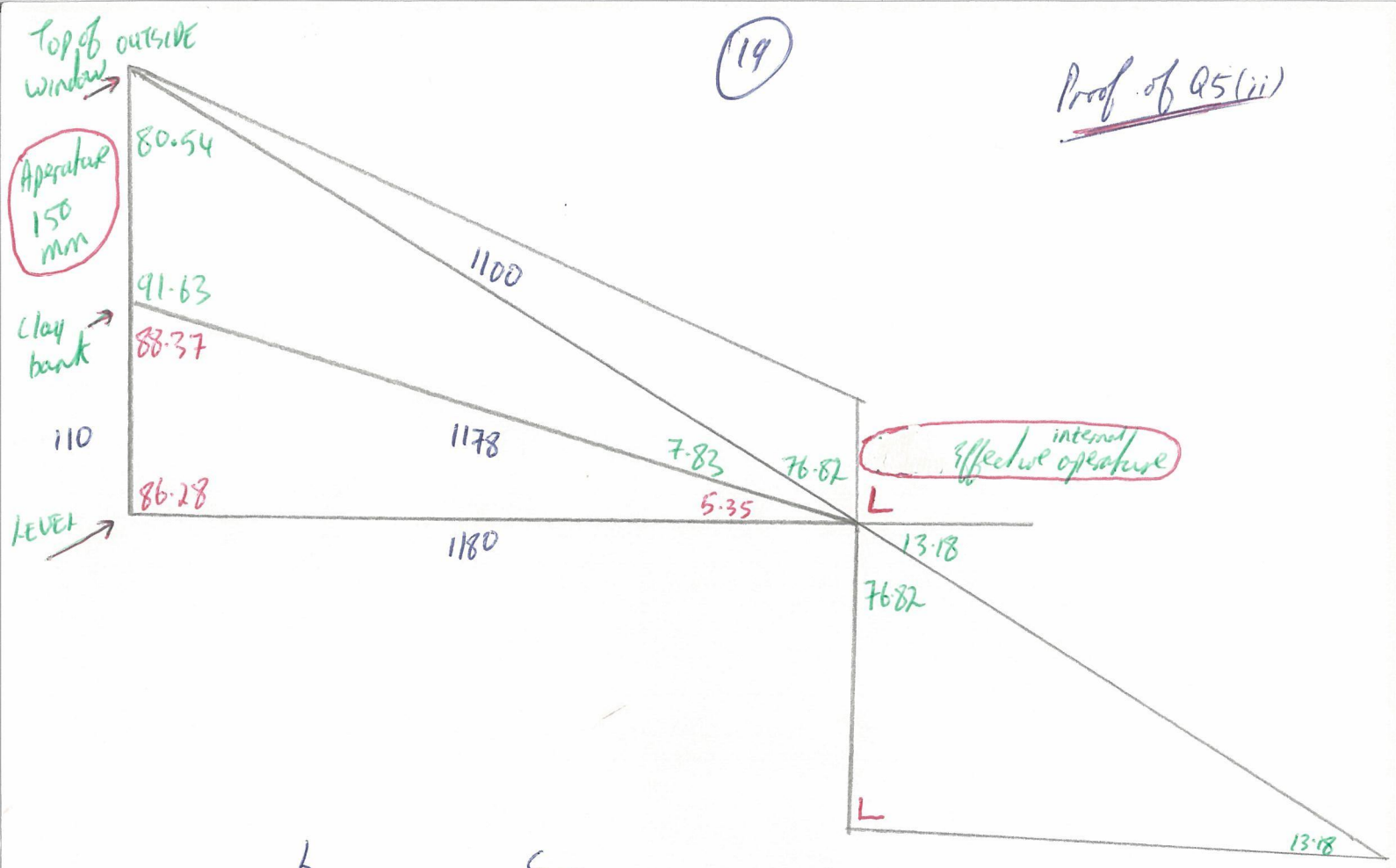
$\sin b = 0.999594015$

$b = 88.36729817$

$\sin C = 0.997899788$

86.28597206

Proof of Q5(ii)



