

Eratosthenes

in 360 Big European Solar Tour

Summer Solstice 2020

14 June -23 June

Click to find details on:
[Eratosthenes method](#)
[Your way to follow Eratosthenes](#)
[The working process to follow](#)

[Type the name of your school](#)
[in this table](#) (Click)
[to register your school to this](#)
[collaborative activity](#) and to
inform you for your time of
measurement ([local solar noon](#))

JUNE SOLSTICE 2020

Eratosthenes experiment

in the eTwinning project 2019-2020

“360 Big European Solar Tour”

Participation of 11 Schools: 10 Europeans and 1 Latin American
(Colombian-guest teacher in eTwinning),

with 37 measurements (13-23 June 2020)

Collaborative activity in the frame of the 1st (STEM) axis

Eratosthenes method
in June solstice

Eratosthenes method

1. Eratosthenes had **MEASURED THE SHADOW OF his GNOMON** and he calculated angle α

Angle $\alpha = \arctan(\text{shadow length} / \text{gnomon height})$

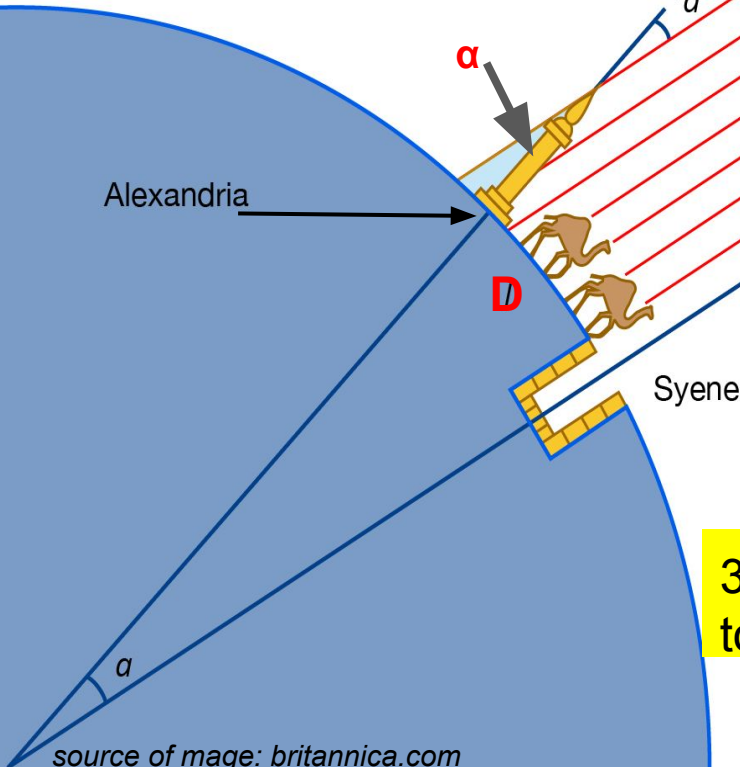
from Sun

**Tropic of Cancer has NO shadow in summer solstice at solar noon*

2. He got the **Distance D** among Alexandria and Syene (Syene at that time was at the Tropic of Cancer)

3. The **Circumference C** of the Earth according to Eratosthenes data on June solstice:

$$C = \frac{360 \cdot D}{\alpha}$$



source of mage: britannica.com

Following his steps

1. YOU HAVE MEASURED
THE SHADOW OF YOUR GNOMON

Angle $\alpha = \arctan(\text{shadow length/gnomon height})$

Use this to calculate angle α after your measurement

**YOUR
CALCULATIONS FOR
SUMMER SOLSTICE
following
Eratosthenes method**

2. Your distance from Tropic of Cancer * is $\text{Distance} = ((\text{your latitude}) - 23.44) * 111.1$

**Tropic of Cancer has NO shadow in summer solstice at solar noon and has Latitude=23.44°N*

For example Petroupoli's Latitude=38.036

Distance(Petroupoli-Tropic of Cancer)=(38.036-23.44)*111.1=1622km

3. Circumference C of the Earth according to your data on June solstice:

$$C = \frac{360 * D}{\alpha}$$

Our working process
in 360 Big European Solar Tour
for Eratosthenes experiment

Working process

BEFORE THE MEASUREMENT

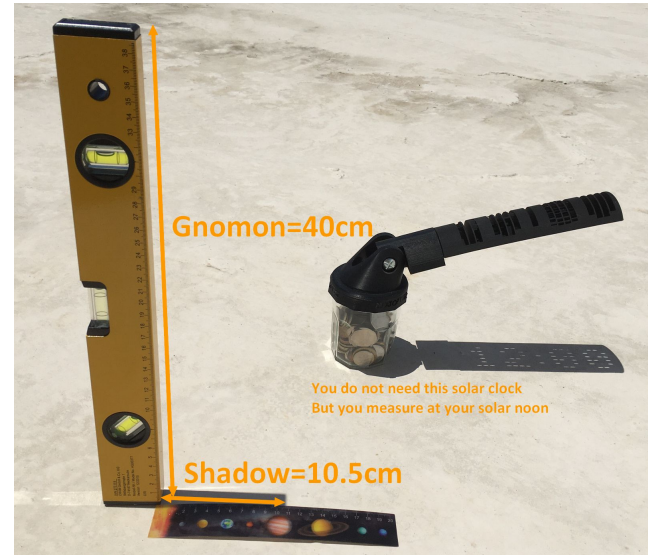
1. **Look at the [table to find your solar noon](#)** (when the sun is over your longitude that day and the shadow of any object is the shortest)
2. **Choose an object that you will use as gnomon (you will measure the shadow of this object at solar noon)**
It can be any object but prefer one that stands vertical easily and gives a clear shadow

10 mins before solar noon go to a sunny FLAT ground

1. **Set your gnomon VERTICAL to the ground**
2. **Measure the shadow of your gnomon at solar noon** (better to also have some measurements some minutes before and some minutes after solar noon as well)
3. **Take some photos of your measurement**

AFTER the measurement and as soon as possible

1. [Fill the table](#)
2. [Upload your photos in this google slide](#) in any [empty page](#)
3. **Worst case: if you can not upload then email your data (date-time-gnomon height-shadow length) and your photos to your teacher**



Participating schools data

Partners have to add school's name only
and some hours later to check for the time
of solar noon at their town

Town	Country	Name of the school	Longitude(°N)	Latitude(°E)	Solar noon (local time)
Lafrancaise	France	College Antonin Perbosc	44.127	1.237	13:56
Petroupoli	Greece	4th Junior High School of Petroupoli	38.036	23.674	13:27
Garmisch-Partenkirchen	Germany	St.-Irmengard-Gymnasium	47.493	11.102	13:17
Ioannina	Greece	Collège Modèle Zosimaias Scholis	39.655	20.846	13:38
Ioannina	Greece	7th Junior High School	39.653	20.852	13:38
Agiasos	Greece	Agiasos Junior High School	39.085	26.371	13:15
Dorohoi	Romania	National College "Grigore Ghica"	47.953	26.394	13:16
Salcuta	Moldova	High School "Mesterul Manole"	46.599	29.248	13:04
Lozova	Ukraine	Lozova Secondary School	48.881	36.291	12:36
Khust	Ukraine	Khust school № 3	48.185	23.293	13:29
Guarne	Colombia	Grupo Astrofánaticos	6.274	-75.447	12:03

Data from our measurements
(Partners add their measurement
in this section)

Measurements

School	Date dd/06/2020	Time of measurement	Gnomon (cm)	Shadow (cm)	Angle	Notes
7th Junior High School of Ioannina	09/06/202	13:42	59.7	17	15.9	presentation
St.-Irmengard-Gymnasium	13/06/2020	13:20	107	48	24.2	Teacher test at home
4th Junior High School of Petroupolis	14/06/2020	13:26	40	10.5	14.7	Teacher test at home
College Antonin Perbosc	14/06/2020	13:55	100	37.9	20.8	Teacher test at home
Grupo Astrofánaticos	16/06/2020	12:03	61	-18.9	-17.2	Teacher at home
Lozova Secondary School № 12	17/06/2020	12:36	60	28.5	25.4	Teacher test from school
National College "Grigore Ghica"	17/06/2020	13:24	132	66	26.6	Teacher at home
National College "Grigore Ghica"	17/06/2020	13:20	158	78	26.3	Teacher at home

Measurements						
School	Date dd/06/2020	Time of measure ment	Gnomon (cm)	Shadow (cm)	Angle	Notes
St.-Irmengard-Gymnasium	17/06/2020	13:15	128	57	24	Teacher at home
4th Junior High School of Petroupolis	17/06/2020	13:26	40	10.4	14.6	By Marina at home
Gymnasium Agiasos	18/06/2020	13:10	80	25	17.4	By Students Maria and Athanasia and fellow teachers
St.-Irmengard-Gymnasium	18-06-2020	13:15	232	104	24.1	Teacher at home
College Antonin Perbosc	18/06/2020	13:55	12.5	4	21.8	Teacher at school
National College "Grigore Ghica" Dorohoi-Lidia measure1	19/06/2020	13:17	53.2	25	25.2	Teacher at home
National College "Grigore Ghica" Dorohoi-Lidia-measure2	19/06/2020	13:15	25	15.7	32.2	Teacher at home

Measurements

School	Date dd/06/2020	Time of measurement	Gnomon (cm)	Shadow (cm)	<u>Angle</u>	Notes
National College "Grigore Ghica" Dorohoi-Alexandra measure1	20/06/2020	13:16	23	14	31.3	Students at home (summer vacations)
National College "Grigore Ghica" Dorohoi-Aexandra measure2	20/06/2020	13:15	17	14	39.5	Students at home (summer vacations)
National College "Grigore Ghica" Dorohoi-Gabriel	20/06/2020	13:17	39	12	17.1	Students at home (summer vacations)
National College "Grigore Ghica" Dorohoi-Lidia measure	20/06/2020	13:16	119	60	26.8	Teacher at home (summer vacations)
National College "Grigore Ghica" Dorohoi-Maria	20/06/2020	13:15	117	64	28.7	Students at home (summer vacations)

Measurements

School	Date dd/06/2020	Time of measurement	Gnomon (cm)	Shadow (cm)	Angle	Notes
Gymnasio Agiasos	21/06/2020	13:15	80	22.5	15.7	Teacher at school (Sunday)
High School "Mesterul Manole"	21/06/2020	13:04	29.5	12	22.1	???
National College "Grigore Ghica" Dorohoi-Lidia measure	21/06/2020	13:18	49.5	29	30.4	Teacher at home
National College "Grigore Ghica" Dorohoi-Maria 1st measure	21/06/2020	13:20	18	10	29.1	Student at home (summer holidays)
National College "Grigore Ghica" Dorohoi-Maria 2nd measure	21/06/2020	13:20	21	11	27.6	Student at home (summer holidays)
Collège Modèle Zosimaias Scholis Ioannina	21/06/2020	13:40	100	28.8	16.1	Teacher at home

Measurements

School	Date dd/06/2020	Time of measurement	Gnomon (cm)	Shadow (cm)	Angle	Notes
4th Junior High School of Petroupoli	21/06/2020	13:25	40	10.4	14.6	Teacher at home
4th Junior High School of Petroupoli	21/06/2020	13:37	26.5	7.6	16	Erikaiti student at home Summer Holidays
National College "Grigore Ghica" Dorohoi- 1st measure	22/06/2020	13:15	140	67	25.6	Teacher at home
National College "Grigore Ghica" Dorohoi- 2nd measure	22/06/2020	13:23	29	14	25.8	Teacher at home
St.-Irmengard-Gymnasium 1st measure	22/06/2020	13:17	93	41.5	24	Teacher at home
St.-Irmengard-Gymnasium 2nd measure	22/06/2020	13:17	199	90	24.3	Teacher at home
St.-Irmengard-Gymnasium	23/06/2020	13:18	130	58	24	Teacher at home

Measurements

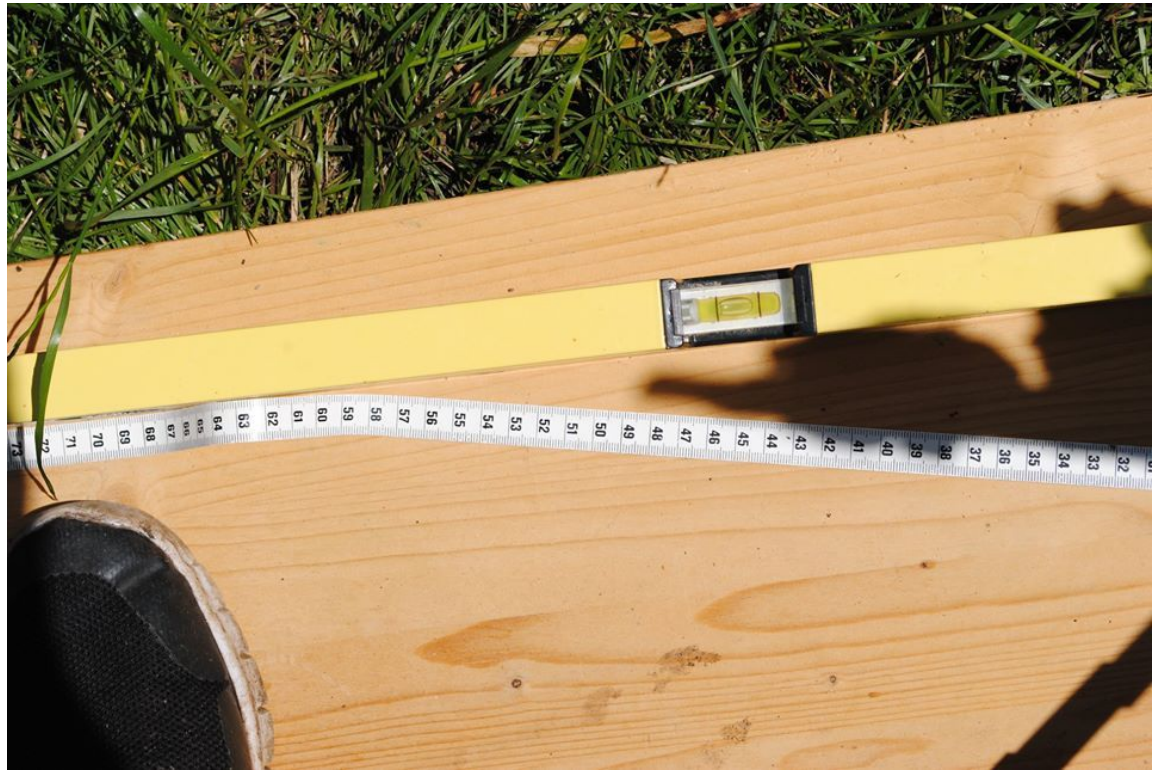
School	Date dd/06/2020	Time of measurement	Gnomon (cm)	Shadow (cm)	Angle	Notes
Khust School No3-Slarka	23/06/2020	12:10	81	28	19.1	Student at home Summer Holidays
Khust School No3-Alex	23/06/2020	12:03	100	34	18.8	Student at home Summer Holidays
Khust School No3-Kristian	23/06/2020	12:05	150	70	25	Student at home Summer Holidays
Khust School No3-Valentyna	23/06/2020	12:00	54	17	17.5	Student at home Summer Holidays

**Photos of our measurements
(partners add photos in this
section)**



09 June 2020

7th Junior High
School of
Ioannina

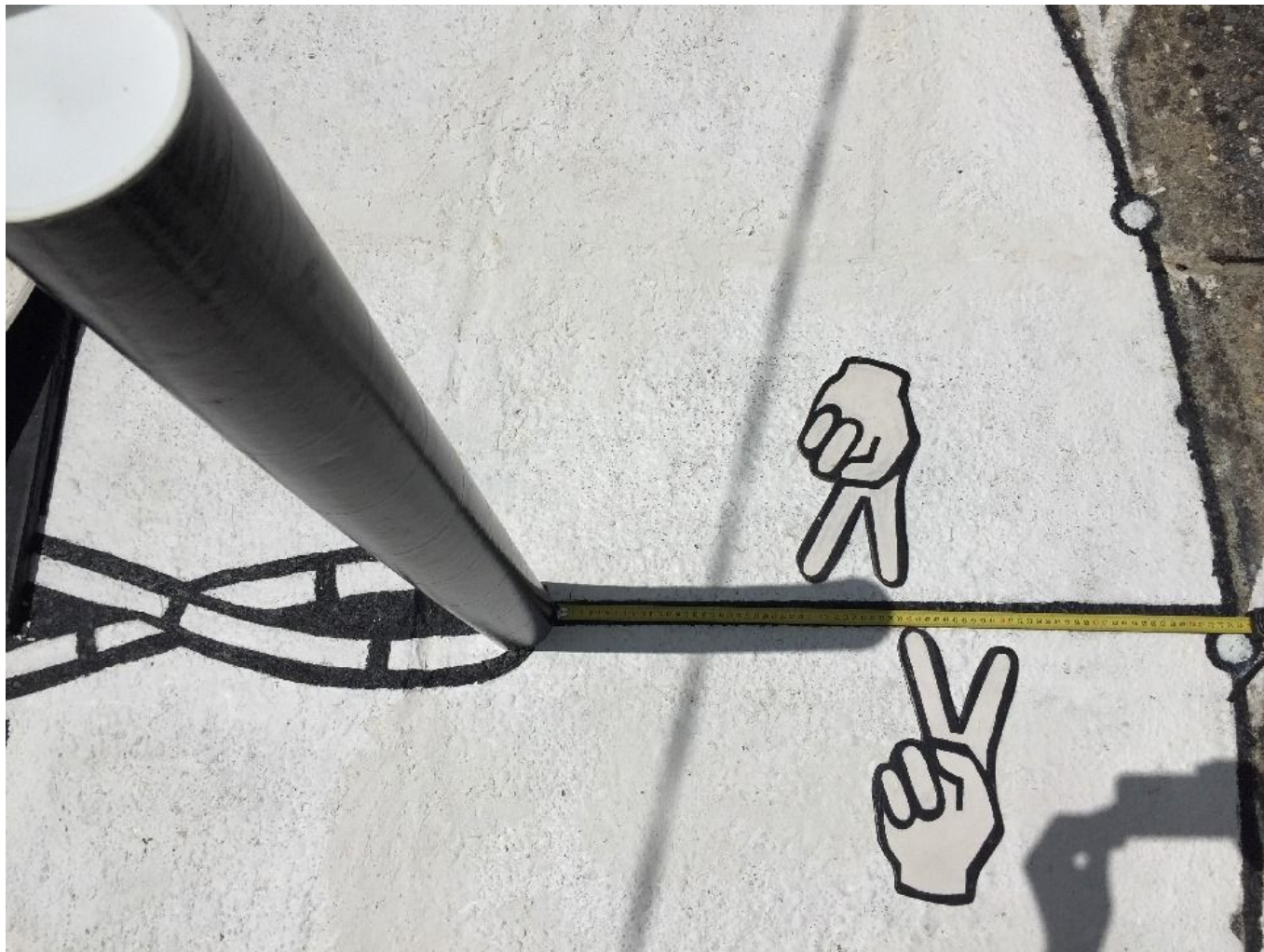


13 June 2020
St.-Irmengard-Gymnasium



14 June 2020

4th Junior High School of Petroupoli




14 June 2020

Collège Antonin
Perbosc



16 June
Grupo Astrofánaticos

A yellow spirit level is positioned vertically on a grey concrete floor. A pink measuring tape is laid out horizontally on the floor, extending from the base of the level towards the right. The background is a textured concrete surface with small stones and some cracks.

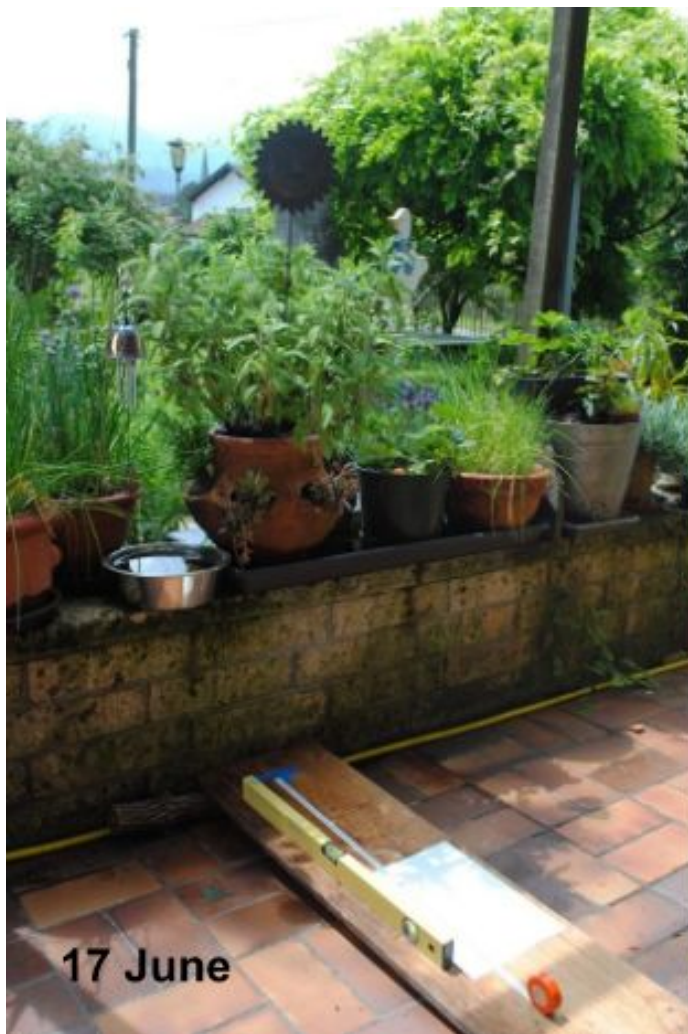
Lozova
Secondary School
№ 12
June, 17 (at 12:36)



Gnomon:132cm
Shadow:66cm
Angle:26.6°

Dorohoï 17 June 2020





17 June
**St.-Irmengard-
Gymnasium**

Gnomon: 128cm

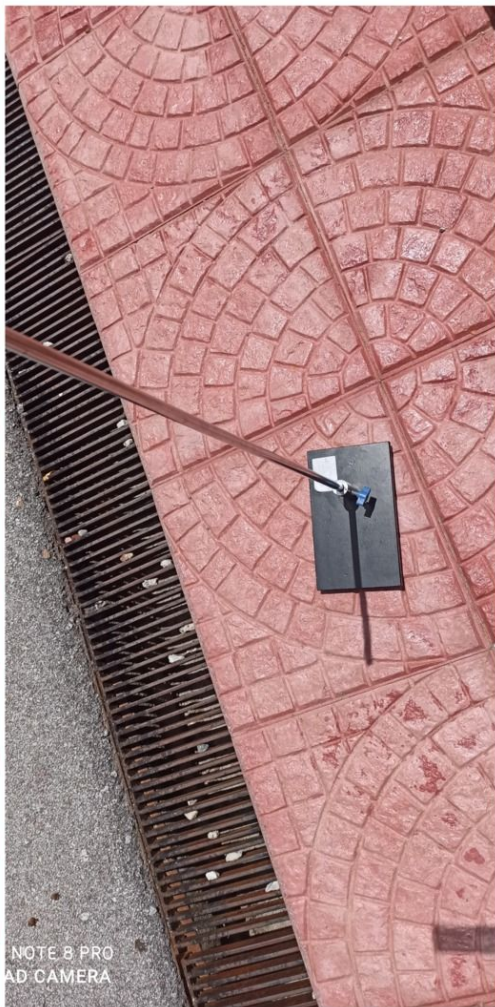
Shadow: 57cm

Angle: 24°

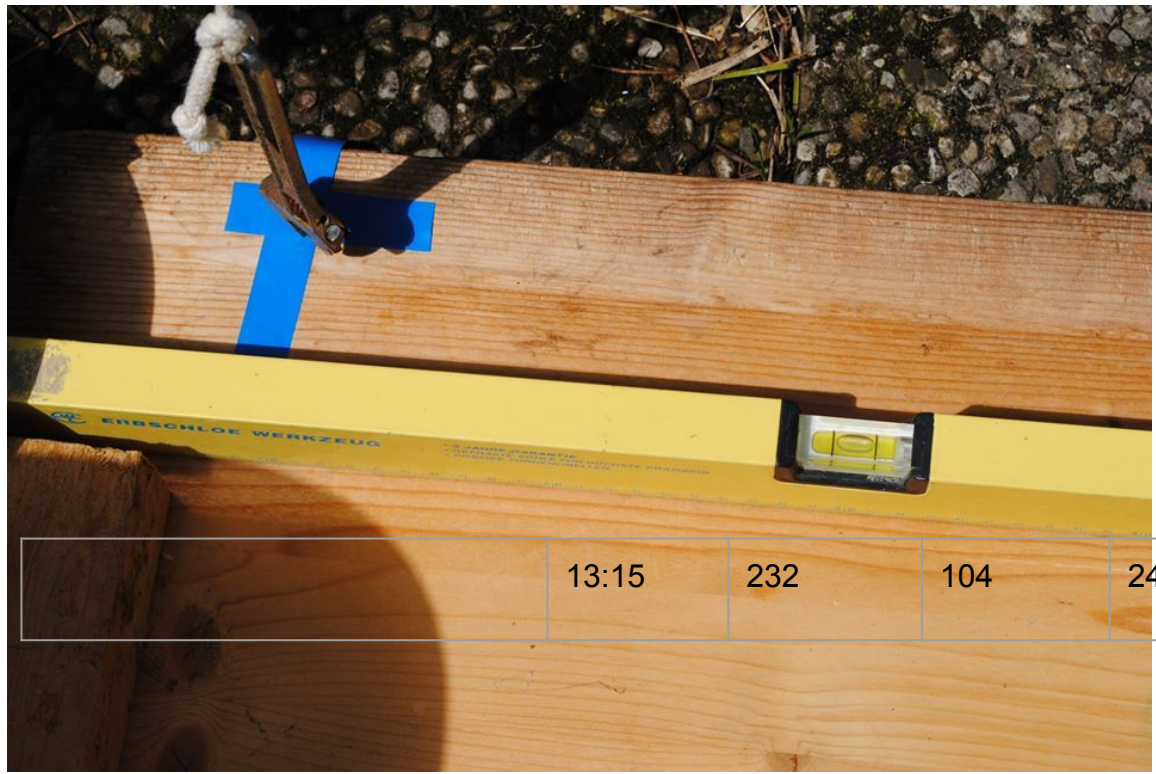


17 June 2020
4th Junior High School of Petroupoli

Gnomon:40cm Shadow:10.4cm
Angle:14.6°



18 June 2020
Gymnasium Agiasos



18 June 2020
Garmisch Partenkirchen
Gnomon: 232cm Shadow:104cm Angle:24.1°



18 June
2020

Collège
Antonin
Perbosc

**National College "Grigore Ghica"
Dorohoi, 19/06/2020**



Measure 1



Measure 2



20/06/2020
Lafrançaise

Gnomon: 100cm
Shadow: 37.8cm
Angle: 20.7°



20/06/2020
National College
"Grigore Ghica"

Dorohoi
student Gabriel

Gnomon:39cm
Shadow:12cm
Angle:17.1°

20/06/2020

National College

"Grigore Ghica"

Dorohoi

student Maria Pintilie

Gnomon: 117cm

Shadow: 64cm

Angle: 28.7°





20/06/2020

**National College
"Grigore Ghica"**

**Dorohoi
student Alexandra
Barbacariu**

**Gnomon: 23cm
Shadow: 14cm
Angle: 31.3°**

20/06/2020

National College "Grigore Ghica"

Dorohoi

Teacher Lidia

Gnomon:119cm

Shadow:60cm

Angle: 26.8°



21/06/2020

Gymnasio Agiasos

Gnomon: 80cm Shadow: 22.5cm

Angle: 15.7°





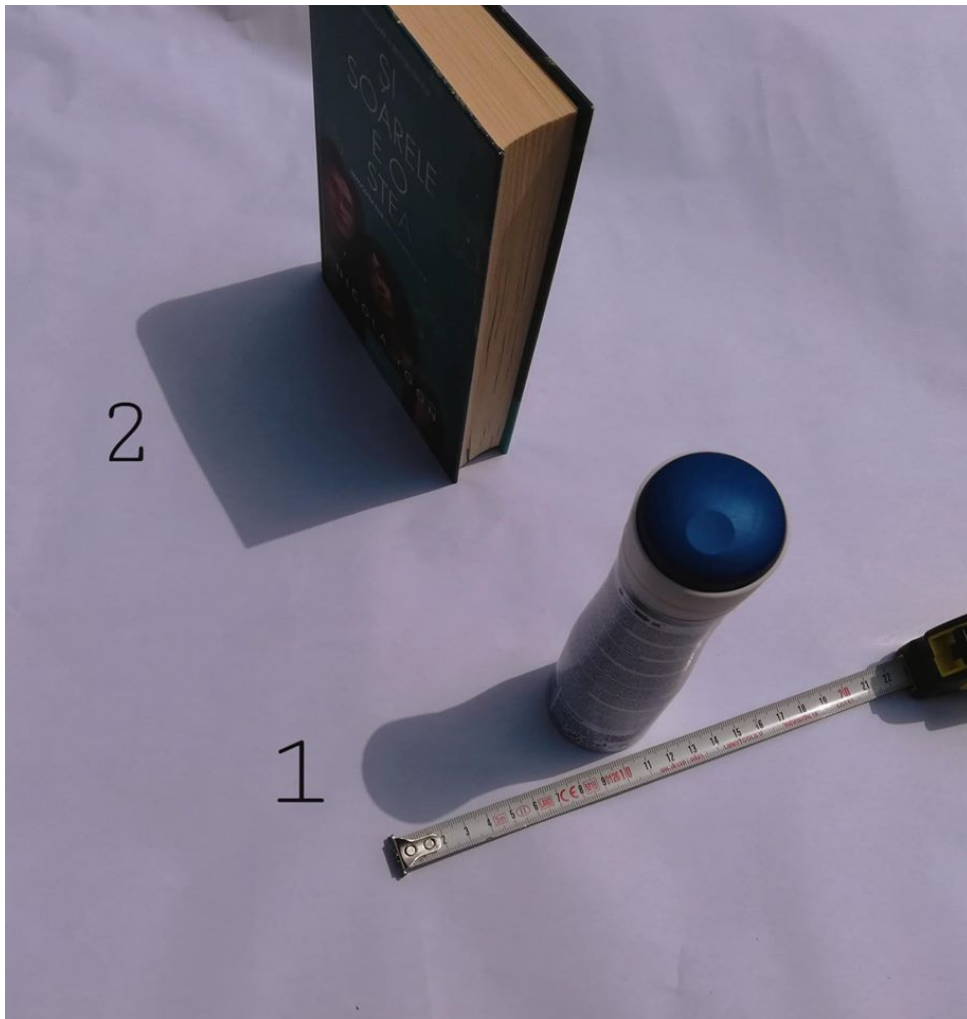
21/06/2020

Dorohoi

Gnomon:49.5cm

Shadow: 29cm

Angle:30.4°



21/06/2020
Dorohoi by Maria

Gnomon1:18cm
Shadow: 10cm
Angle:29.1°

Gnomon(book):21cm
Shadow: 11cm
Angle:27.6°



21/06/2020 Ioannina
Collège Modèle Zosimaias Scholis Ioannina

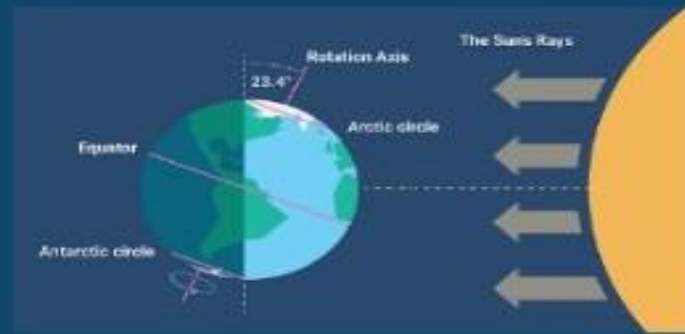
Gnomon:100cm Shadow: 28.8cm Angle:16.1°



21/06/2020
Petroupoli

Gnomon: 40cm
Shadow: 10.4cm
Angle: 14.6°

4rth Junior High
School Petroupolis



Gnomon : 26,5 cm
Time : 13.37 pm
Shadow : 7,6 cm

SUMMER SOLSTICE 2020



By Erikaiti



22.06.2020, noon at
13,15

(26.394 E, 47.953 N)

Gnomon: 140 cm

Shadow: 67 cm

Angle: $25.34=25.574$

Dorohoi, Romania

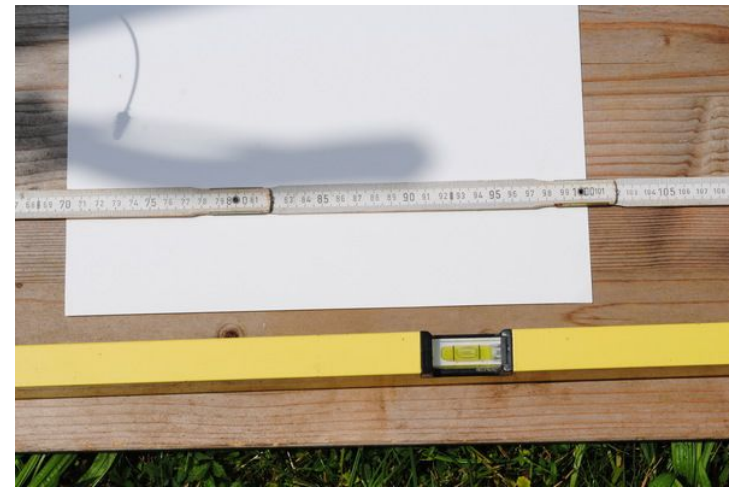


22.06.2020, noon at 13,23

(26.394 E, 47.953 N)

Gnomon: 29 Shadow: 14 cm

Angle: $25.46=25.769$

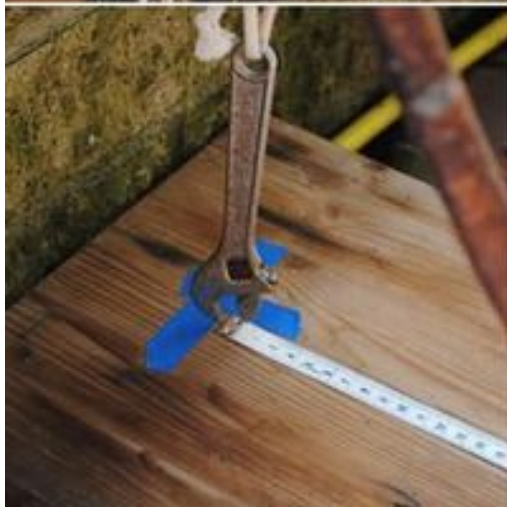


**Garmisch-Partenkirchen 47.493 N
11.102 E, Time 13:15 (Solar noon
13:17 CEST)**

**Gnomon1: 93 cm, Shadow: 41.5
cm, Angle 24.0°**

Time 13:15 (Solar noon 13:17 CEST)

Gnomon2 (mask) 199cm, Shadow 90cm, Angle 24.6°



23-06-2020
Garmisch-Partenkirc
hen

Gnomon: 130cm
Shadow: 58cm
Angle: 24°



23-06-2020
By Slarka at
Khust (12:10)

Gnomon:81cm
Shadow:28cm
Angle: 19.1°

*Students are on
summer vacations,
measurement from
home



23-06-2020

By Alex at Khust
(12:03)

Gnomon: 100cm

Shadow: 34cm

Angle: 18.8°



23-06-2020

By Kristian at Khust
(12:05)

Gnomon: 150cm

Shadow: 70cm

Angle: 25°



23-06-2020

By Valentyna at
Khust (12:00)

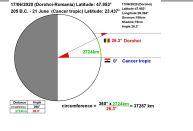
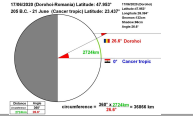
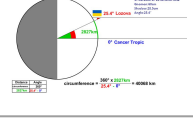
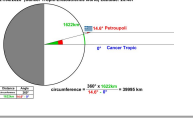
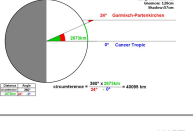
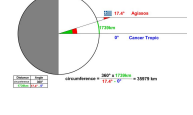
Gnomon: 54cm


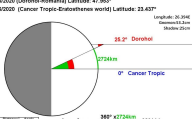
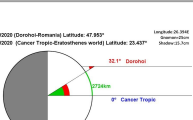

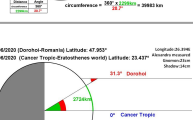
Shadow: 17cm

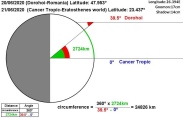
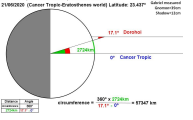
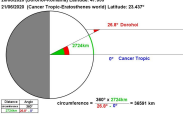
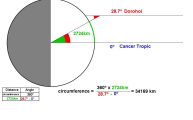
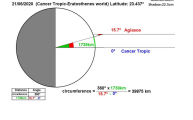
Angle: 17.5°

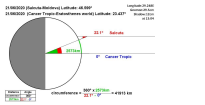
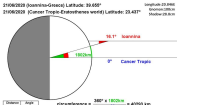
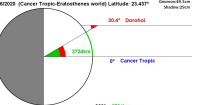


Daily results
from the admins

School	Date	angle α (°)	Distance from Tropic of Cancer (km)	Circumference (km)	Geogebra figure
7th Junior High School of Ioannina	09-06-2020	15.9	1802	40800	<p>09-06-2020 (Ioannina-Greece) Latitude: 38.637° 23.437° - 21 Axis (Cancer tropic) Latitude: 23.437° Ioannina (Greece) Latitude: 38.637° Angle: 15.9° Circumference = $2\pi \times 6371 \text{ km} = 40020 \text{ km}$</p>
St.-Irmengard-Gymnasium	13-06-2020	27.2	2673	39764	<p>13-06-2020 (Garmisch-Gemany) Latitude: 47.467° 23.437° - 21 Axis (Cancer tropic) Latitude: 23.437° Garmisch (Germany) Latitude: 47.467° Angle: 27.2° Circumference = $2\pi \times 6371 \text{ km} = 39764 \text{ km}$</p>
4th Junior High School of Petroupoli	14-06-2020	14.7	1622	39722	<p>14-06-2020 (Petroupoli-Greece) Latitude: 36.020° 23.437° - 21 Axis (Cancer tropic) Latitude: 23.437° Petroupoli (Greece) Latitude: 36.020° Angle: 14.7° Circumference = $2\pi \times 6371 \text{ km} = 39722 \text{ km}$</p>
College Antonin Perbosc	14-06-2020	20.8	2299	39790	<p>14-06-2020 (Lafrespays-France) Latitude: 44.127° 23.437° - 21 Axis (Cancer tropic) Latitude: 23.437° Lafrespays (France) Latitude: 44.127° Angle: 20.8° Circumference = $2\pi \times 6371 \text{ km} = 39790 \text{ km}$</p>
Grupo Astrofánaticos	16-06-2020	-17.2	1907	39914	<p>16-06-2020 (Osaka-Japan) Latitude: 35.68° 23.437° - 21 Axis (Cancer tropic) Latitude: 23.437° Osaka (Japan) Latitude: 35.68° Angle: 17.2° Circumference = $2\pi \times 6371 \text{ km} = 39914 \text{ km}$</p>

School	Date	angle α (°)	Distance from Tropic of Cancer (km)	Circumference (km)	Geogebra figure
National College "Grigore Ghica"	17-06-2020	26.3	2724	37287	
National College "Grigore Ghica"	17-06-2020	26.6	2724	36866	
Lozova Secondary School № 12	17-06-2020	25.4	2827	40068	
4th Junior High School of Petroupoli	17-06-2020	14.7	1622	39995	
St.-Irmengard-Gymnasium	17-06-2020	24	2673	40095	
Gymnasium Agiasos	18-06-2020	17.4	1739	35979	

School	Date	angle α (°)	Distance from Tropic of Cancer (km)	Circumference (km)	Geogebra figure
College Antonin Perbosc	18-06-2020	21.8	2299	37965	
National College "Grigore Ghica" measurement 1	19-06-2020	25.2	2724	38914	
National College "Grigore Ghica" measurement 2	19-06-2020	32.2	2724	30550	
College Antonin Perbosc	20-06-2020	20.7	2299	39983	
National College "Grigore Ghica" Alexandra (measure1)	20-06-2020	31.3	2299	31330	

School	Date	angle α (°)	Distance from Tropic of Cancer (km)	Circumference (km)	Geogebra figure
National College "Grigore Ghica" (Alexandra measure2)	20-06-2020	39.5	2299	24862	
National College "Grigore Ghica" Gabriel	20-06-2020	17.1	2299	57347	
National College "Grigore Ghica" Lidia	20-06-2020	26.8	2299	36591	
National College "Grigore Ghica" Maria	20-06-2020	28.7	2299	34169	
Gymnasio Agiasos	21-06-2020	15.7	1739	39875	

School	Date	angle α (°)	Distance from Tropic of Cancer (km)	Circumference (km)	Geogebra figure
Salcuta	21-06-2020	22.1	2573	41913	
Ioannina Zosimaia	21-06-2020	16.1	1802	40293	
National College "Grigore Ghica" Lidia	21/06/2020	30.4	2724	32258	
National College "Grigore Ghica" Maria (measure1)	21/06/2020	29.1	2724	33699	
National College "Grigore Ghica" Maria (measure2)	21/06/2020	27.6	2724	35530	

School	Date	angle α (°)	Distance from Tropic of Cancer (km)	Circumference (km)	Geogebra figure
4th Junior High School of Petroupoli(Ioanna)	21/06/2020	14.6	1622	39995	
4th Junior High School of Petroupoli(Erikaiti)	21/06/2020	16	1622	36495	
National College "Grigore Ghica" Dorohoi- 1st measure	22/06/2020	25.6	2724	38306	
National College "Grigore Ghica" Dorohoi- 2nd measure	22/06/2020	25.8	2724	38009	
St.-Irmengard-Gymnasium 1st measure	22/06/2020	24	2673	39930	

School	Date	angle α (°)	Distance from Tropic of Cancer (km)	Circumference (km)	Geogebra figure
St.-Irmengard-Gymnasium 2nd measure	22/06/2020	24.3	2673	39437	
St.-Irmengard-Gymnasium	23/06/2020	24	2673	40095	
Khust No3 (Slarka)	23-06-2020	19.1	2750	51832	
Khust No3 (Alex)	23-06-2020	18.8	2750	52600	
Khust No3 (Kristian)	23-06-2020	25	2750	39600	
Khust No3 (Valentyna)	23-06-2020	17.5	2750	56751	

Results in Geometric figures
created by admins

09/06/2020 (Ioannina-Greece) Latitude: 39.653°

205 B.C. - 21 June (Cancer tropic) Latitude: 23.437°

09/06/2020 (Ioannina)

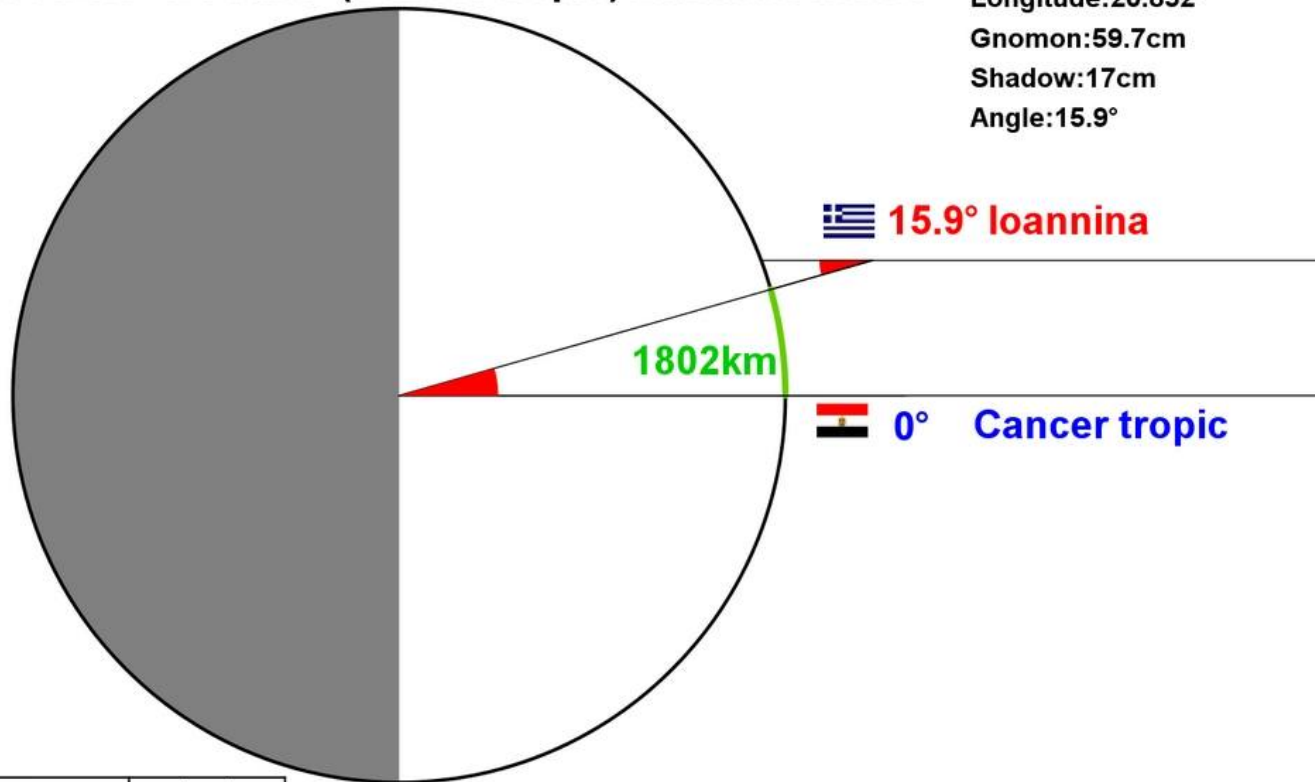
Latitude: 39.653°

Longitude: 20.852°

Gnomon: 59.7cm

Shadow: 17cm

Angle: 15.9°



 15.9° Ioannina

 0° Cancer tropic

Distance	Angle
circumference	360°
1802km	15.9°

$$\text{circumference} = \frac{360^\circ \times 1802\text{km}}{15.9^\circ} = 40800 \text{ km}$$

13/06/2020 (Garmisch-Germany) Latitude: 47.493°

205 B.C. - 21 June (Cancer tropic) Latitude: 23.437°

13/06/2020 (Garmisch)