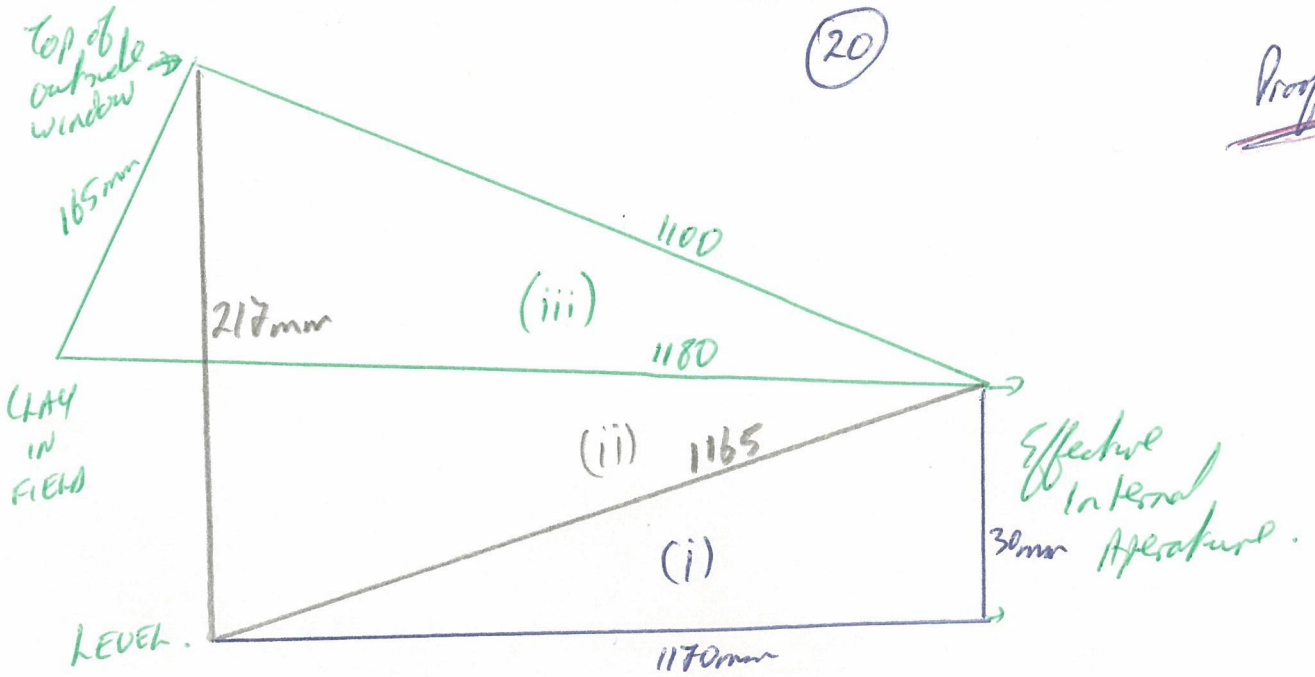
$$\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin c}$$

$$\frac{1100}{\sin 91.63} = \frac{150}{\sin b} = \frac{1178}{\sin C}$$

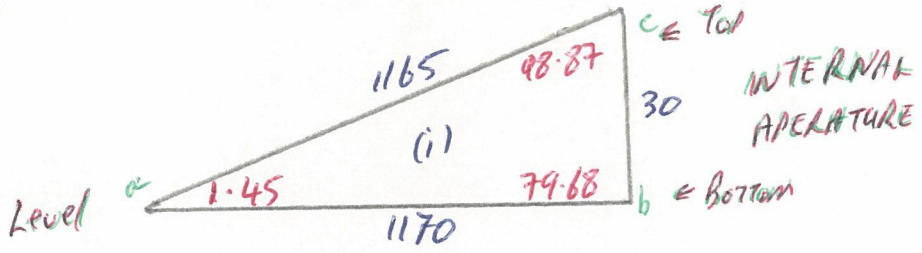
$$\frac{1100}{0.999595358} = \frac{150}{\sin b} = \frac{1178}{\sin C}$$

$$\sin b = 0.136308457$$
$$b = 7.834288472$$
$$\sin C = 1.070475756$$
$$C = \text{not defined}$$
$$C = 180 - 91.63 - 7.83$$
$$C = 80.54$$