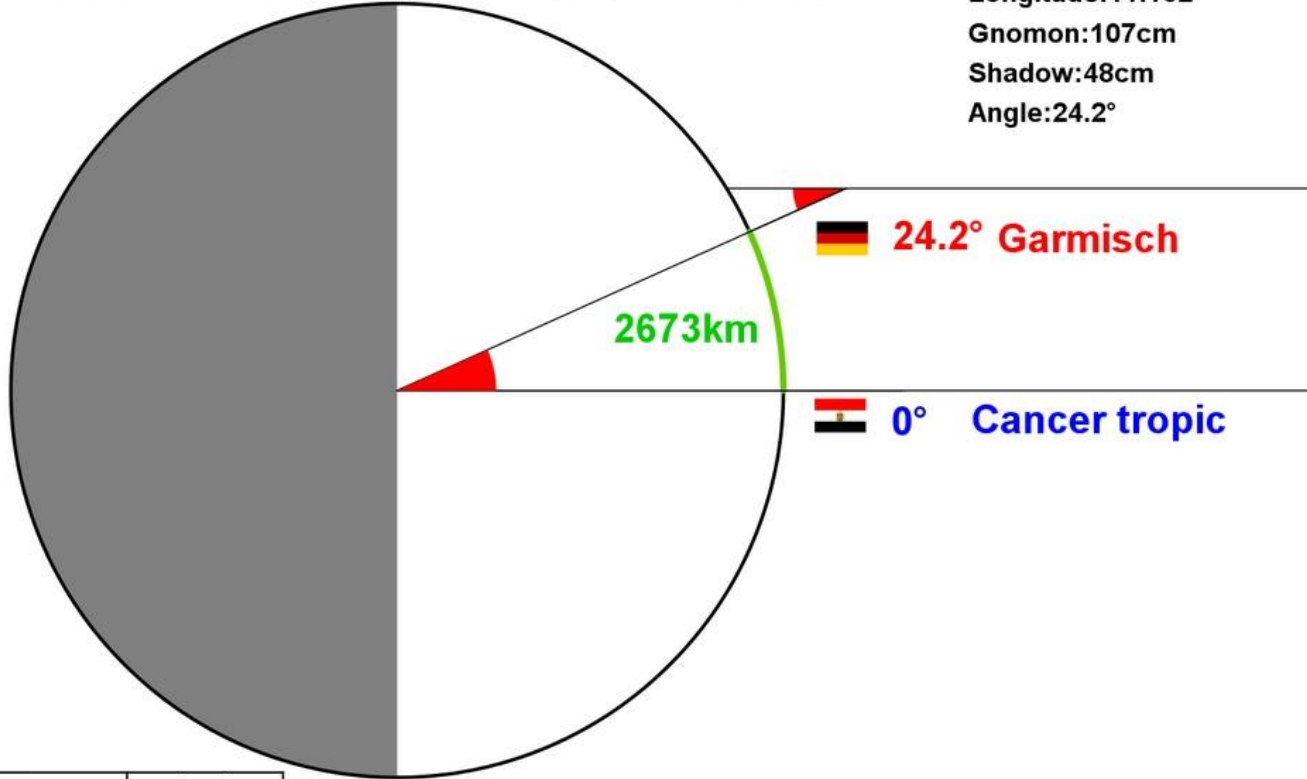
Latitude:47.493°

Longitude:11.102°

Gnomon:107cm

Shadow:48cm

Angle:24.2°



Distance	Angle
circumference	360°
2673km	24.2°

$$\text{circumference} = \frac{360^\circ \times 2673\text{km}}{24.2^\circ} = 39764 \text{ km}$$

14/06/2020 (Petroupoli-Greece) Latitude: 38.036°

14/06/2020 (Petroupoli)

205 B.C. - 21 June (Cancer tropic) Latitude: 23.437°

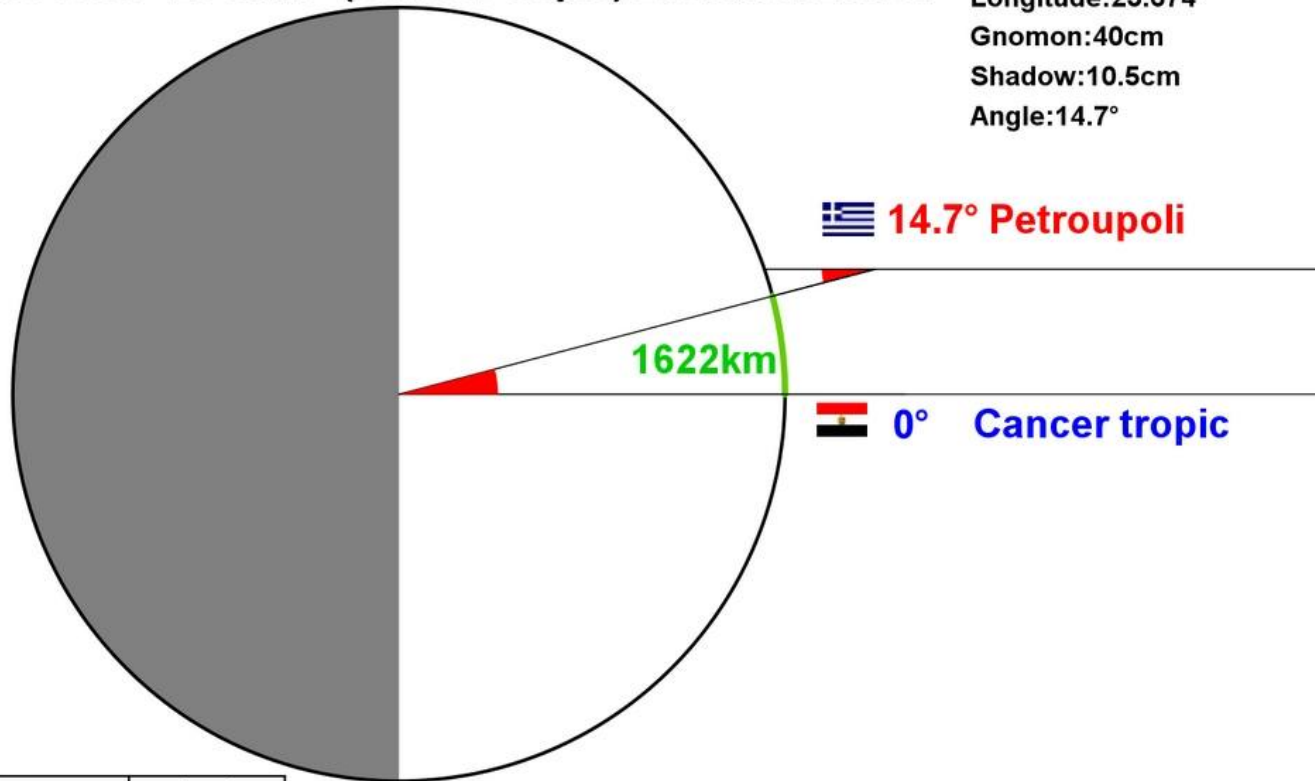
Latitude:38.036°

Longitude:23.674°

Gnomon:40cm

Shadow:10.5cm

Angle:14.7°



Distance	Angle
circumference	360°
1622km	14.7°

$$\text{circumference} = \frac{360^\circ \times 1622\text{km}}{14.7^\circ} = 39722 \text{ km}$$

14/06/2020 (Lafrançaise-France) Latitude: 44.127°

14/06/2020 (Lafrançaise)

205 B.C. - 21 June (Cancer tropic) Latitude: 23.437°

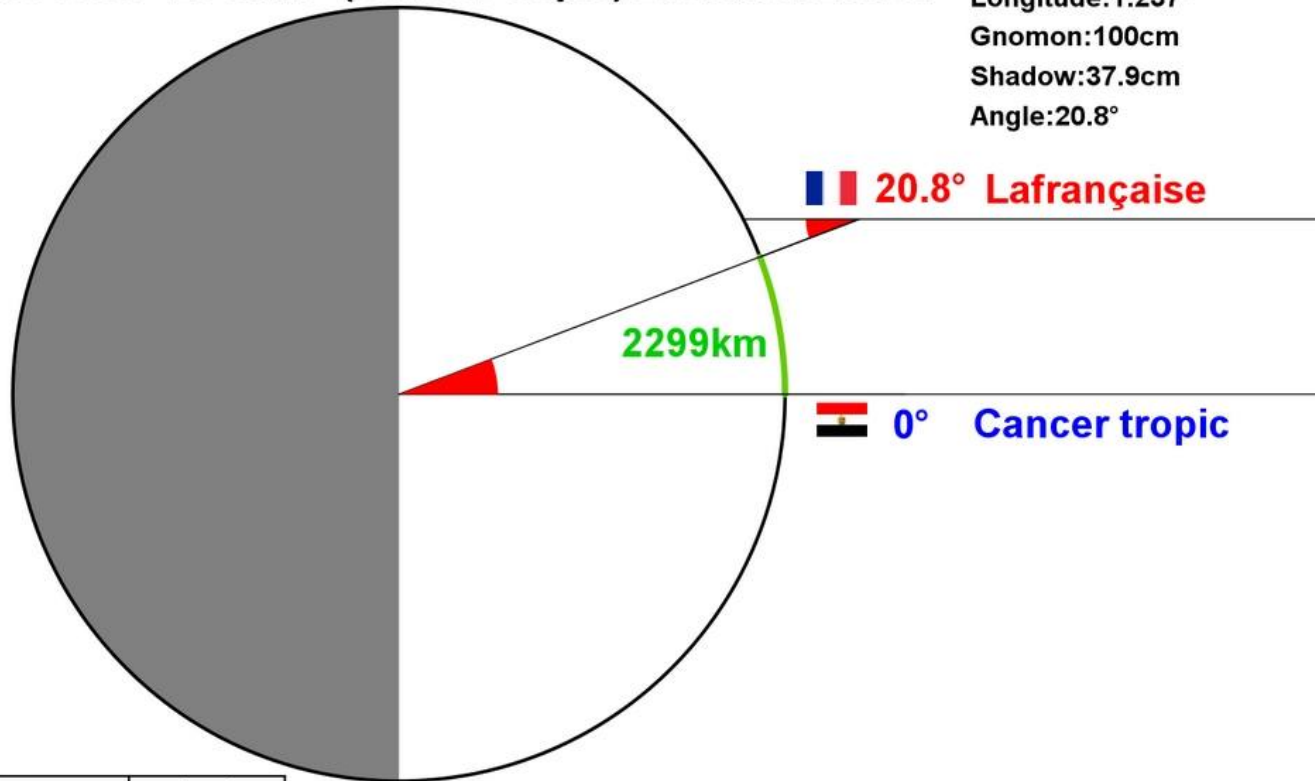
Latitude:44.127°

Longitude:1.237°

Gnomon:100cm

Shadow:37.9cm

Angle:20.8°



 20.8° Lafrançaise

 0° Cancer tropic

Distance	Angle
circumference	360°
2299km	20.8°

$$\text{circumference} = \frac{360^\circ \times 2299\text{km}}{20.8^\circ} = 39790 \text{ km}$$

205 B.C. - 21 June (Cancer tropic) Latitude: 23.437°

16/06/2020 (Guarne-Colombia) Latitude: 6.274°

16/06/2020(Guarne)

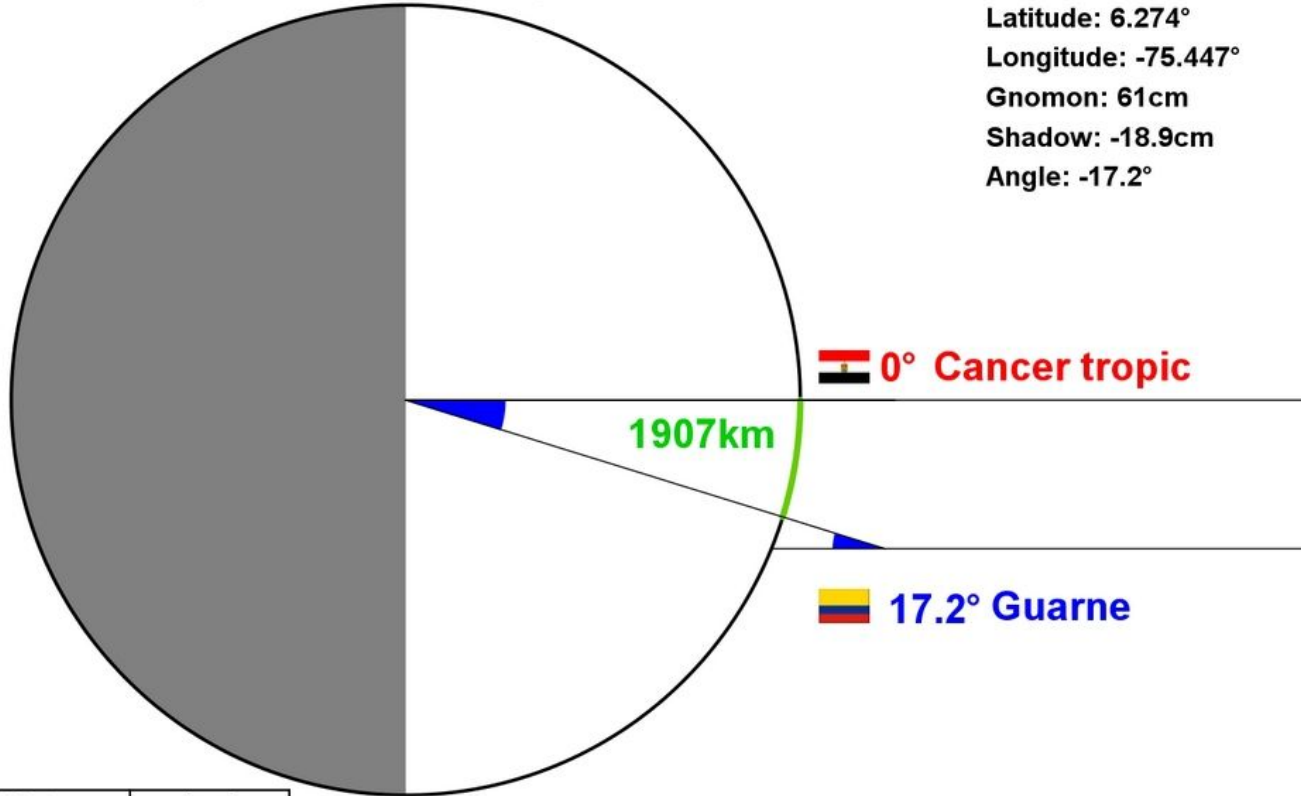
Latitude: 6.274°

Longitude: -75.447°

Gnomon: 61cm

Shadow: -18.9cm

Angle: -17.2°



Distance	Angle
circumference	360°
1907km	17.2°

$$\text{circumference} = \frac{360^\circ \times 1907\text{km}}{17.2^\circ} = 39914 \text{ km}$$

17/06/2020 (Dorohoi-Romania) Latitude: 47.953°

205 B.C. - 21 June (Cancer tropic) Latitude: 23.437°

17/06/2020 (Dorohoi)

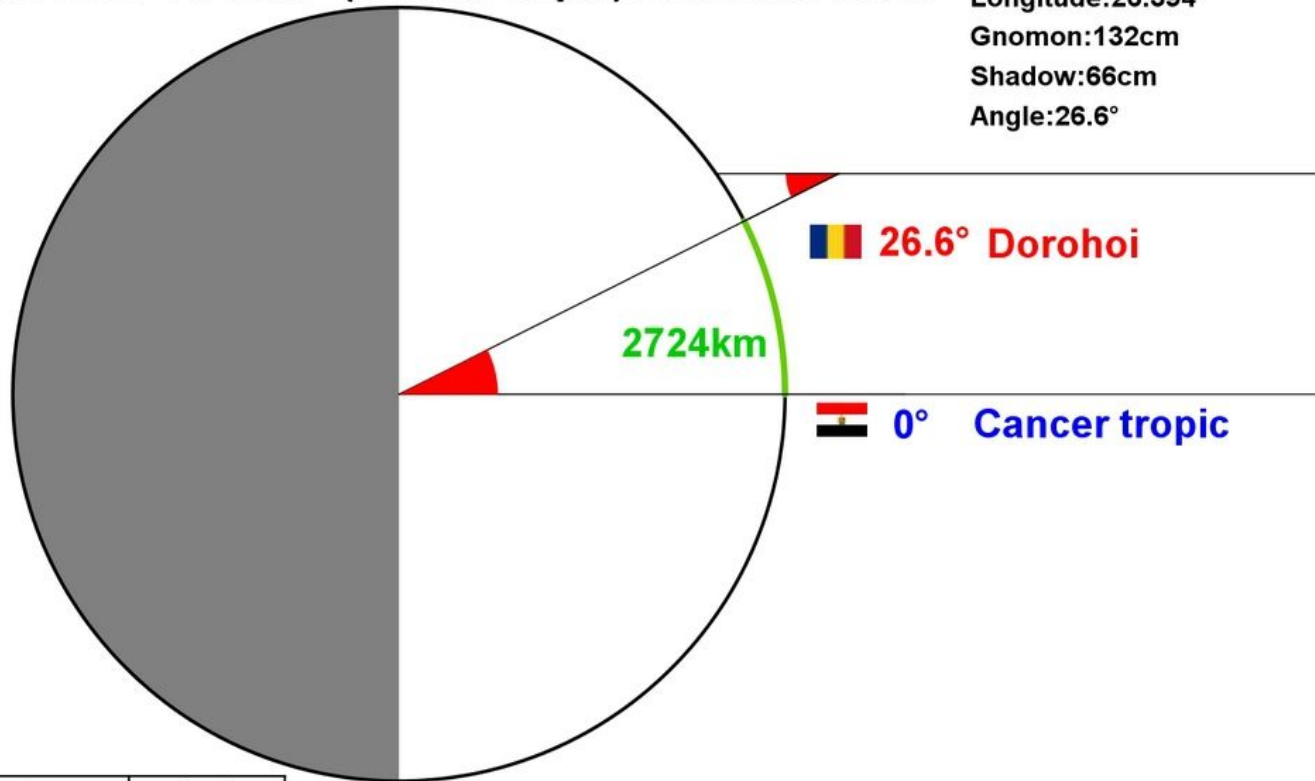
Latitude:47.953°

Longitude:26.394°

Gnomon:132cm

Shadow:66cm

Angle:26.6°



Distance	Angle
circumference	360°
2724km	26.6°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{26.6^\circ} = 36866 \text{ km}$$

17/06/2020 (Dorohoi-Romania) Latitude: 47.953°

205 B.C. - 21 June (Cancer tropic) Latitude: 23.437°

17/06/2020 (Dorohoi)

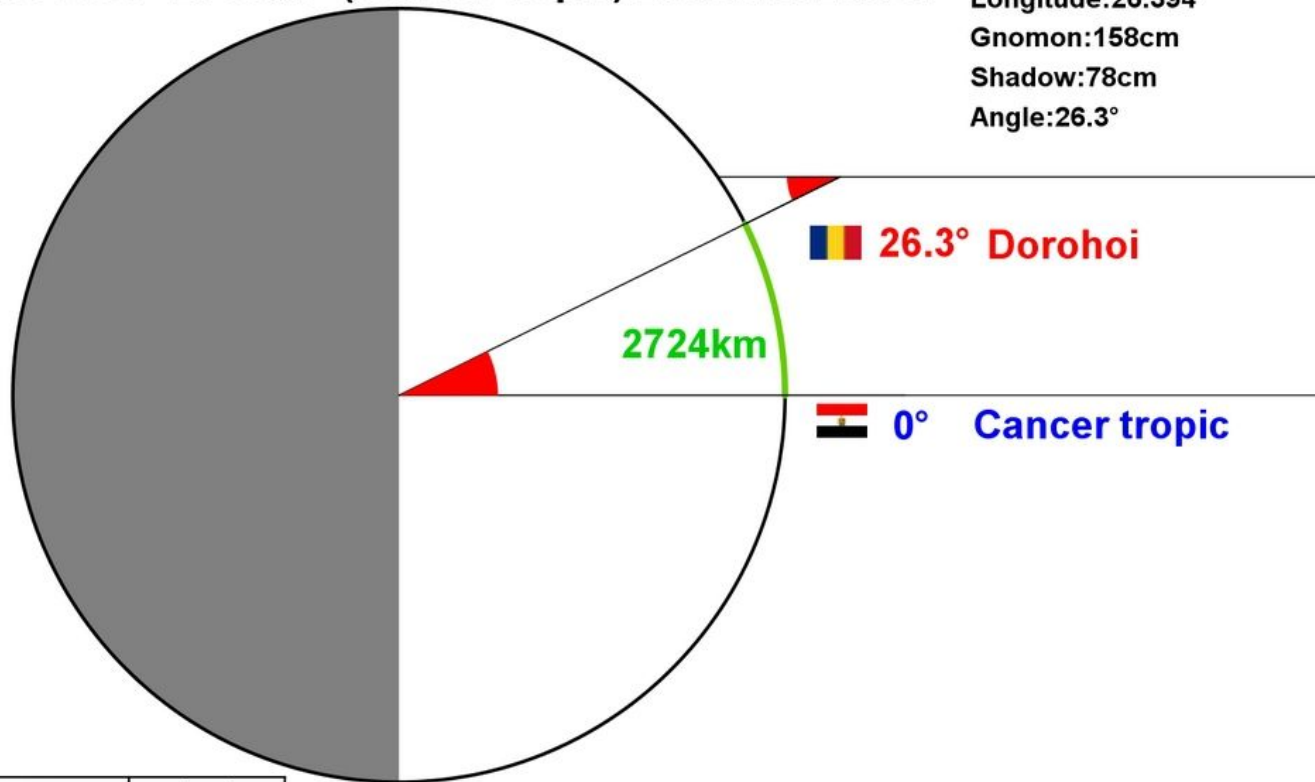
Latitude:47.953°

Longitude:26.394°

Gnomon:158cm

Shadow:78cm

Angle:26.3°



Distance	Angle
circumference	360°
2724km	26.3°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{26.3^\circ} = 37287 \text{ km}$$

17/06/2020 (Lozova-Ukraine) Latitude: 48.881°

21/06/2020 (Cancer Tropic-205BC) Latitude: 23.437°

Lozova Secondary School No12

Latitude: 48.894N

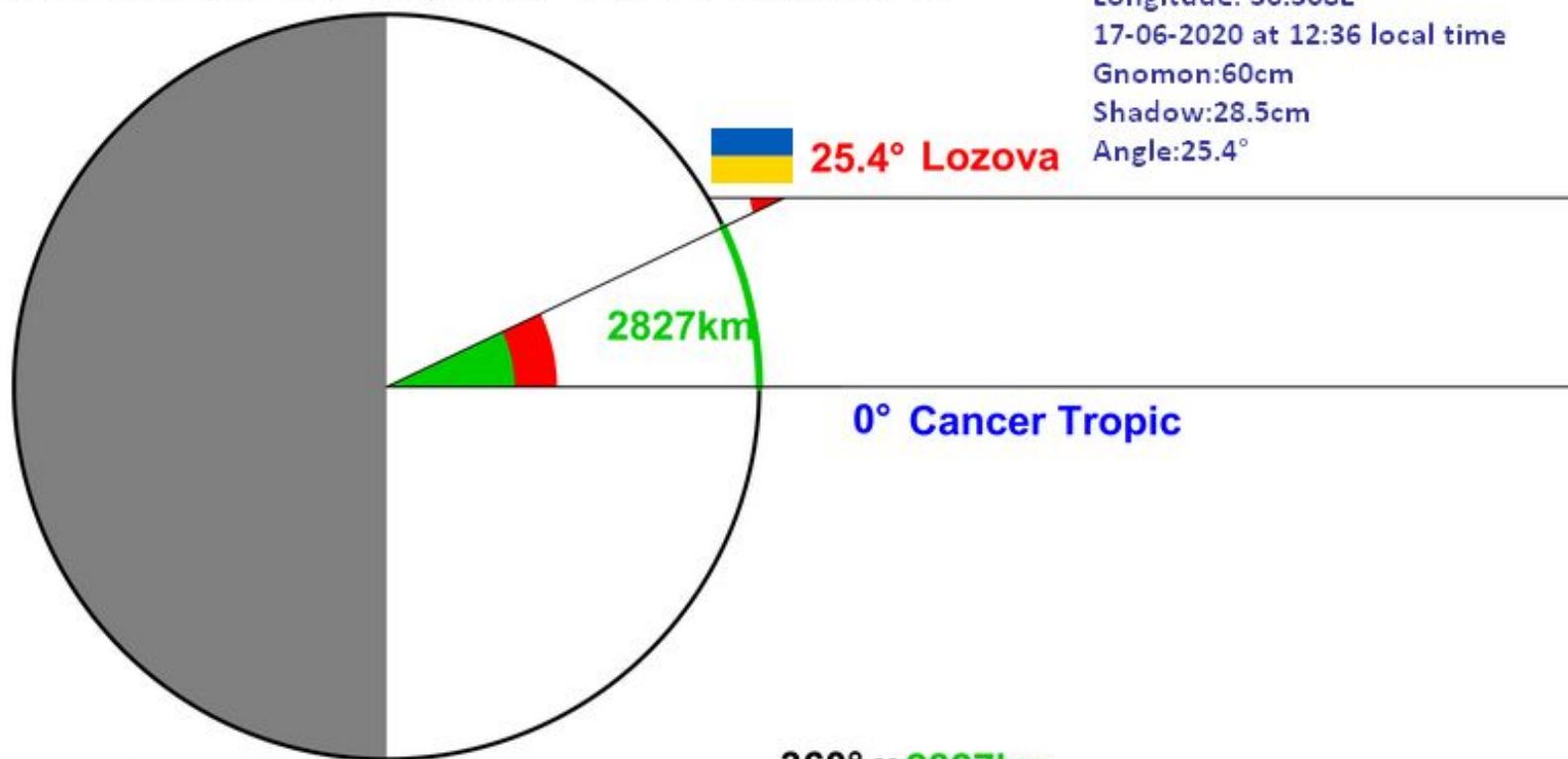
Longitude: 36.308E

17-06-2020 at 12:36 local time

Gnomon:60cm

Shadow:28.5cm

Angle:25.4°



Distance	Angle
circumference	360°
2827km	25.4° - 0°

$$\text{circumference} = \frac{360^\circ \times 2827\text{km}}{25.4^\circ - 0^\circ} = 40068 \text{ km}$$