Proof of Q7(i)



Triangle (i)



$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$30^2 = 1165^2 + 1170^2 - 2.1165.1170 \cos A$$

$$900 = 1357225 + 1368900 - 2726100 \cos A$$

$$2726100 \cos A = 2725225$$

$$\cos A = 0.999679028$$

$$A = 1.451718403$$

$$\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin c}$$

$$\frac{30}{0.025334555} = \frac{1165}{\sin b} = \frac{1170}{\sin c}$$

$$\sin b = 0.983825025$$

$$b = 79.680787 05$$

$$\text{or } b = 100.319213$$

$$\sin C = 0.988047645$$

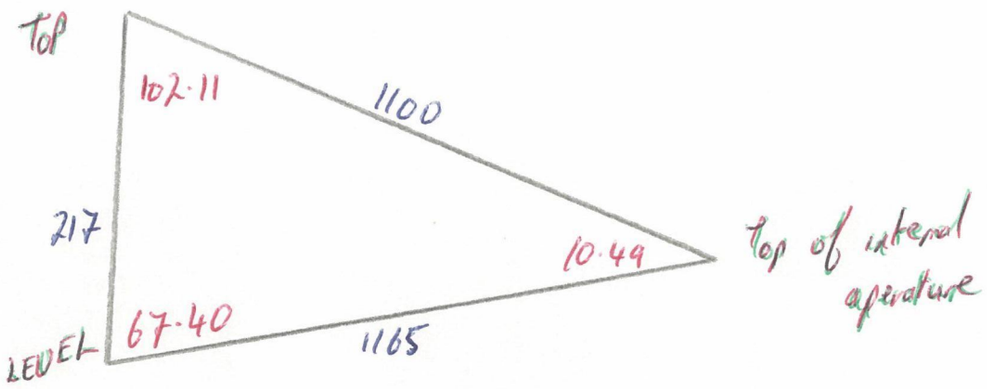
$$C = 81.132567 46$$

or

$$C = 98.867432 54$$

Proof of Q7(ii)

Triangle (ii) + (iii)