17/06/2020 (Petroupoli-Greece) Latitude: 38.036°

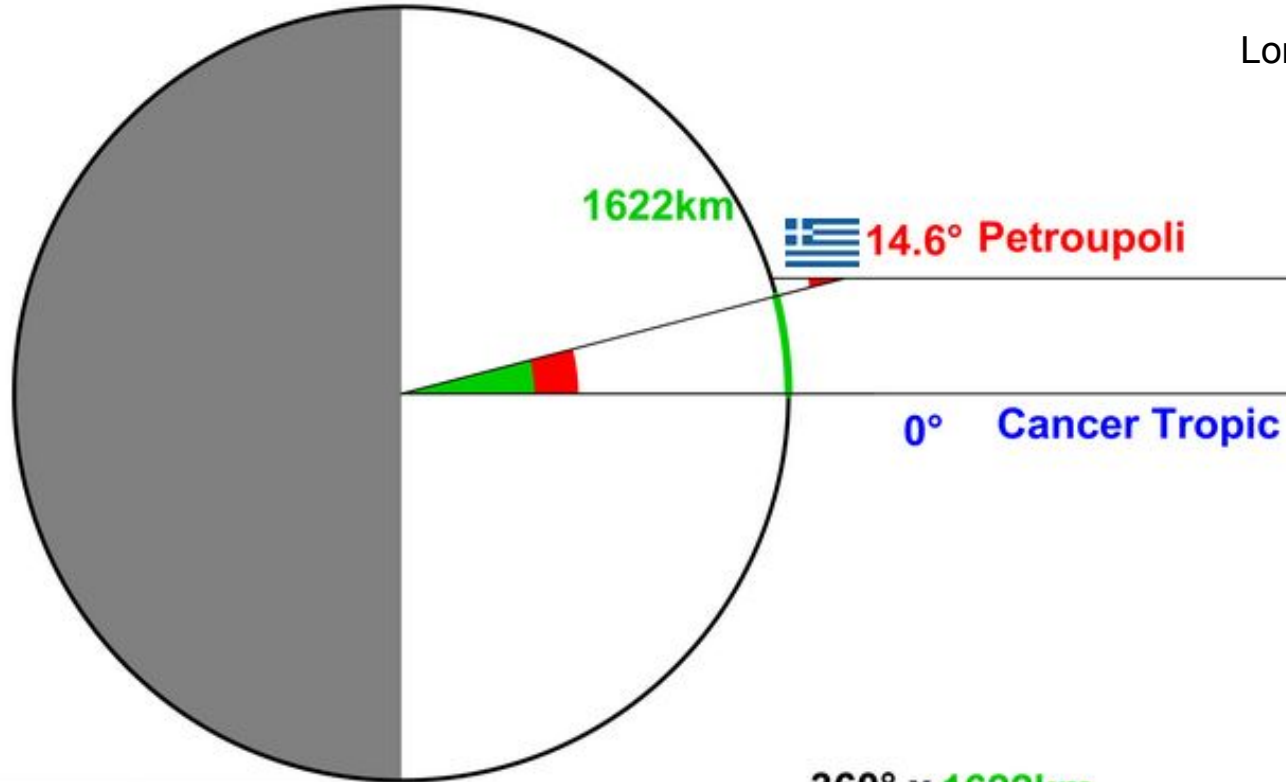
21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Longitude:23.674E

Gnomon:40cm

Shadow:10.4cm

Angle:14.6°



Distance	Angle
circumference	360°
1622km	14.6° - 0°

$$\text{circumference} = \frac{360^\circ \times 1622\text{km}}{14.6^\circ - 0^\circ} = 39995 \text{ km}$$

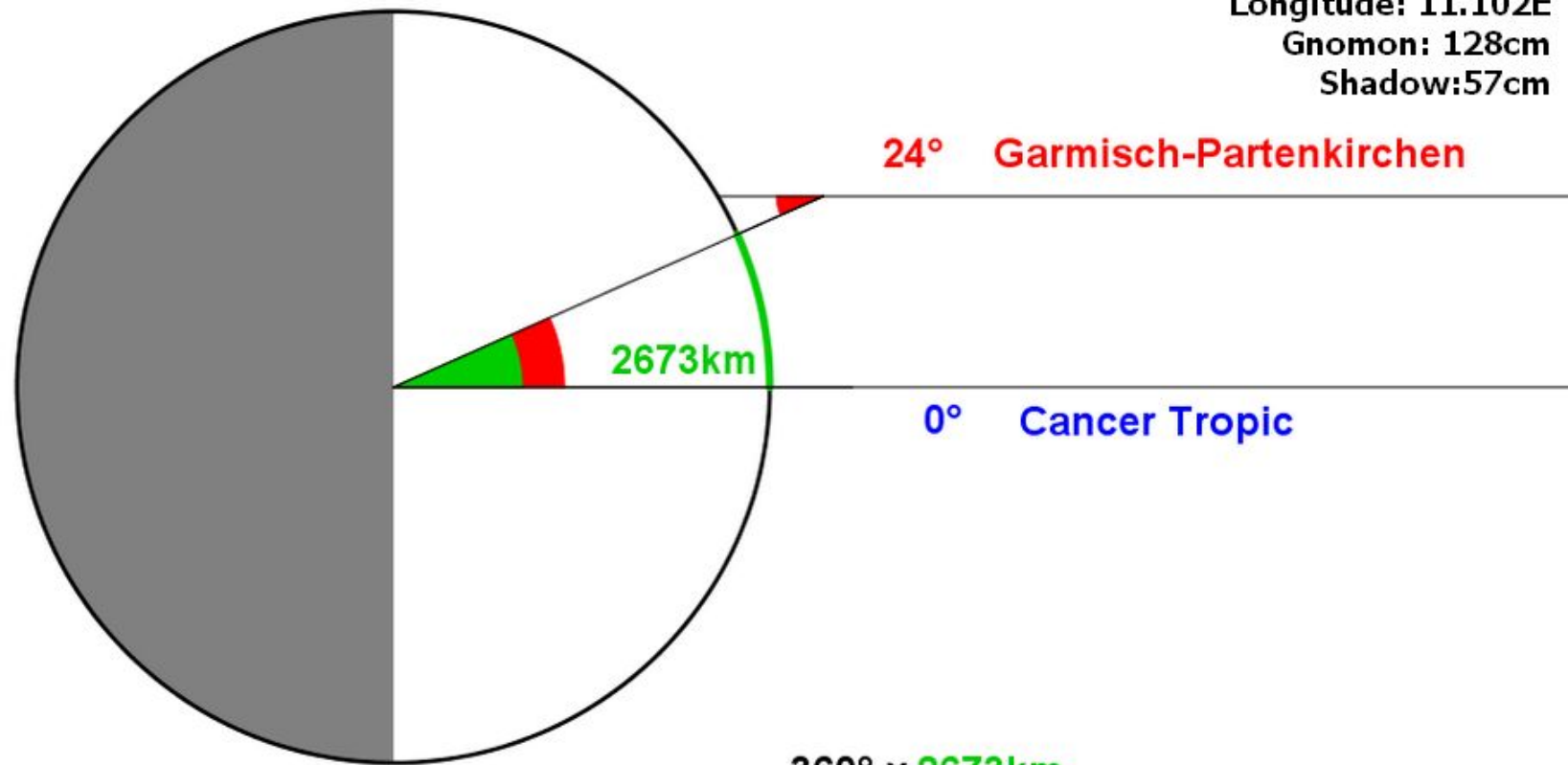
17/06/2020 (Garmisch-Partenkirchen-Germany) Latitude: 47.493°

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Longitude: 11.102E

Gnomon: 128cm

Shadow: 57cm



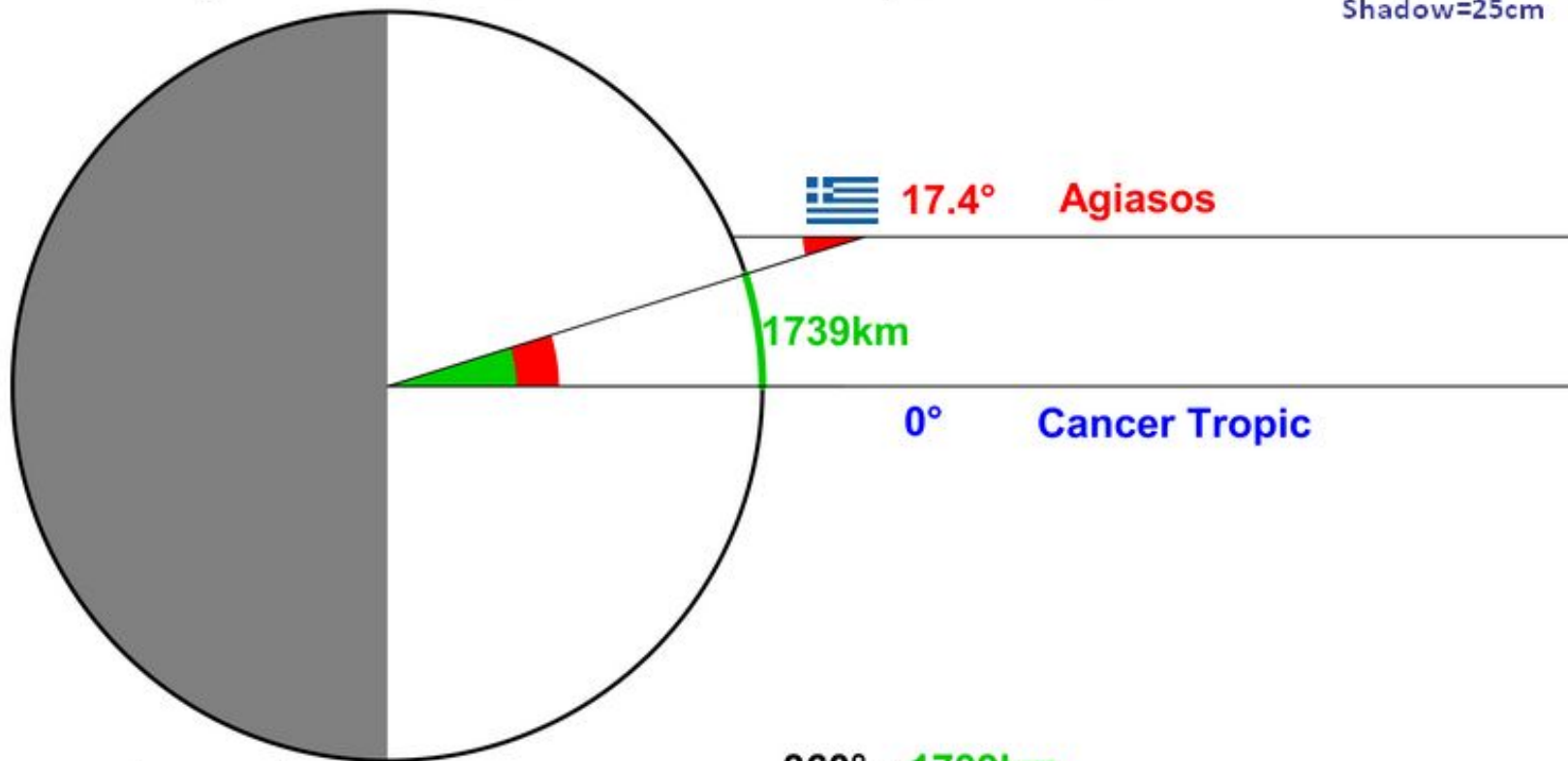
Distance	Angle
circumference	360°
2673km	24° - 0°

$$\text{circumference} = \frac{360^\circ \times 2673\text{km}}{24^\circ - 0^\circ} = 40095 \text{ km}$$

18/06/2020 (Agiastos-Greece) Latitude: 39.086°

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Latitude=39.086N
Longitude=26.371E
Gnomon=80cm
Shadow=25cm



Distance	Angle
circumference	360°
1739km	17.4° - 0°

$$\text{circumference} = \frac{360^\circ \times 1739\text{km}}{17.4^\circ - 0^\circ} = 35979 \text{ km}$$

18/06/2020 (Lafrançaise-France) Latitude: 44.127°

18/06/2020 (Lafrançaise)

205 B.C. - 21 June (Cancer tropic) Latitude: 23.437°

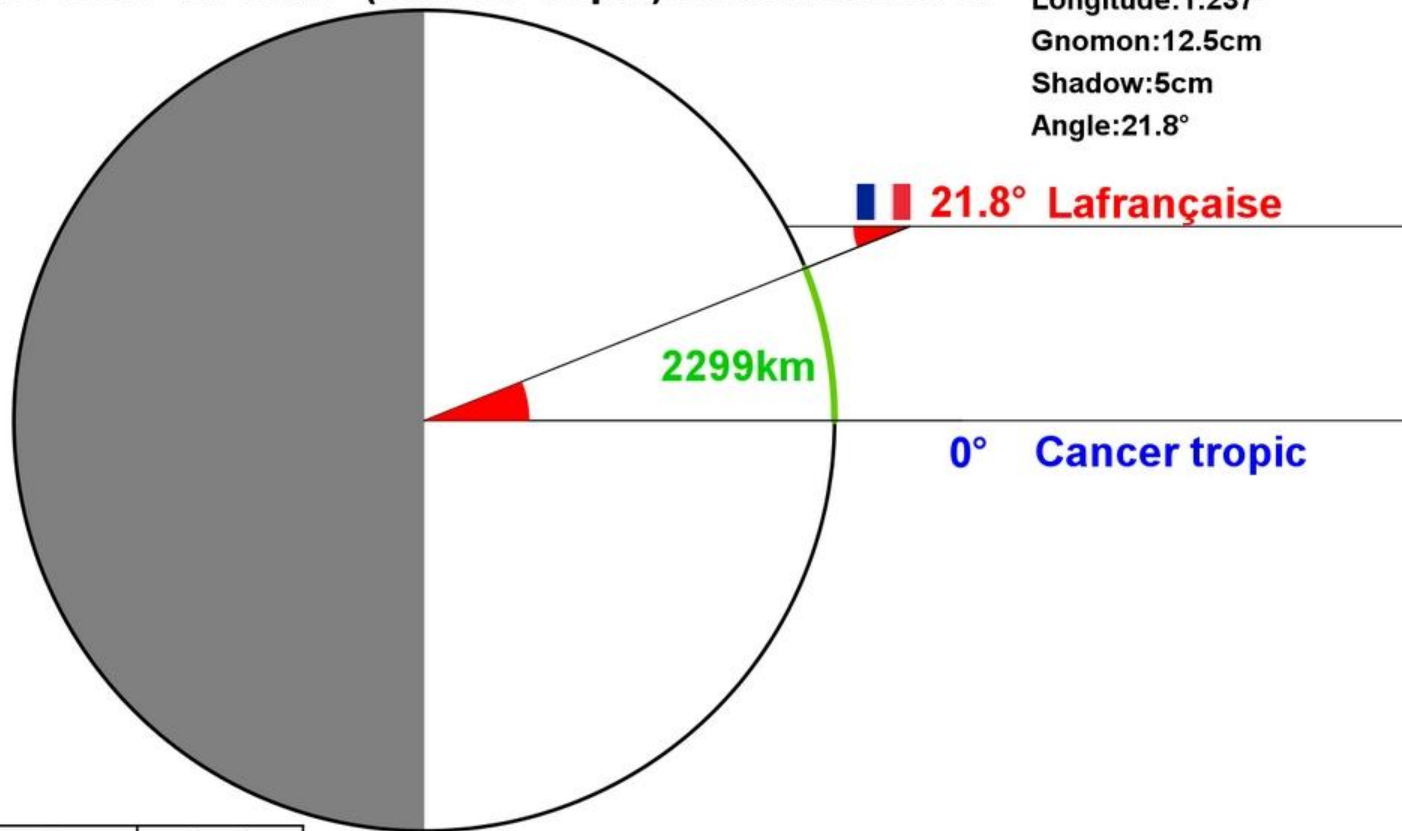
Latitude:44.127°

Longitude:1.237°

Gnomon:12.5cm

Shadow:5cm

Angle:21.8°



Distance	Angle
circumference	360°
2299km	21.8°

$$\text{circumference} = \frac{360^\circ \times 2299\text{km}}{21.8^\circ} = 37965 \text{ km}$$

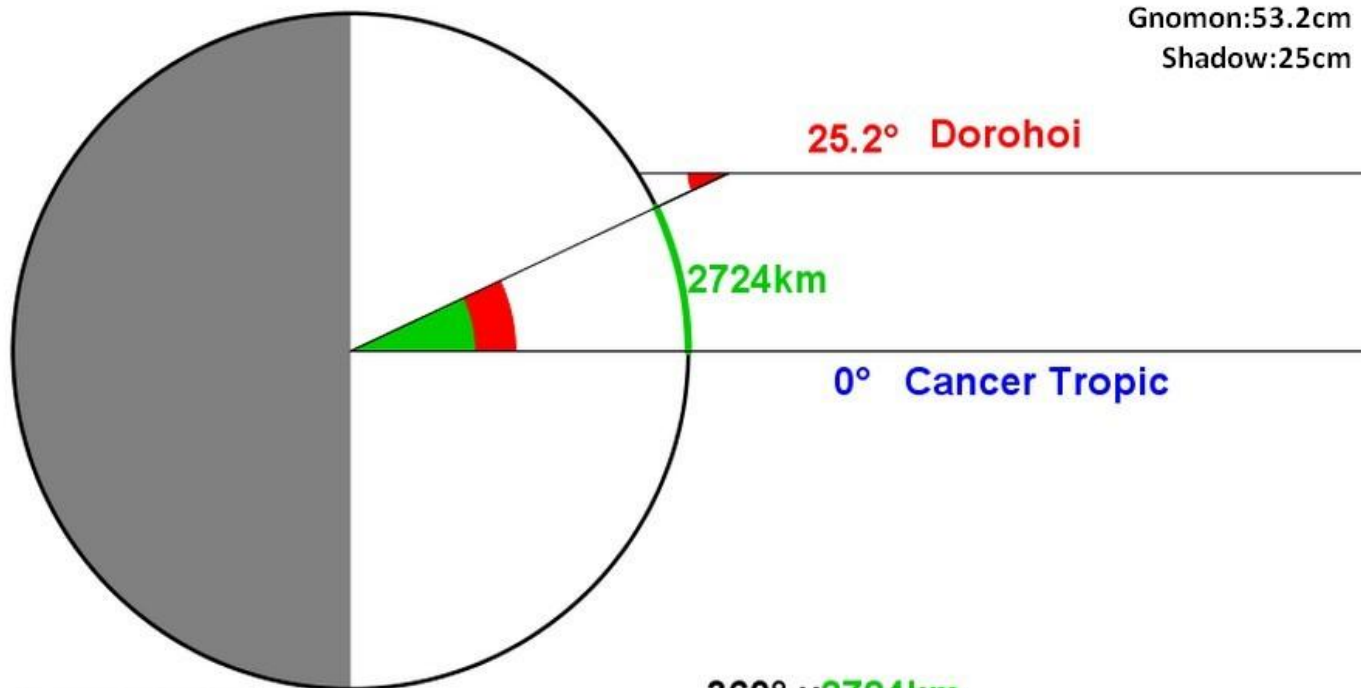
19/06/2020 (Dorohoi-Romania) Latitude: 47.953°

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Longitude: 26.394E

Gnomon:53.2cm

Shadow:25cm



Distance	Angle
circumference	360°
2724km	25.2° - 0°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{25.2^\circ - 0^\circ} = 38914 \text{ km}$$

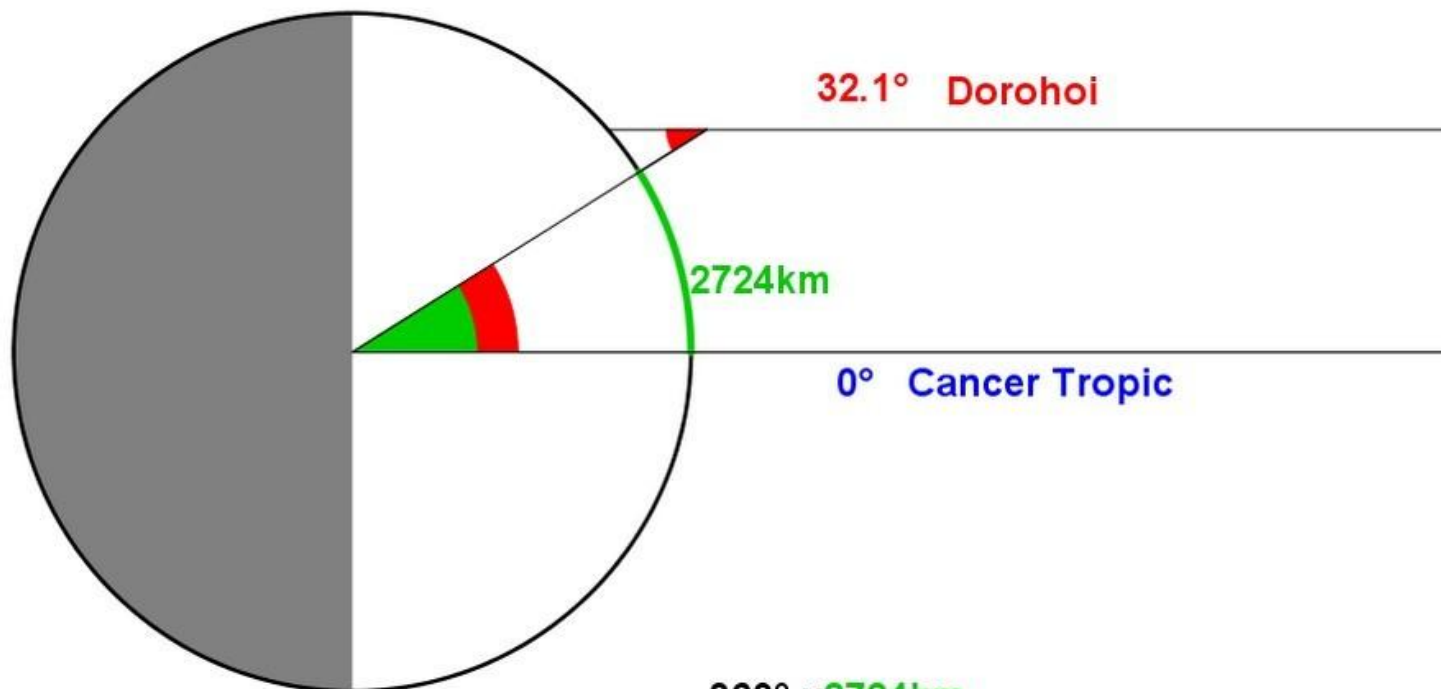
19/06/2020 (Dorohoi-Romania) Latitude: 47.953°