$$a^2 = b^2 + c^2 - 2.b.c.\cos A.$$

$$217^2 = 1100^2 + 1165^2 - 2.1100.1165 \cos A$$

$$47089 = 1210000 + 1357225 - 2563000 \cos A$$

$$2563000 \cos A = 2520136$$

$$\cos A = 0.983275848$$

$$A = 10.49341398$$

$$\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin c}$$

$$\frac{217}{0.182122501} = \frac{1100}{\sin b} = \frac{1165}{\sin c}$$

$$\sin b = 0.92320162$$

$$b = 67.39871829$$

or

$$b = 112.601282$$

$$\sin c = 0.977754 44$$

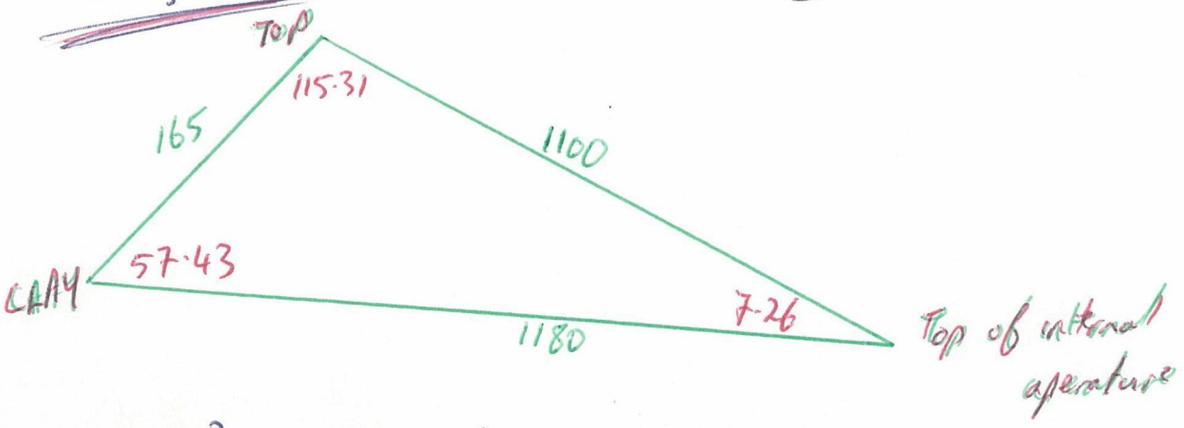
$$c = 77.89213163$$

or

$$c = 102.1078684$$

Triangle (iii)

Proof of Q7(iii)



$$a^2 = b^2 + c^2 - 2.b.c.\cos A$$

$$165^2 = 1100^2 + 1180^2 - 2.1100.\cos A.1180$$

$$27225 = 1210000 + 1392400 - 2596000\cos A$$

$$2596000\cos A = 2575175$$

$$\cos A = 0.991978043$$

$$A = 7.262205657$$

$$\frac{a}{\sin a} = \frac{b}{\sin b} = \frac{c}{\sin C}$$

$$\frac{165}{0.126410292} = \frac{1100}{\sin b} = \frac{1180}{\sin C}$$

$$\sin b = 0.842735528$$

$$b = 57.43009566$$

or

$$b = 122.5699043$$

$$\sin C = 0.904025118$$

$$C = 64.69230132$$

or

$$C = 115.3076987$$

Proof of Q7 (iv)

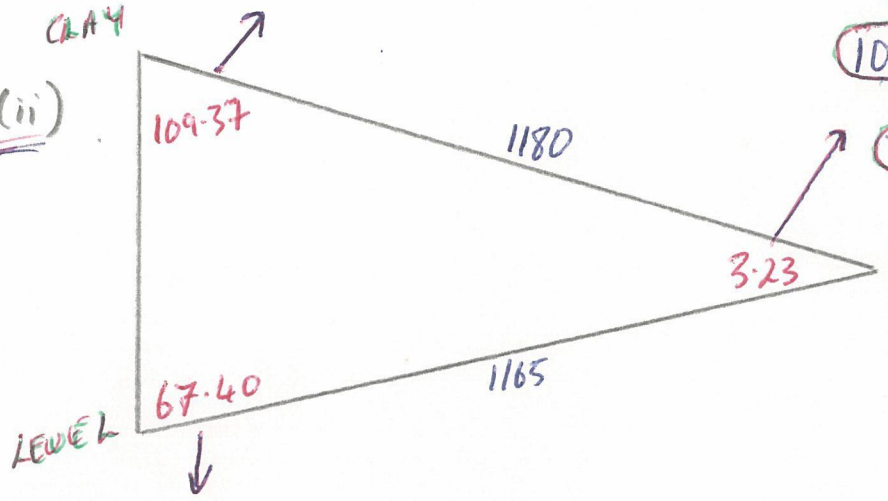
Proof of Q7 (ii) + (iii)