Longitude:26.394E

Gnomon=25cm

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Shadow:15.7cm



Distance	Angle
circumference	360°
2724km	32.1° - 0°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{32.1^\circ - 0^\circ} = 30550 \text{ km}$$

20/06/2020 (Lafrançaise-France) Latitude: 44.127°

20/06/2020 (Lafrançaise)

205 B.C. - 21 June (Cancer tropic) Latitude: 23.437°

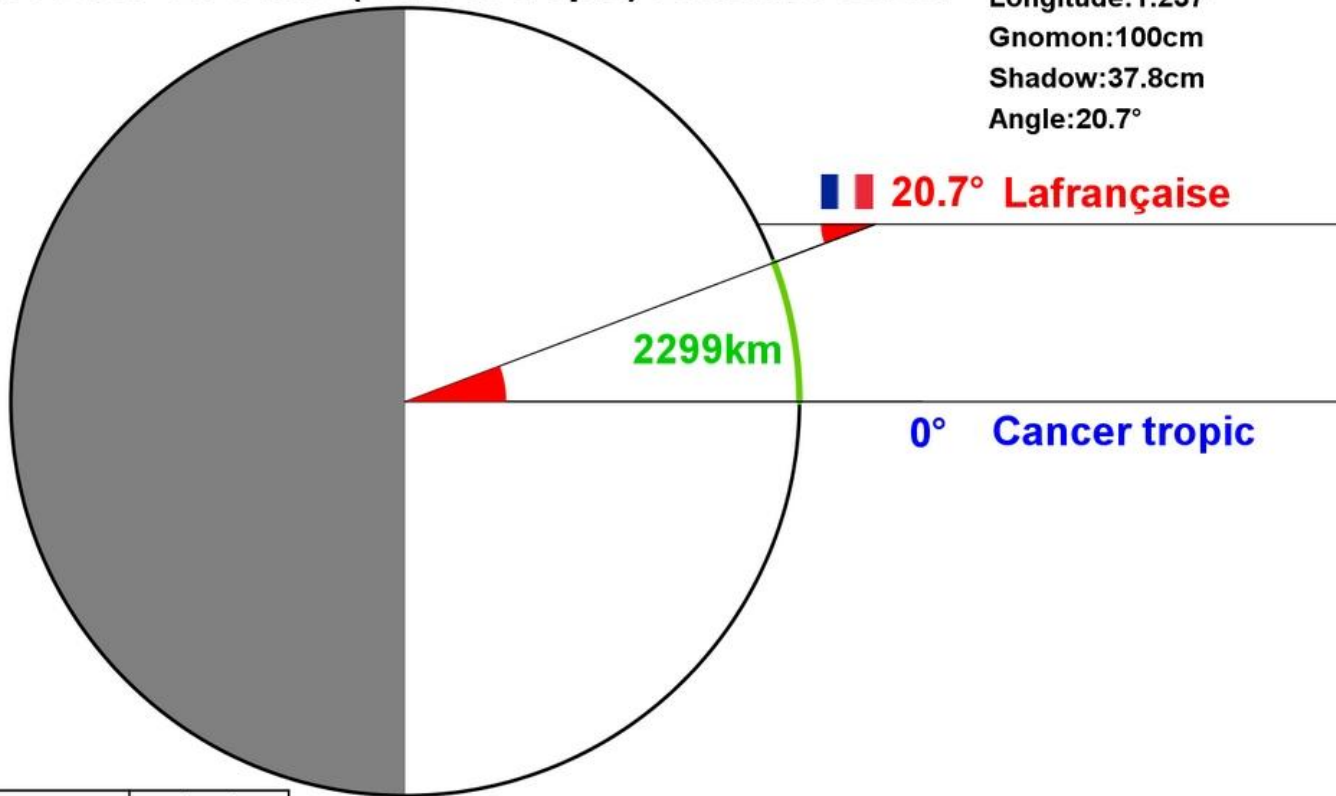
Latitude:44.127°

Longitude:1.237°

Gnomon:100cm

Shadow:37.8cm

Angle:20.7°



 20.7° Lafrançaise

0° Cancer tropic

2299km

Distance	Angle
circumference	360°
2299km	20.7°

$$\text{circumference} = \frac{360^\circ \times 2299\text{km}}{20.7^\circ} = 39983 \text{ km}$$

20/06/2020 (Dorohoi-Romania) Latitude: 47.953°

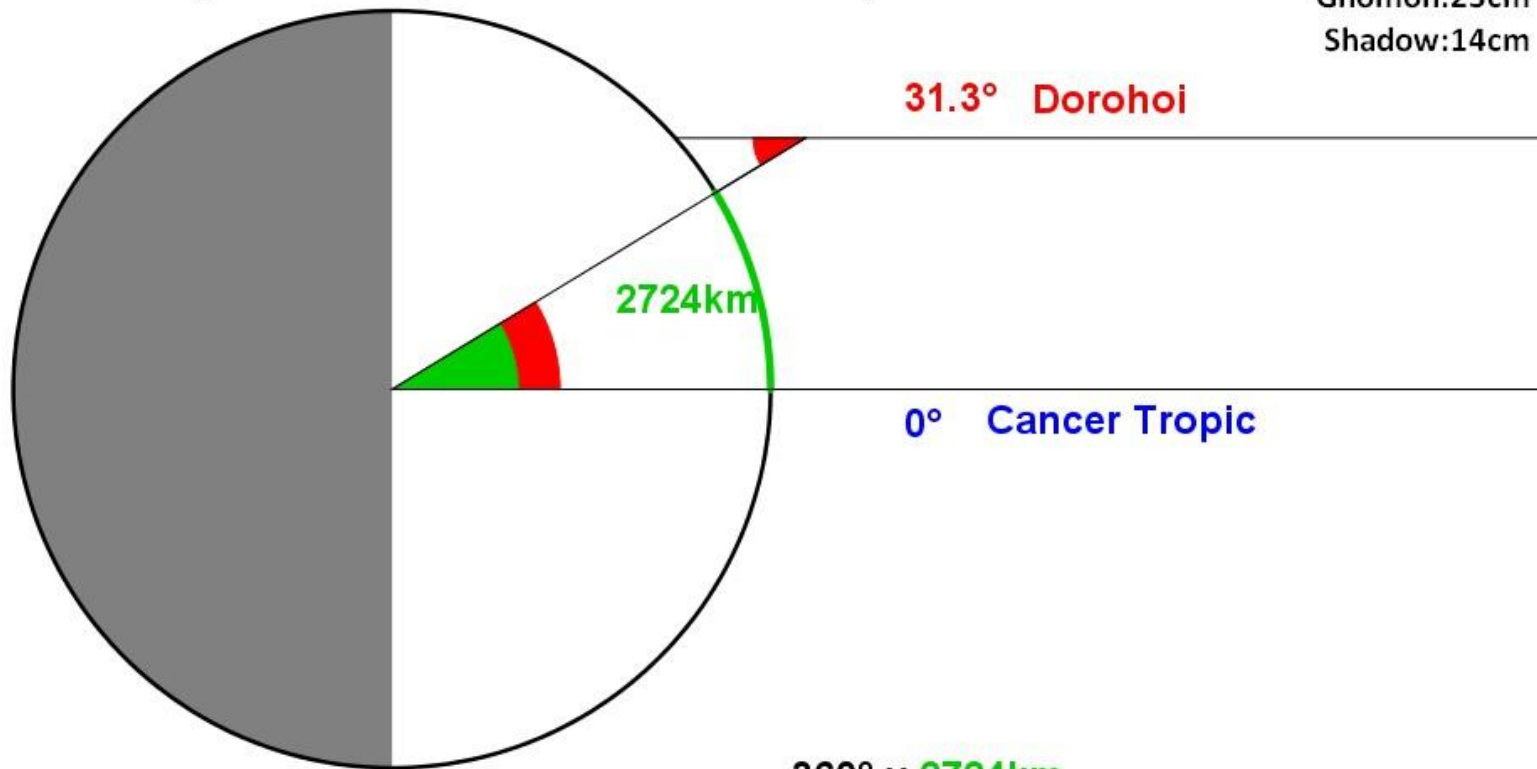
Longitude:26.394E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Alexandra measured

Gnomon:23cm

Shadow:14cm



31.3° Dorohoi

2724km

0° Cancer Tropic

Distance	Angle
circumference	360°
2724km	31.3° - 0°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{31.3^\circ - 0^\circ} = 31330 \text{ km}$$

20/06/2020 (Dorohoi-Romania) Latitude: 47.953°

Longitude:26.394E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon:17cm

Shadow:14cm

39.5° Dorohoi

0° Cancer Tropic

2724km

Distance	Angle
circumference	360°
2724km	39.5° - 0°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{39.5^\circ - 0^\circ} = 24826 \text{ km}$$

20/06/2020 (Dorohoi-Romania) Latitude: 47.953°

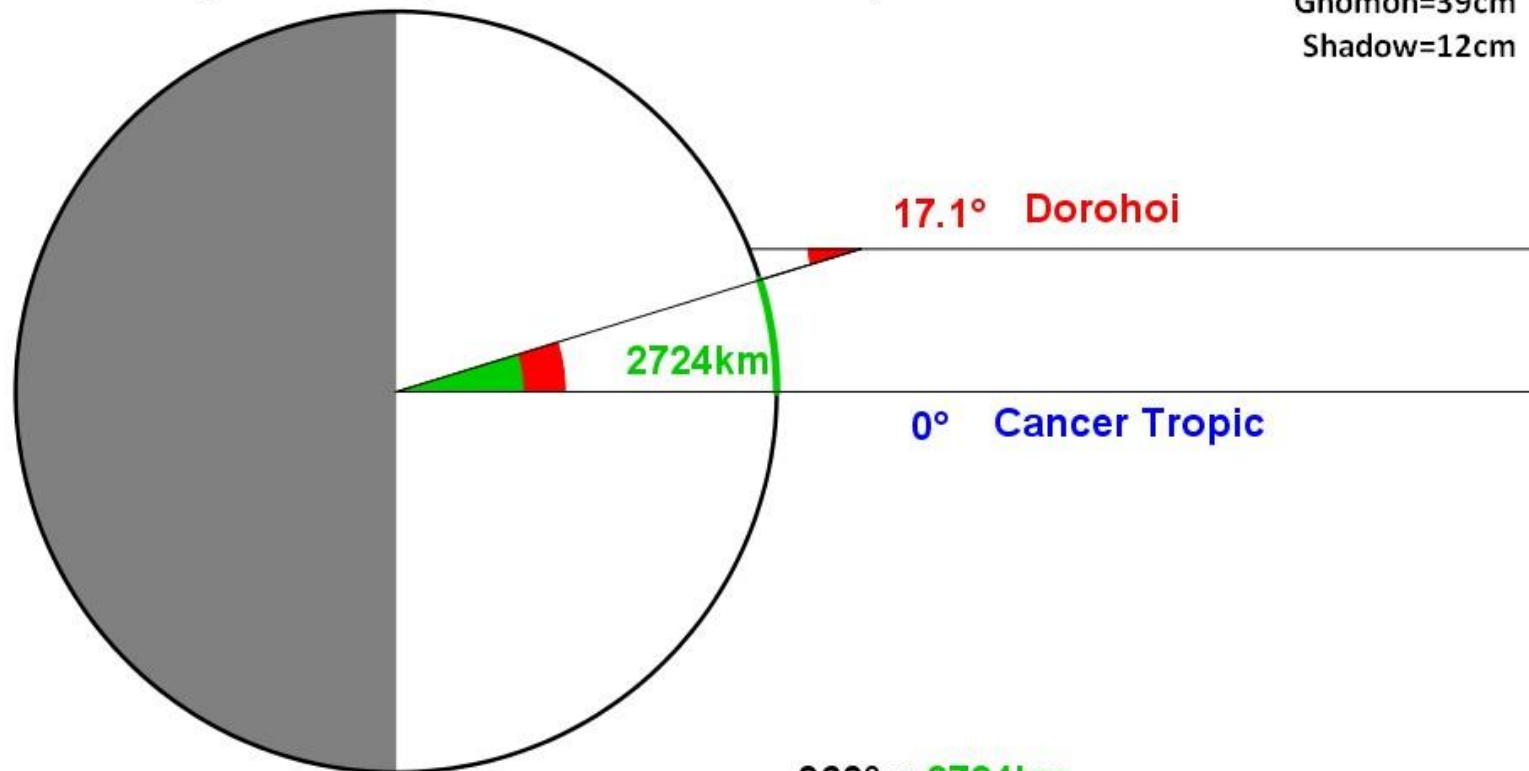
Longitude:26.394E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gabriel measured

Gnomon=39cm

Shadow=12cm

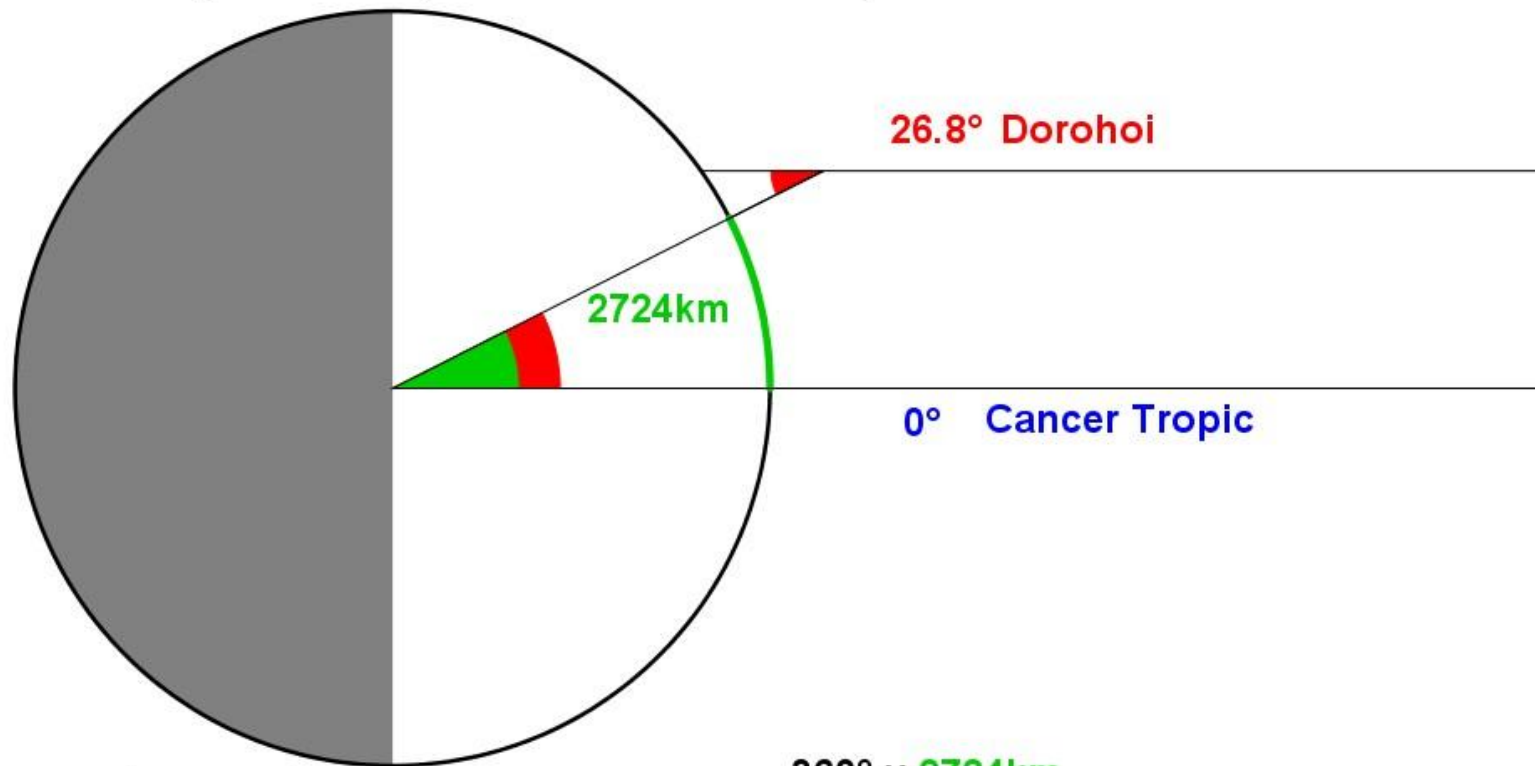


Distance	Angle
circumference	360°
2724km	17.1° - 0°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{17.1^\circ - 0^\circ} = 57347 \text{ km}$$

20/06/2020 (Dorohoi-Romania) Latitude: 47.953°

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°



Distance	Angle
circumference	360°
2724km	26.8° - 0°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{26.8^\circ - 0^\circ} = 36591 \text{ km}$$

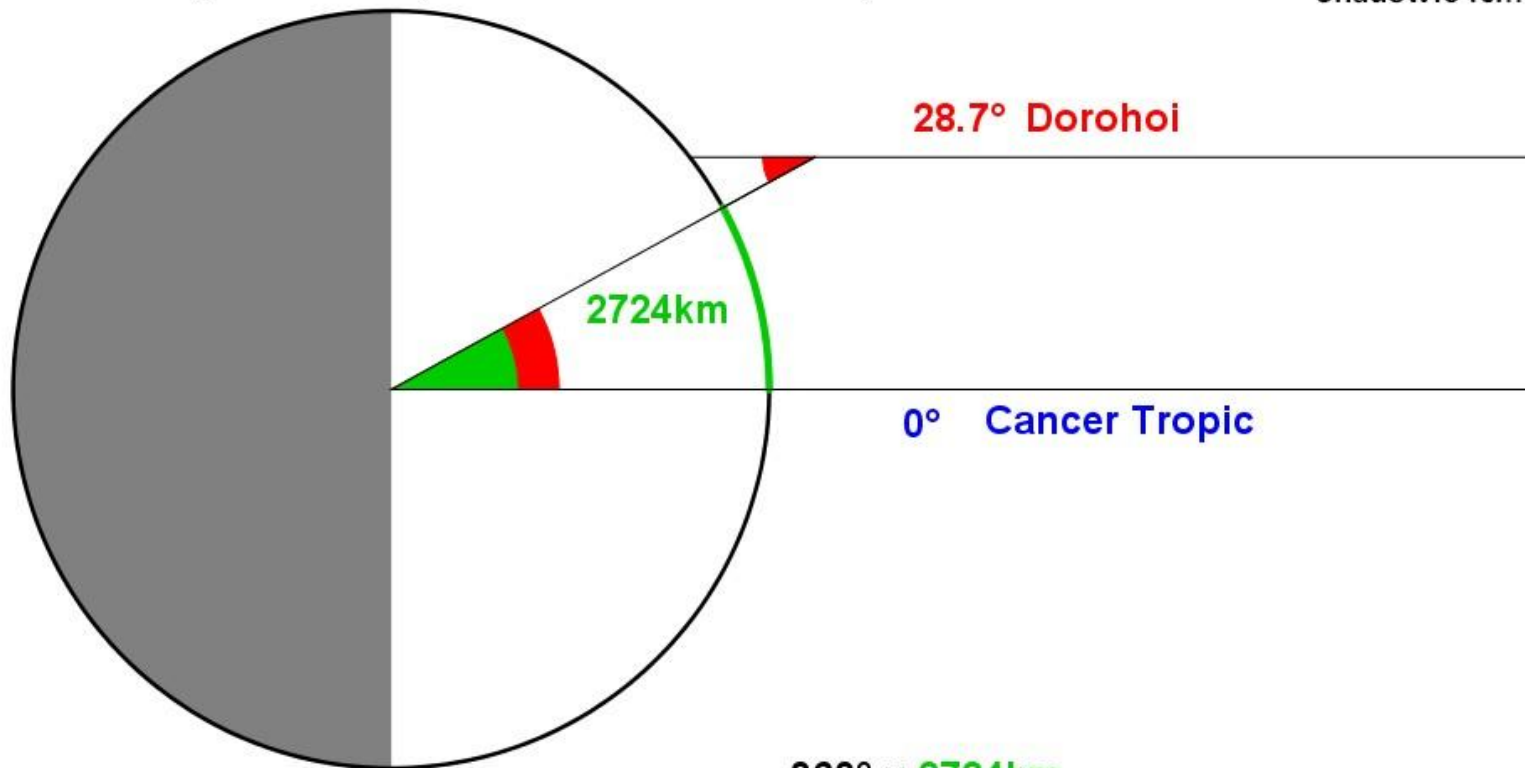
20/06/2020 (Dorohoi-Romania) Latitude: 47.953°

Longitude:26.394E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon:117cm

Shadow:64cm



Distance	Angle
circumference	360°
2724km	28.7° - 0°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{28.7^\circ - 0^\circ} = 34169 \text{ km}$$

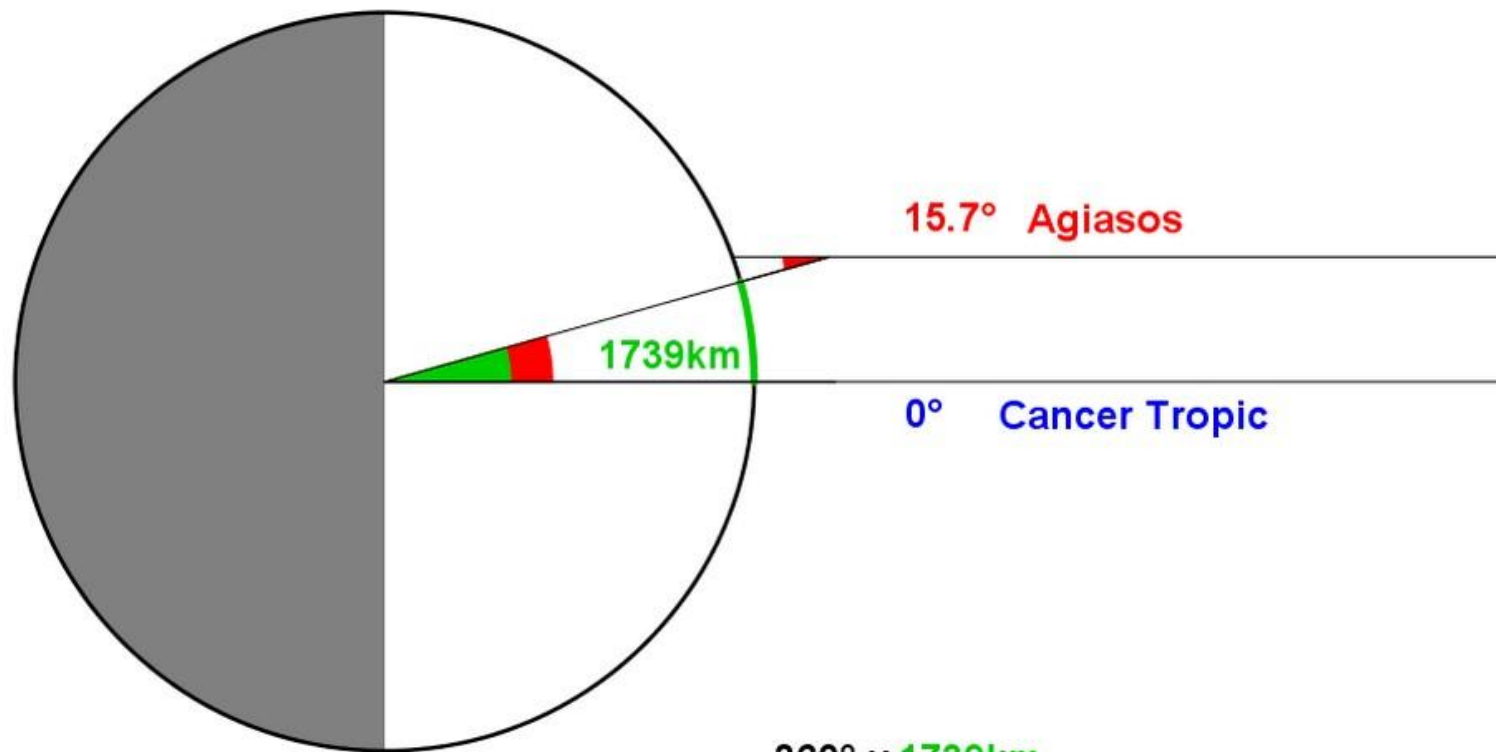
21/06/2020 (Agiastos-Greece) Latitude: 39.086°