10·49

minus

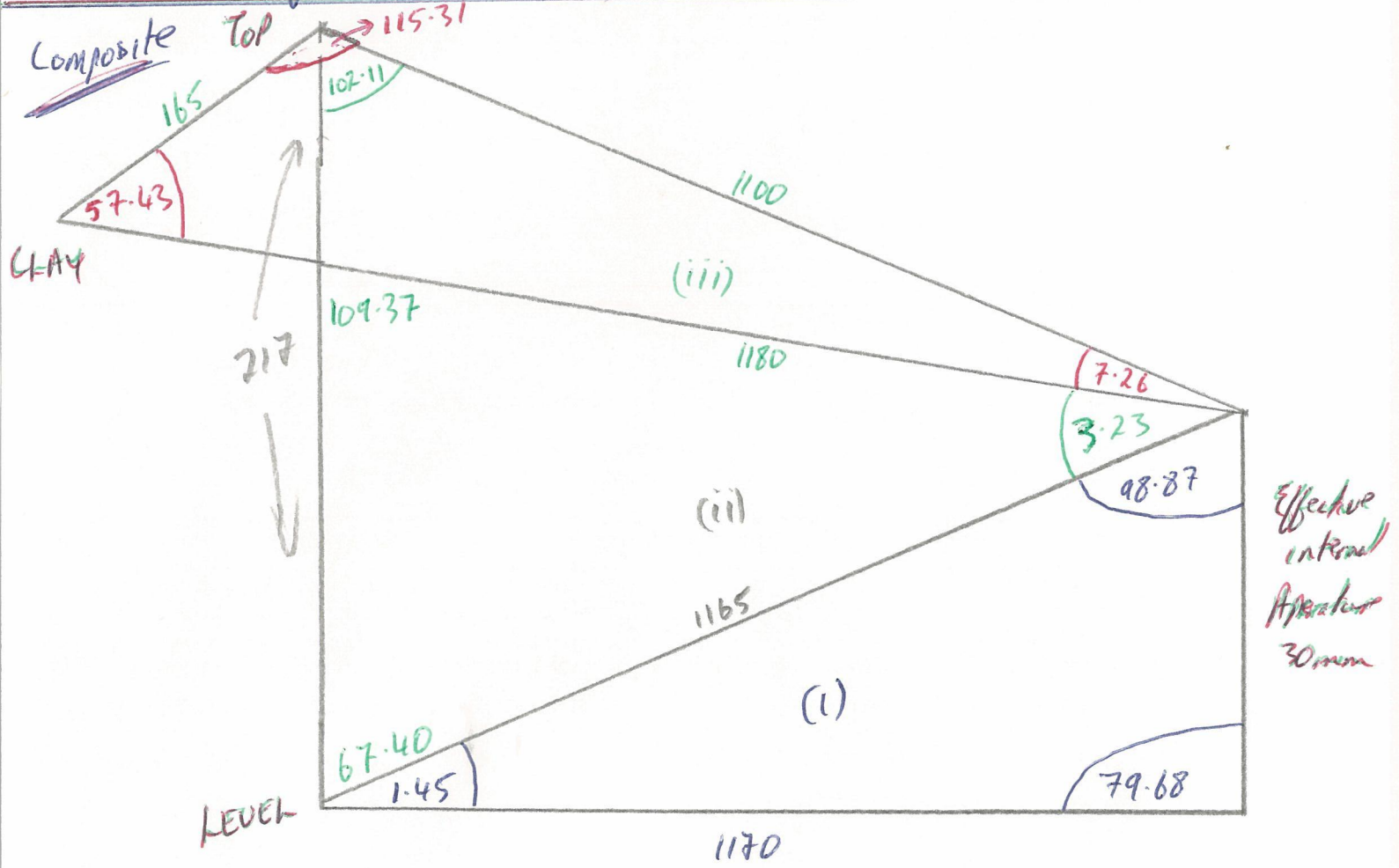
7·26 Proof of Q7 (iii)

Triangle (ii)