Longitude:26.371E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon:80cm

Shadow:22.5cm



Distance	Angle
circumference	360°
1739km	15.7° - 0°

$$\text{circumference} = \frac{360^\circ \times 1739\text{km}}{15.7^\circ - 0^\circ} = 39875 \text{ km}$$

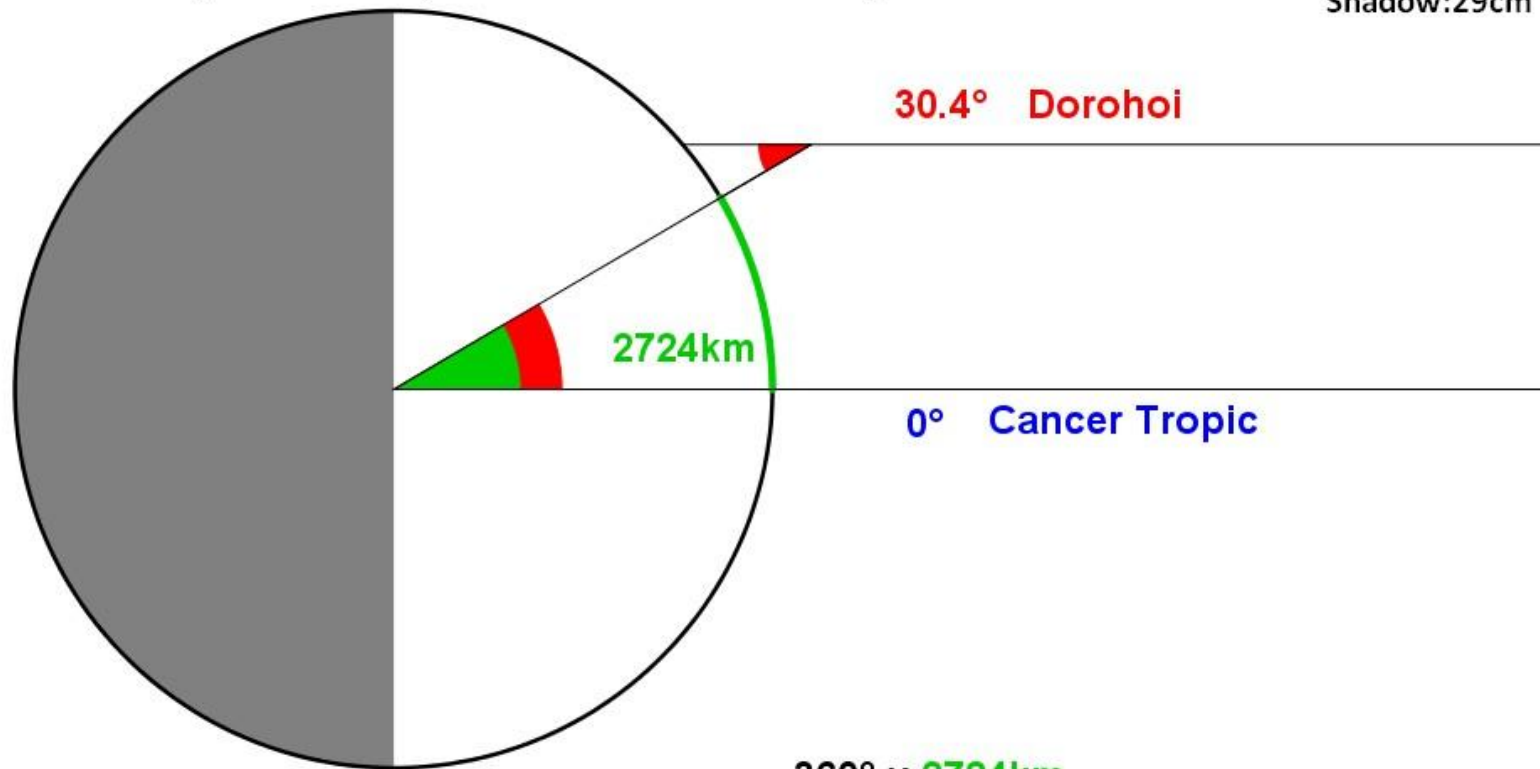
21/06/2020 (Dorohoi-Romania) Latitude: 47.953°

Longitude:26.394E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon:49.5cm

Shadow:29cm



30.4° Dorohoi

0° Cancer Tropic

2724km

Distance	Angle
circumference	360°
2724km	30.4° - 0°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{30.4^\circ - 0^\circ} = 32258 \text{ km}$$

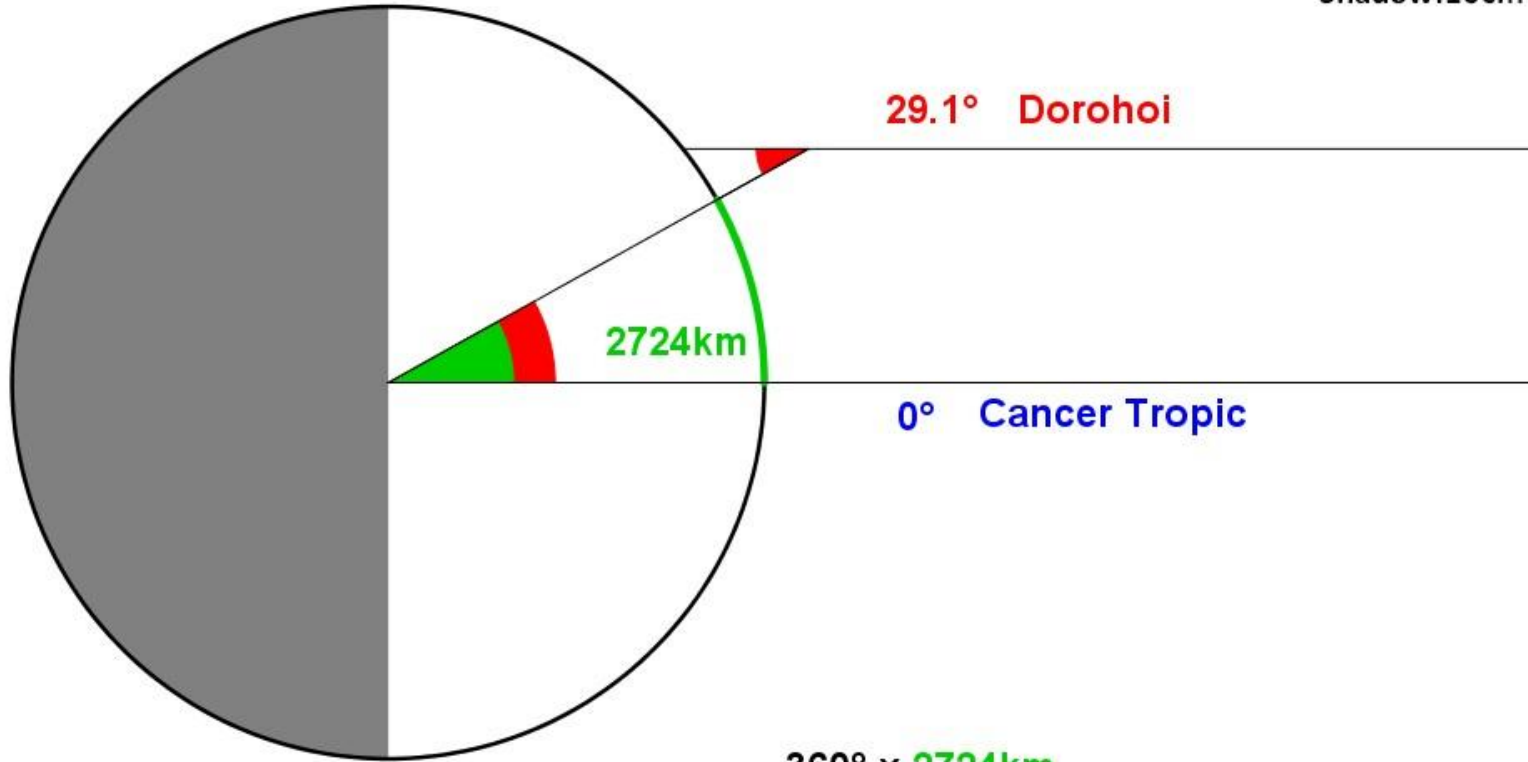
21/06/2020 (Dorohoi-Romania) Latitude: 47.953°

Longitude: 26.397E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon:18cm

Shadow:10cm



Measurement
by Maria

Distance	Angle
circumference	360°
2724km	29.1° - 0°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{29.1^\circ - 0^\circ} = 33699 \text{ km}$$

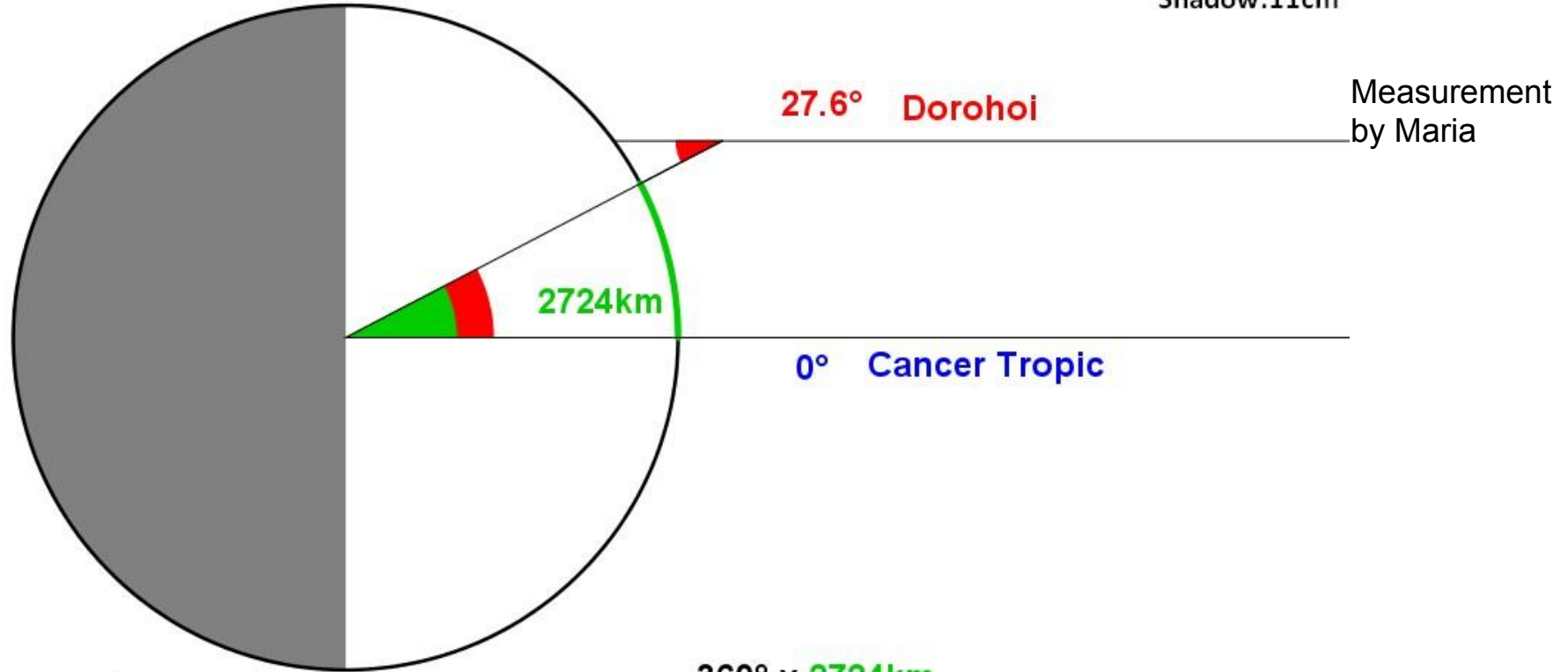
21/06/2020 (Dorohoi-Romania) Latitude: 47.953°

Longitude:26.397E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon:21cm

Shadow:11cm



Distance	Angle
circumference	360°
2724km	27.6° - 0°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{27.6^\circ - 0^\circ} = 35530 \text{ km}$$

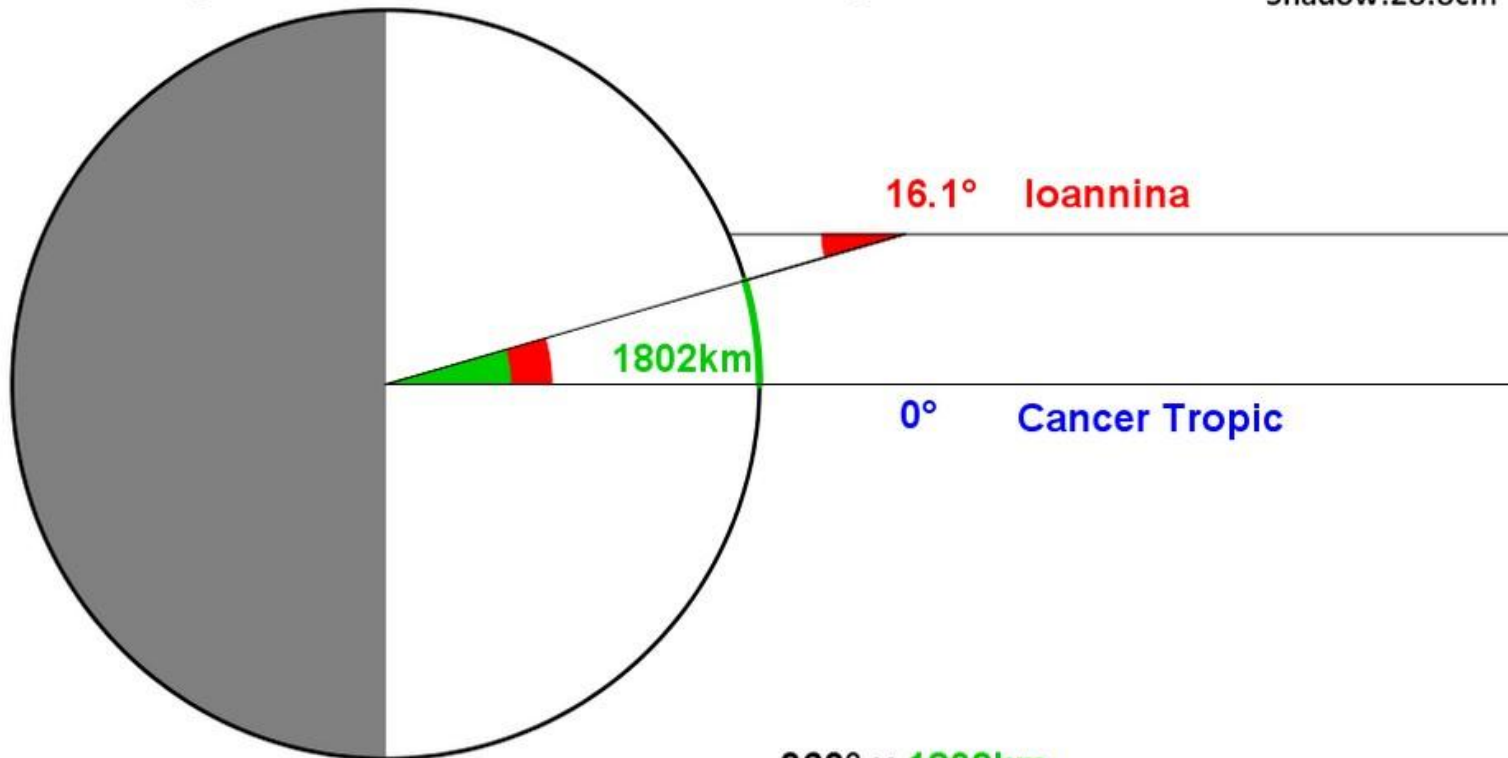
21/06/2020 (Ioannina-Greece) Latitude: 39.655°

Longitude:20.846E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon:100cm

Shadow:28.8cm



Distance	Angle
circumference	360°
1802km	16.1° - 0°

$$\text{circumference} = \frac{360^\circ \times 1802\text{km}}{16.1^\circ - 0^\circ} = 40293 \text{ km}$$

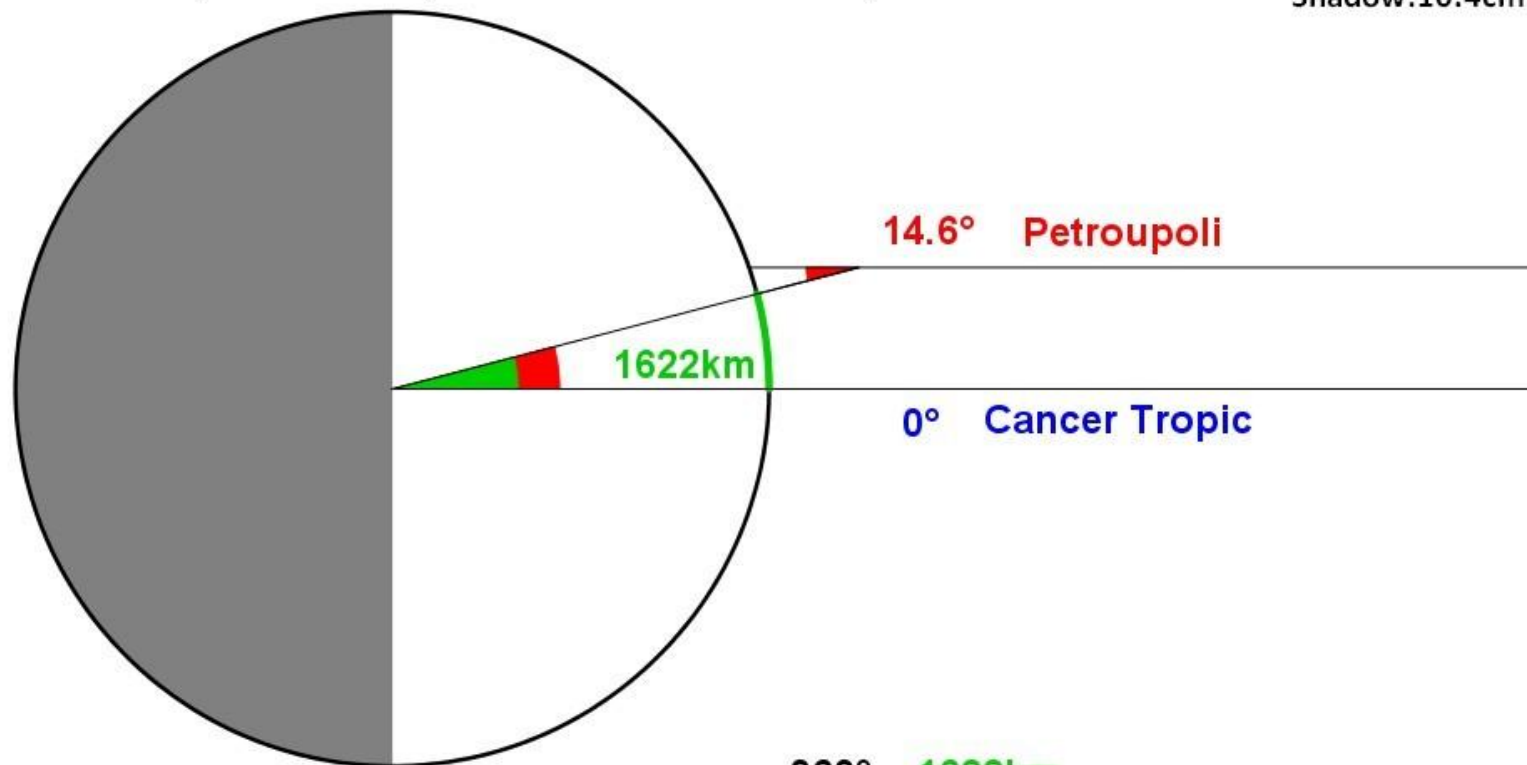
21/06/202 (Petroupoli-Greece) Latitude: 38.036°

Longitude:23.674E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon:40cm

Shadow:10.4cm



Distance	Angle
circumference	360°
1622km	14.6° - 0°

$$\text{circumference} = \frac{360^\circ \times 1622\text{km}}{14.6^\circ - 0^\circ} = 39995 \text{ km}$$

21/06/202 (Petroupoli-Greece) Latitude: 38.036°

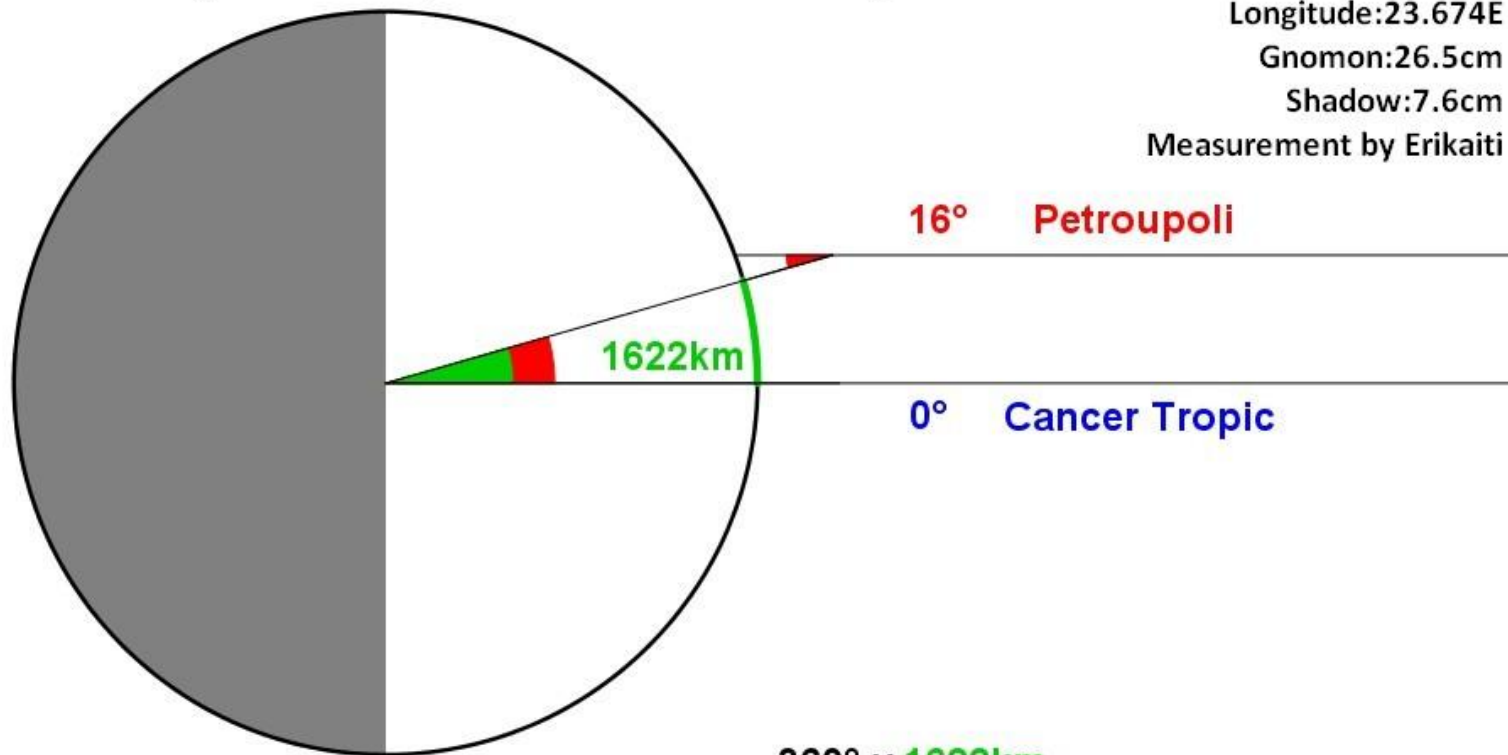
21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Longitude:23.674E