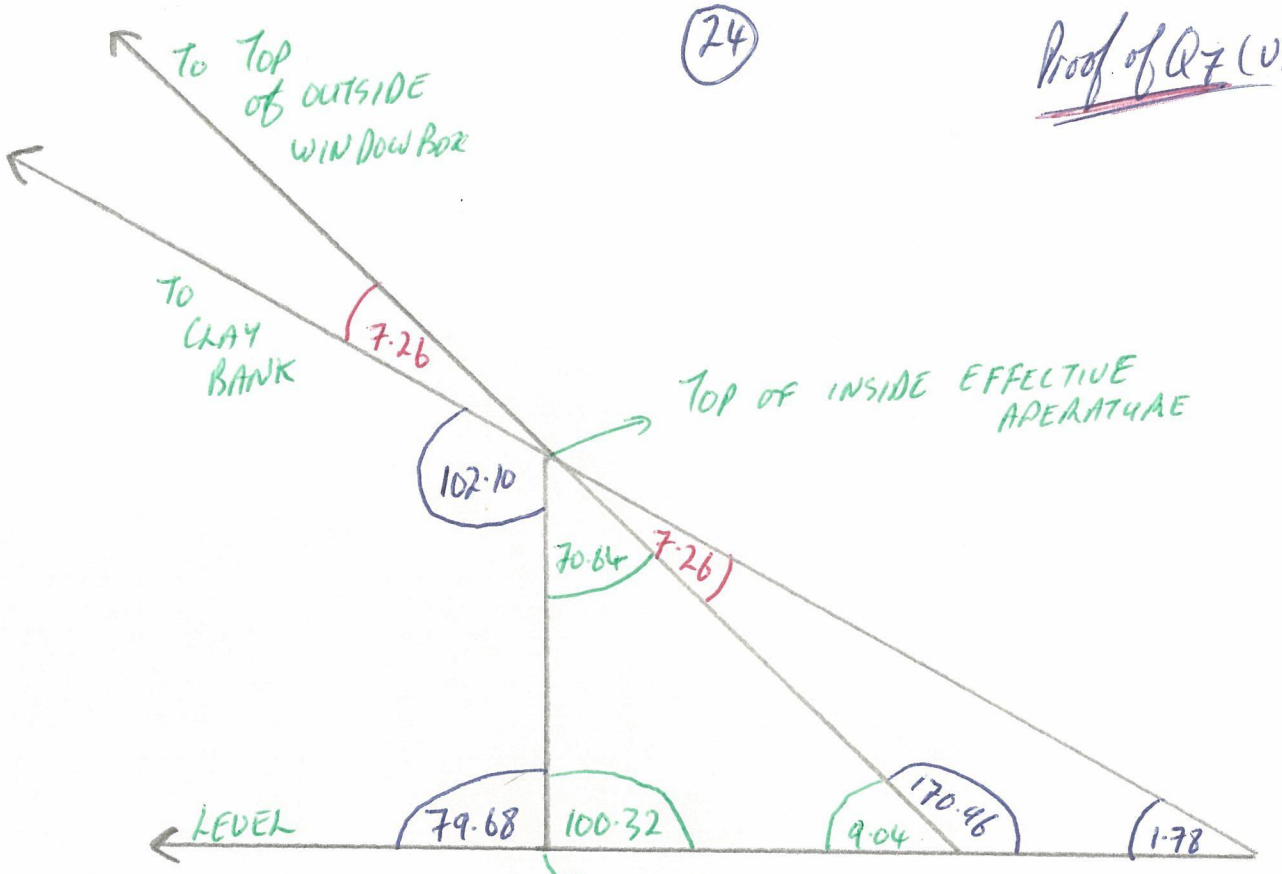


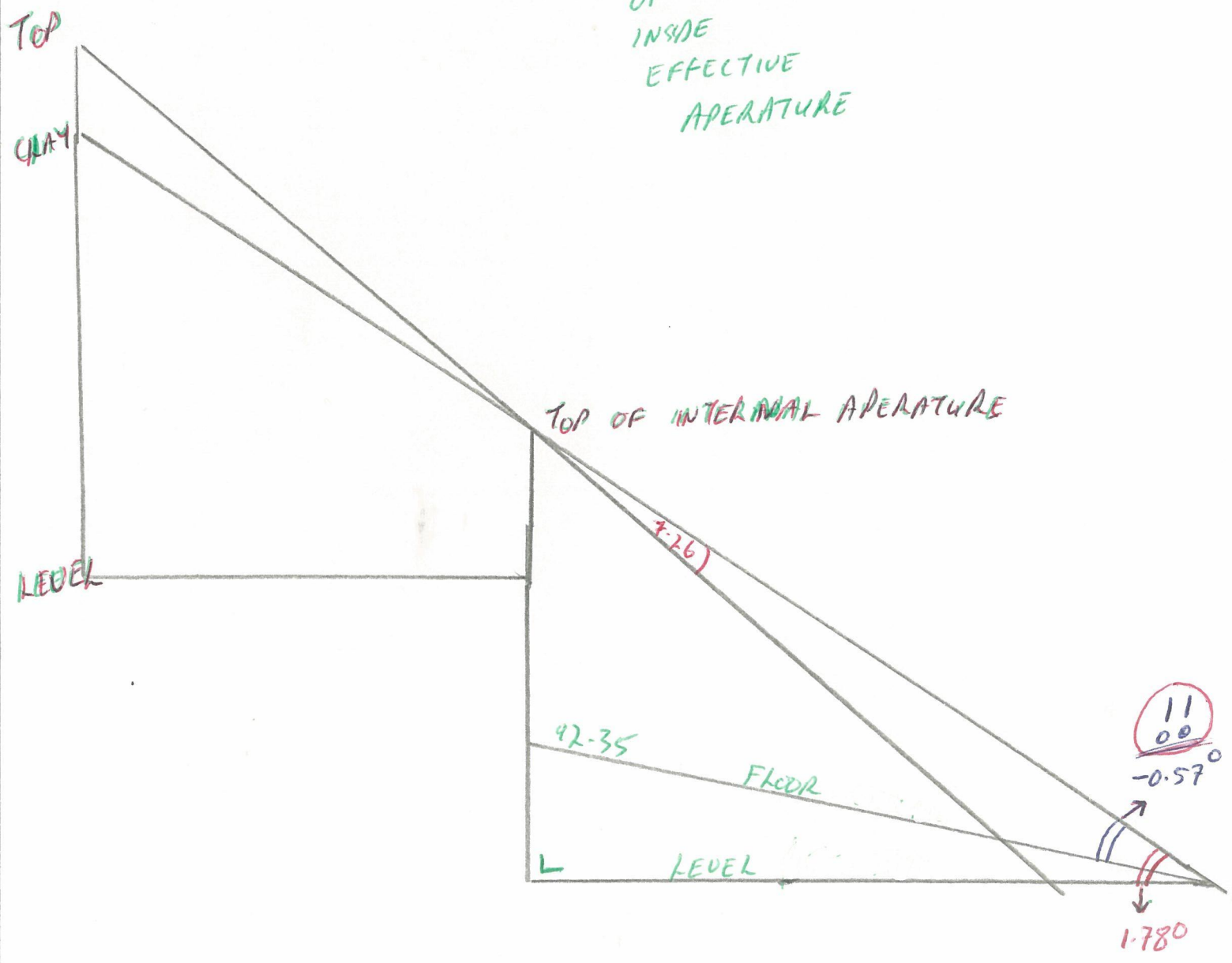
from Proof of Q7 (ii)

Composite



Proof of Q7 (v)


To Top of OUTSIDE WINDOW BOX
To CLAY BANK
7·26
Top of INSIDE EFFECTIVE APERATURE
102·10
70·64
7·26
LEVEL
79·68
100·32
170·96
9·04
1·78
Bottom OF INSIDE EFFECTIVE APERATURE


TOP
CLAY
Top of INTERNAL APERATURE
7·26
LEVEL
42·35
FLOOR
LEVEL
-0·57°
1·780

Basic Cave Mathematics.

Conclusions.

As this project has progressed I have become progressively more offended by the presumption that our Ancestors might have lived in caves,

THEY BUILT CAVES

And the caves they built were not only precision instruments ,but were engineered to withstand the tests of time and remain functional throughout (despite planetary adjustments).

A testament to this level of expertise in the building alone of TonroeSouterrain is that despite the passage of a lot of time the lower limit of the beam of light allowed to enter the cave as defined by the level of the field outside has not changed relative to lower part of the internal window to the cave or relative to the floor of the cave. It defies subsidence.

It would be better if the measurements could be taken using Laser Technology and analysed by Professional Mathematicians.

One of the minor vagaries which would be eliminated by the more accurate Laser measurements would be the difference in the internal effective aperatures used in Questions 2 and 7 (45mm and 30mm respectively);thankfully this discrepancy made both more difficult to prove and added to the veracity of the answers.

However it is certain that there are other minor discrepancies in this section given that the work was done on different days with low technology instrumentation.

For the greater part this section has addressed the function of the Souterrain in one dimension /plane only. It is important to remember however that TonroeSouterrain is a three (and arguably four dimensional)structure which operates/functions at all these levels.