Gnomon:26.5cm

Shadow:7.6cm

Measurement by Erikaiti



Distance	Angle
circumference	360°
1622km	16° - 0°

$$\text{circumference} = \frac{360^\circ \times 1622\text{km}}{16^\circ - 0^\circ} = 36495 \text{ km}$$

21/06/2020 (Salcuta-Moldova) Latitude: 46.599°

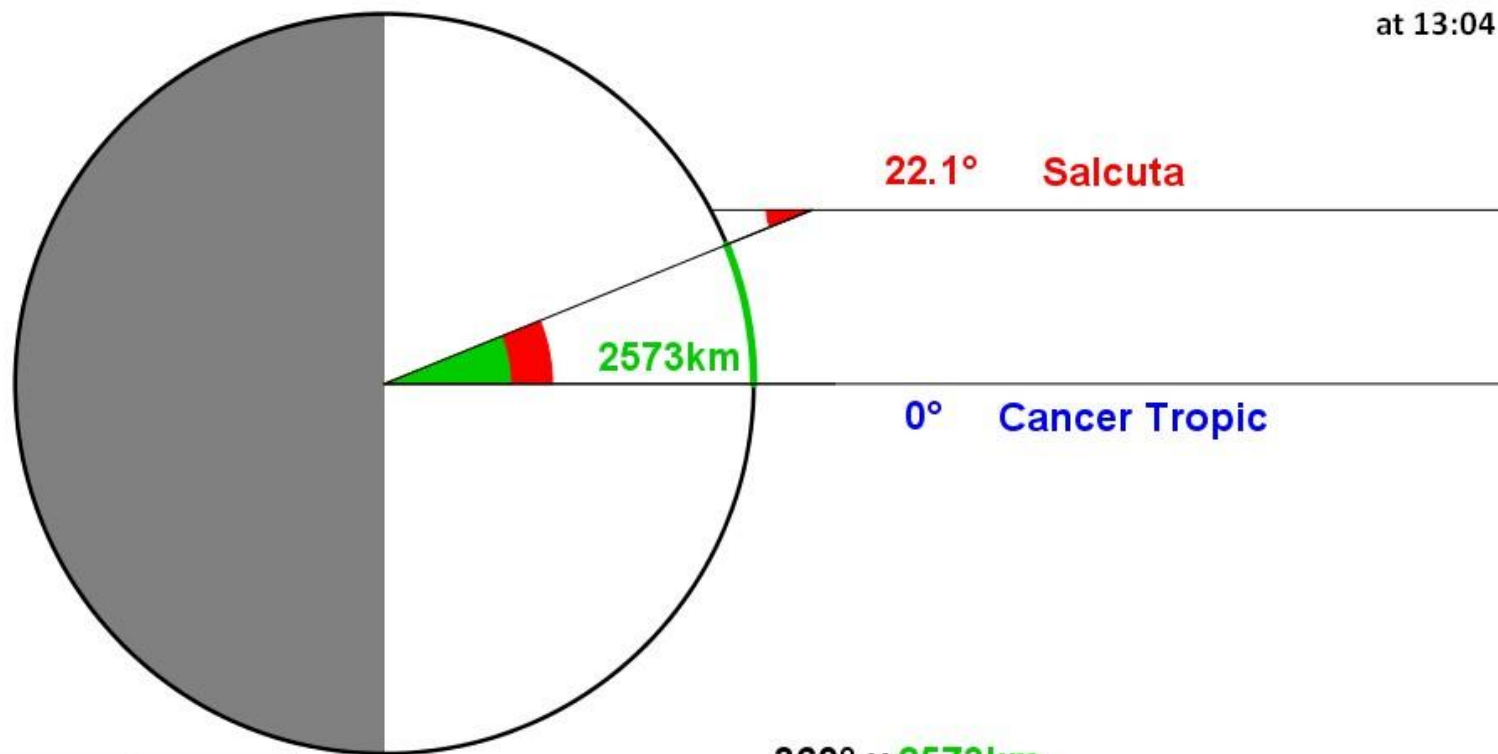
Longitude:29.248E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon:29.5cm

Shadow:12cm

at 13:04



Distance	Angle
circumference	360°
2573km	22.1° - 0°

$$\text{circumference} = \frac{360^\circ \times 2573\text{km}}{22.1^\circ - 0^\circ} = 41913 \text{ km}$$

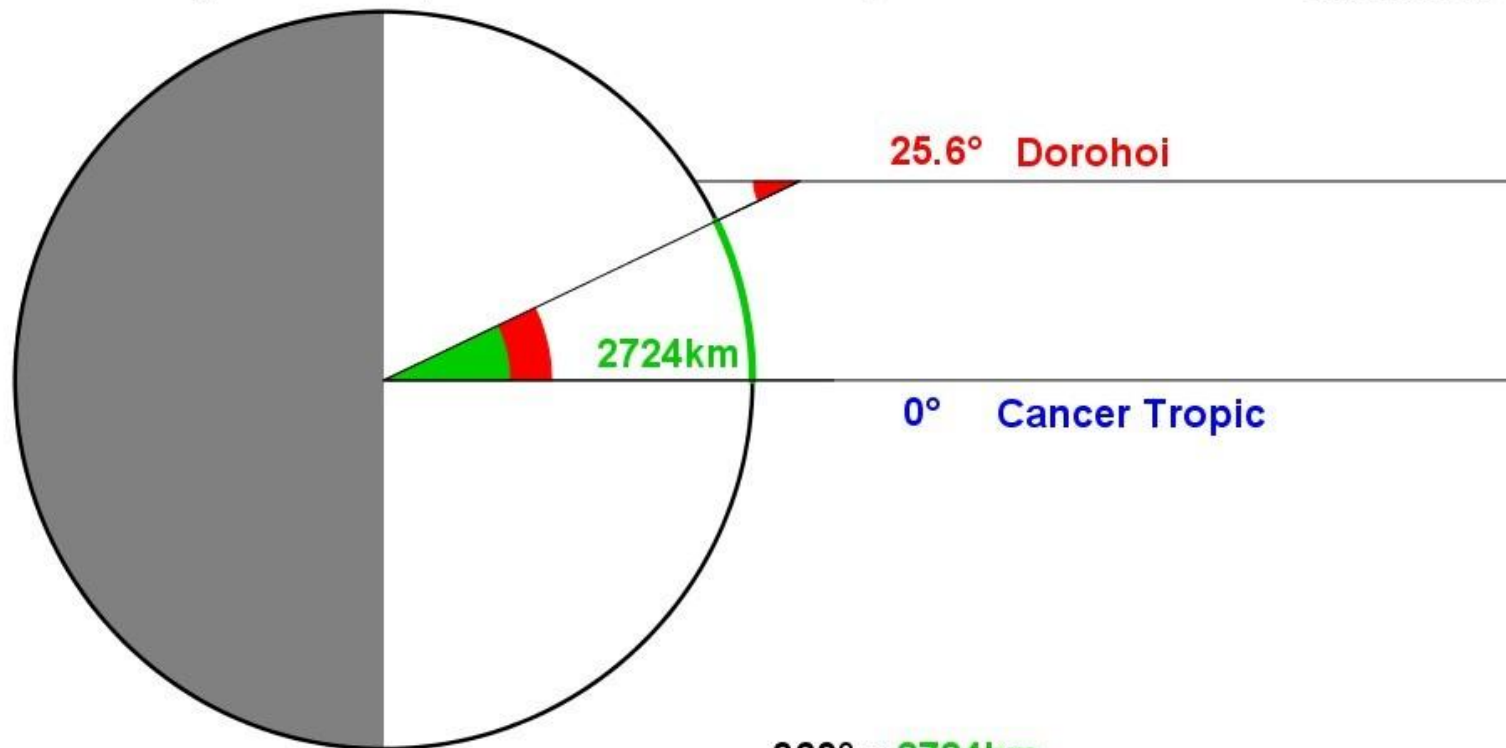
22/06/2020 (Dorohoi-Romania) Latitude: 47.953°

Longitude:26.394E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon:140cm

Shadow:67cm



Distance	Angle
circumference	360°
2724km	25.6° - 0°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{25.6^\circ - 0^\circ} = 38306 \text{ km}$$

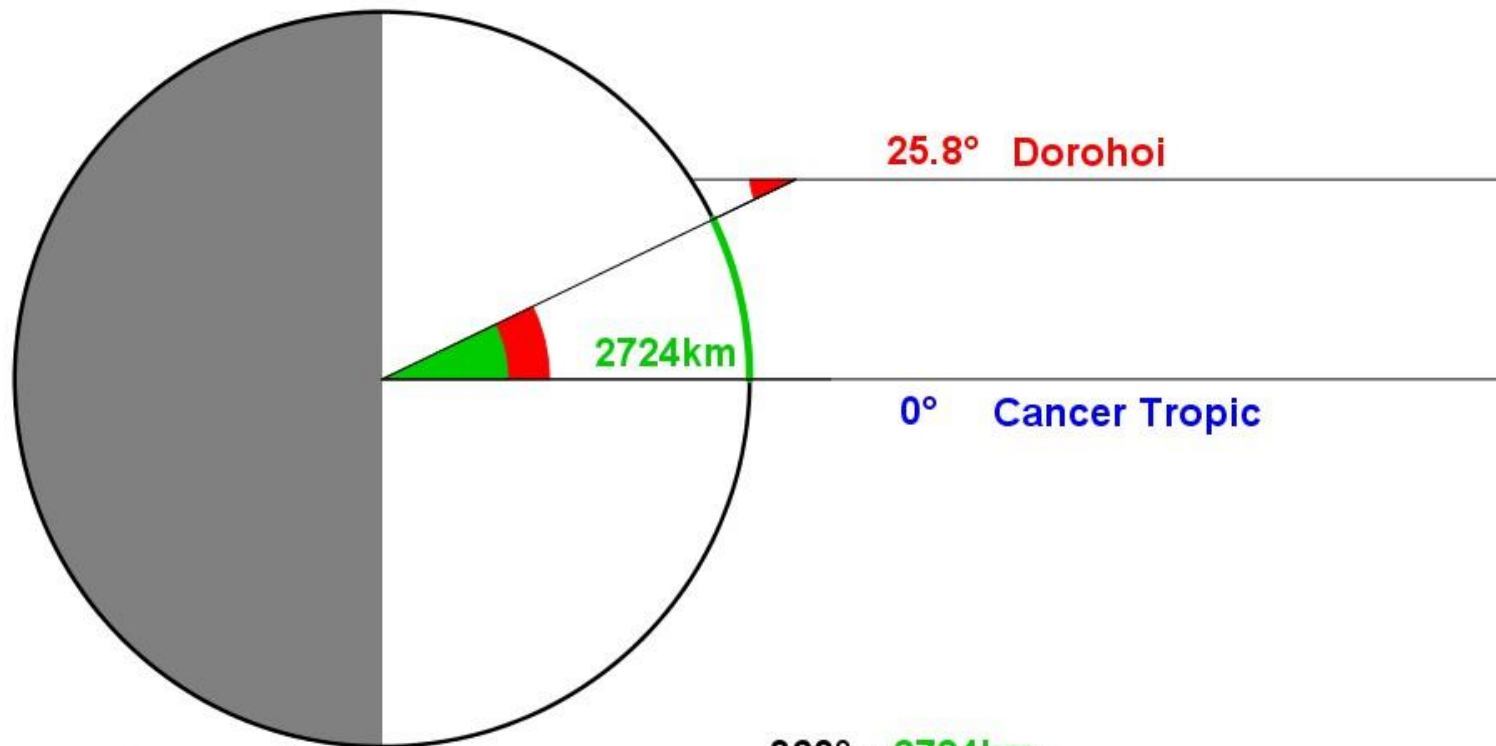
22/06/2020 (Dorohoi-Romania) Latitude: 47.953°

Longitude: 26.394E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon:29cm

Shadow:14cm



Distance	Angle
circumference	360°
2724km	25.8° - 0°

$$\text{circumference} = \frac{360^\circ \times 2724\text{km}}{25.8^\circ - 0^\circ} = 38009 \text{ km}$$

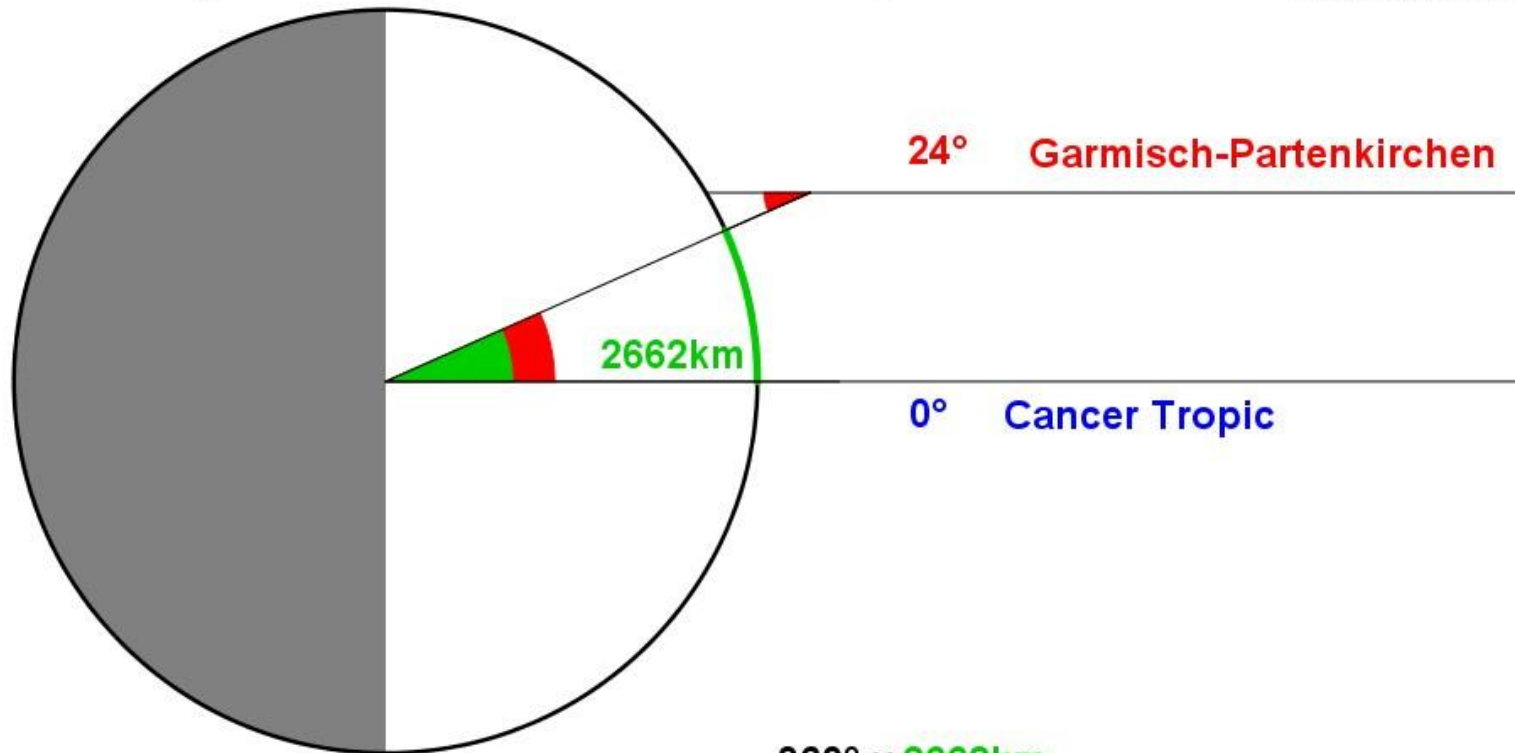
22/06/2020 (Garmisch-Partenkirchen-Germany) Latitude: 47.394°

Longitude: 11.102E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon: 93cm

Shadow: 41,5cm



Distance	Angle
circumference	360°
2662km	24° - 0°

$$\text{circumference} = \frac{360^\circ \times 2662\text{km}}{24^\circ - 0^\circ} = 39930 \text{ km}$$

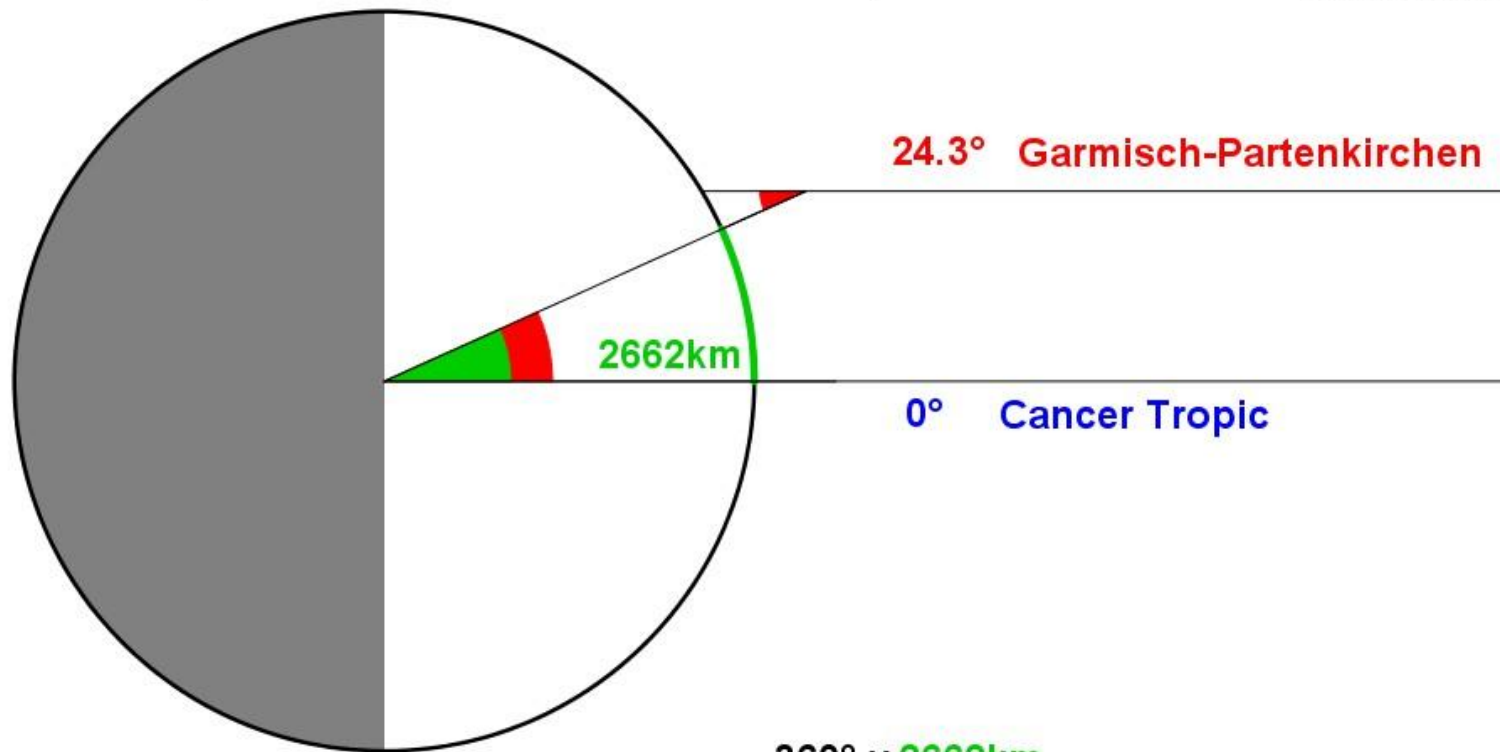
22/06/2020 (Garmisch-Partenkirchen-Germany) Latitude: 47.394°

Longitude:11.102E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon:199cm

Shadow:90cm



Distance	Angle
circumference	360°
2662km	24.3° - 0°

$$\text{circumference} = \frac{360^\circ \times 2662\text{km}}{24.3^\circ - 0^\circ} = 39437 \text{ km}$$

23/06/2020 (Khust-Ukraine) Latitude: 48.185°

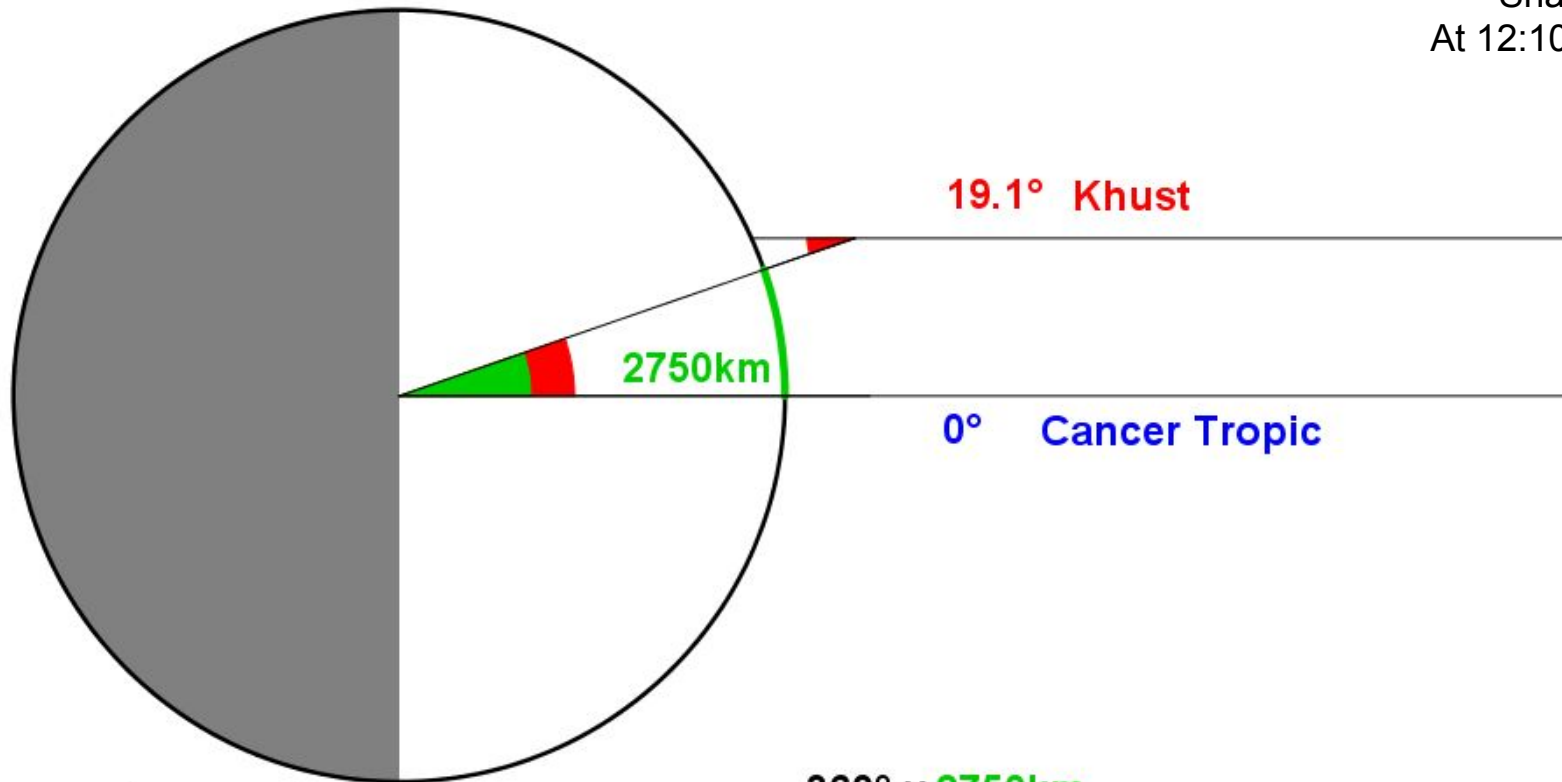
21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Longitude:23.293E

Gnomon:81cm

Shadow:28cm

At 12:10 by Slarka



Distance	Angle
circumference	360°
2750km	19.1° - 0°

$$\text{circumference} = \frac{360^\circ \times 2750\text{km}}{19.1^\circ - 0^\circ} = 51832 \text{ km}$$

23/06/2020 (Khust-Ukraine) Latitude: 48.185°

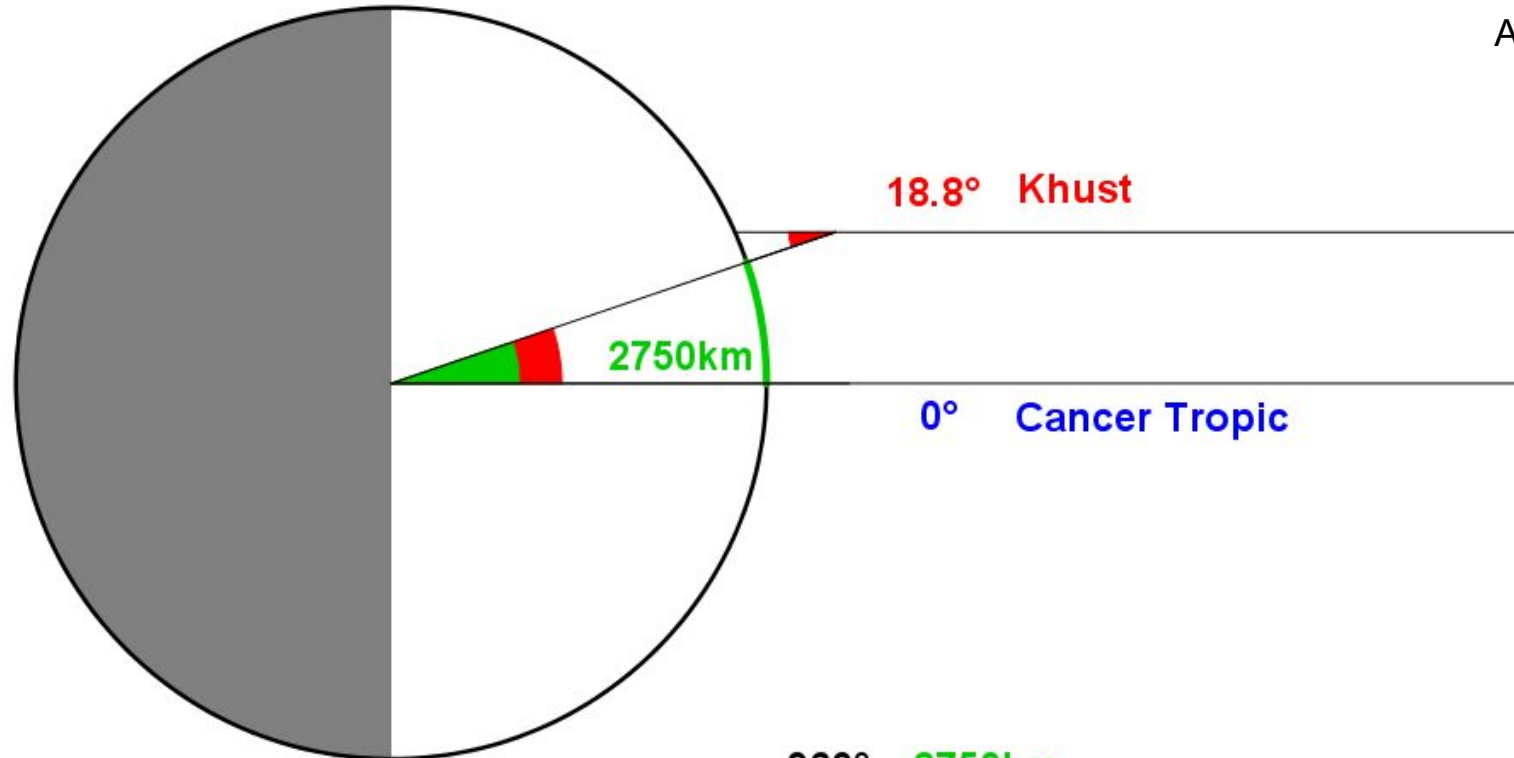
21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Longitude:23.293E

Gnomon:100cm

Shadow:31cm

At 12:03 by Alex



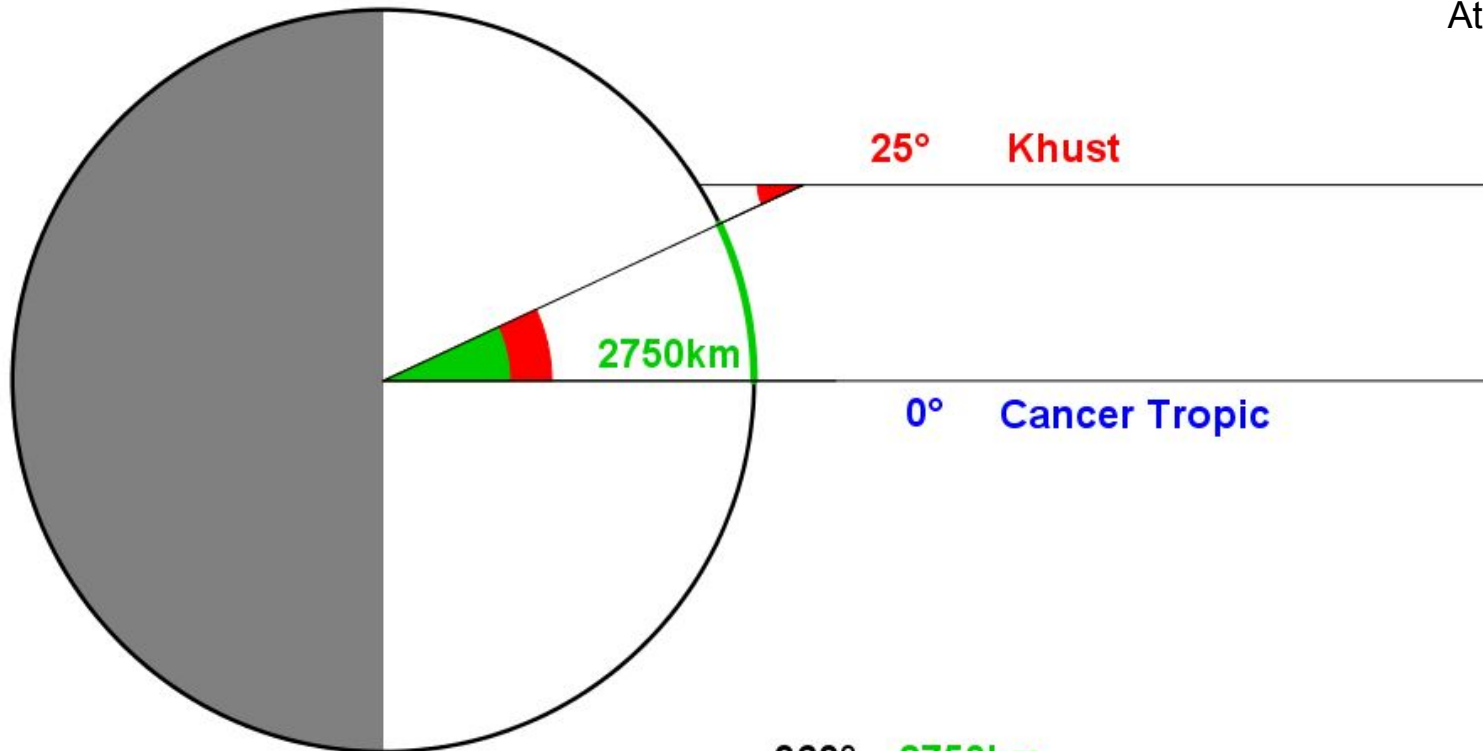
Distance	Angle
circumference	360°
2750km	18.8° - 0°

$$\text{circumference} = \frac{360^\circ \times 2750\text{km}}{18.8^\circ - 0^\circ} = 52660 \text{ km}$$

23/06/2020 (Khust-Ukraine) Latitude: 48.185°

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Longitude:23.293E
Gnomon:150cm
Shadow:70cm
At 12:05 by Kristian



Distance	Angle
circumference	360°
2750km	25° - 0°

$$\text{circumference} = \frac{360^\circ \times 2750\text{km}}{25^\circ - 0^\circ} = 39600 \text{ km}$$

23/06/2020 (Khust-Ukraine) Latitude: 48.185°

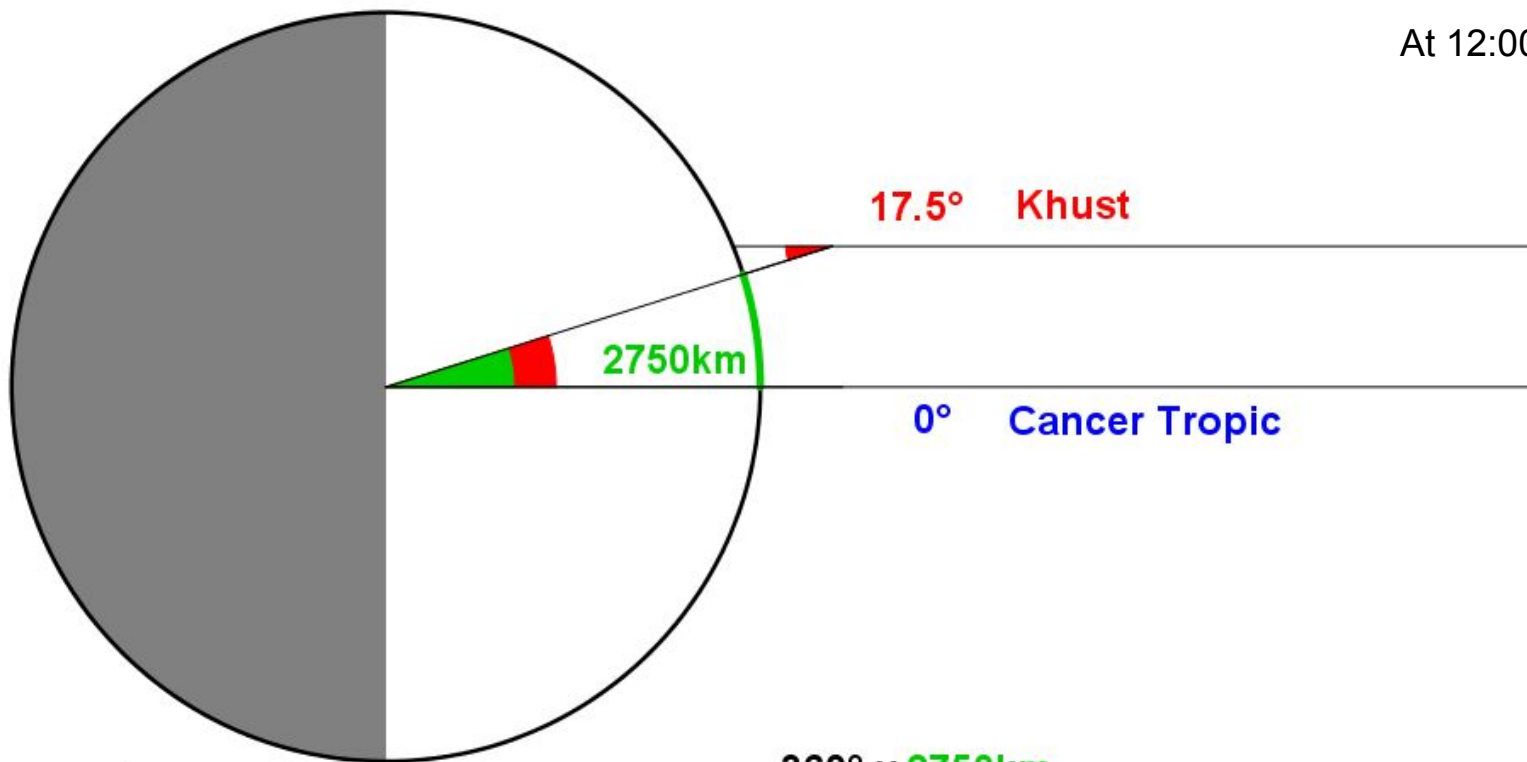
Longitude:23.293E

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Gnomon: 54cm

Shadow:17cm

At 12:00 by Valentyna



Distance	Angle
circumference	360°
2750km	17.5° - 0°

$$\text{circumference} = \frac{360^\circ \times 2750\text{km}}{17.5^\circ - 0^\circ} = 56571 \text{ km}$$

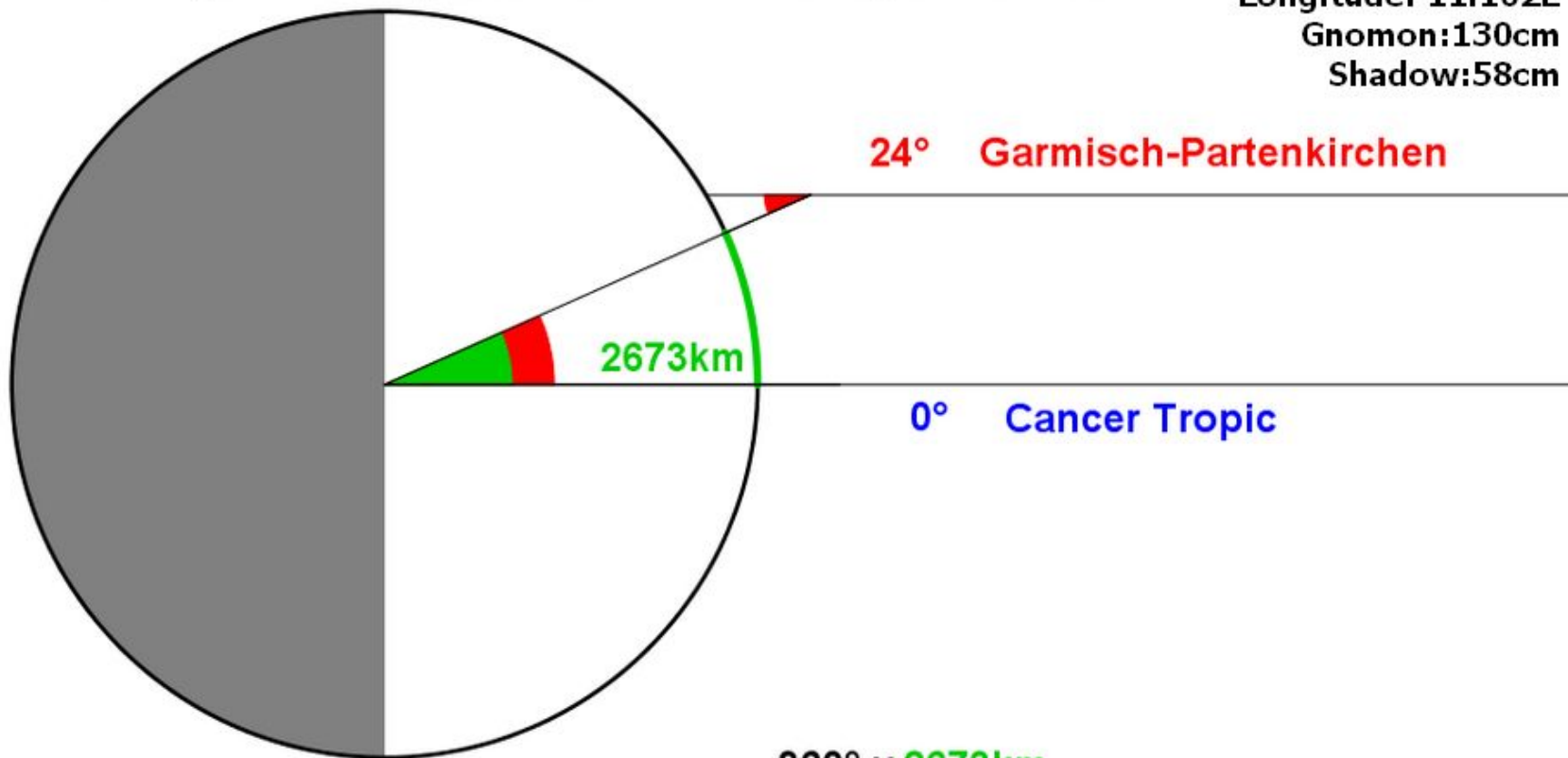
23/06/2020 (Garmisch-Partenkirchen-Germany) Latitude: 47.493°

21/06/2020 (Cancer Tropic-Eratosthenes world) Latitude: 23.437°

Longitude: 11.102E

Gnomon:130cm

Shadow:58cm



24° Garmisch-Partenkirchen

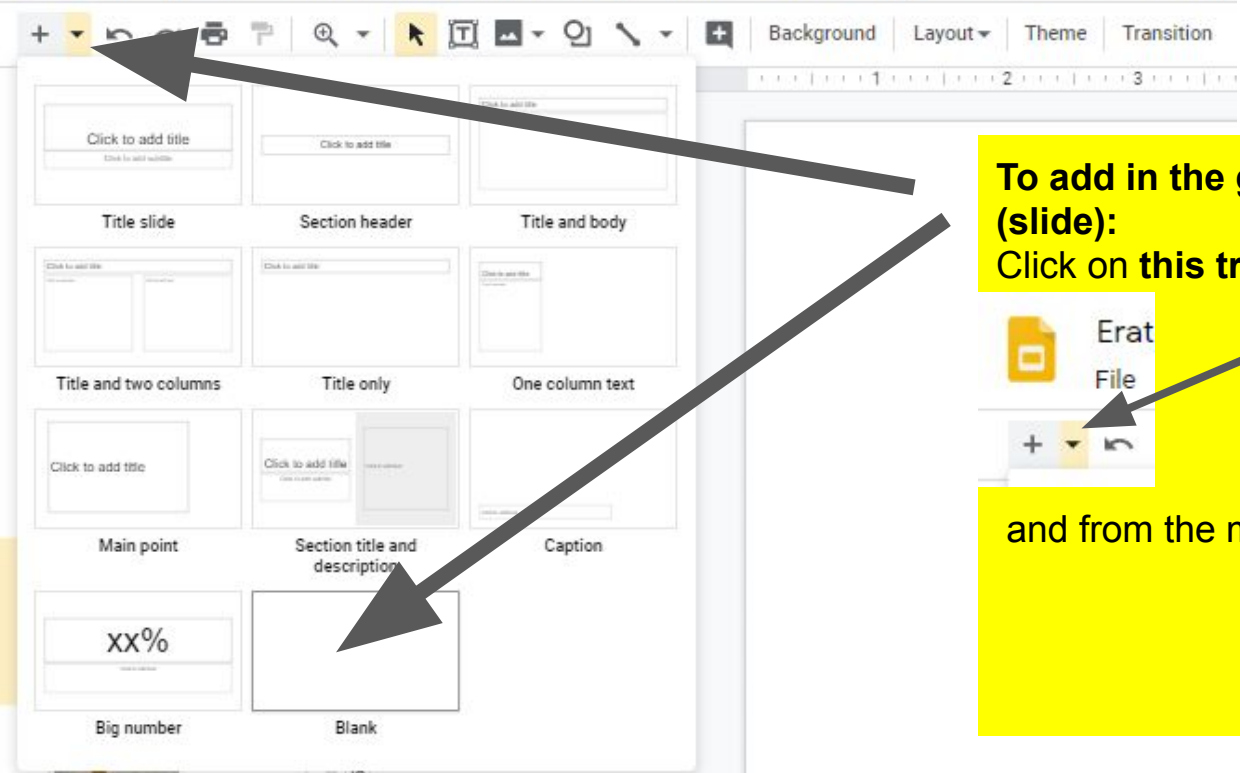
2673km

0° Cancer Tropic

Distance	Angle
circumference	360°
2673km	24° - 0°

$$\text{circumference} = \frac{360^\circ \times 2673\text{km}}{24^\circ - 0^\circ} = 40095 \text{ km}$$

Some help for managing
with this presentation

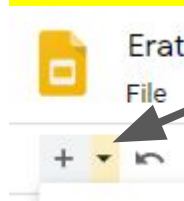


The screenshot shows the Google Slides interface with the layout selection menu open. The menu contains the following options:

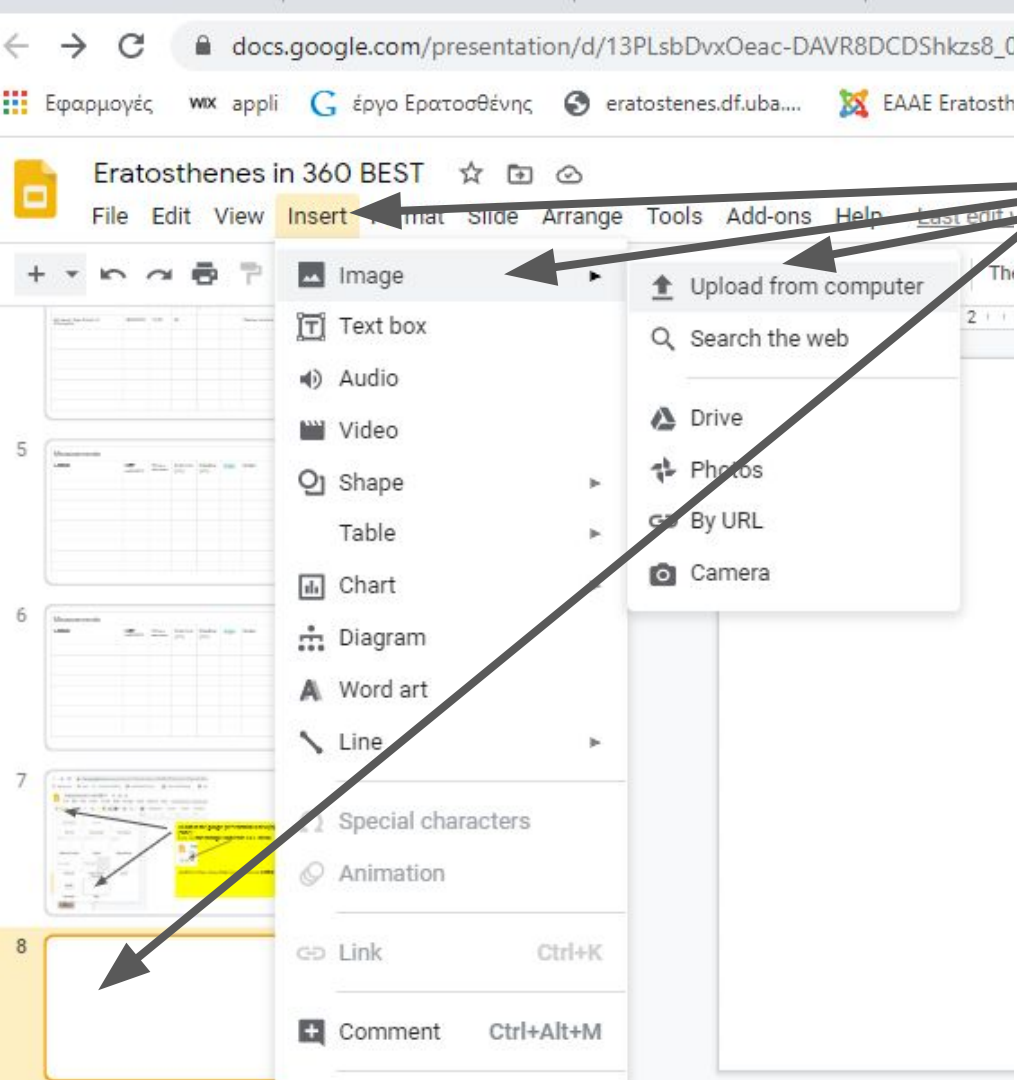
- Title slide
- Section header
- Title and body
- Title and two columns
- Title only
- One column text
- Main point
- Section title and description
- Caption
- Big number
- Blank

Two large grey arrows point from the yellow callout box to the '+' icon in the top toolbar and the 'Blank' layout option.

To add in the google presentation a new page (slide):
Click on this triangle under the FILE menu



and from the menu that opens, choose **Blank**



To upload your photos

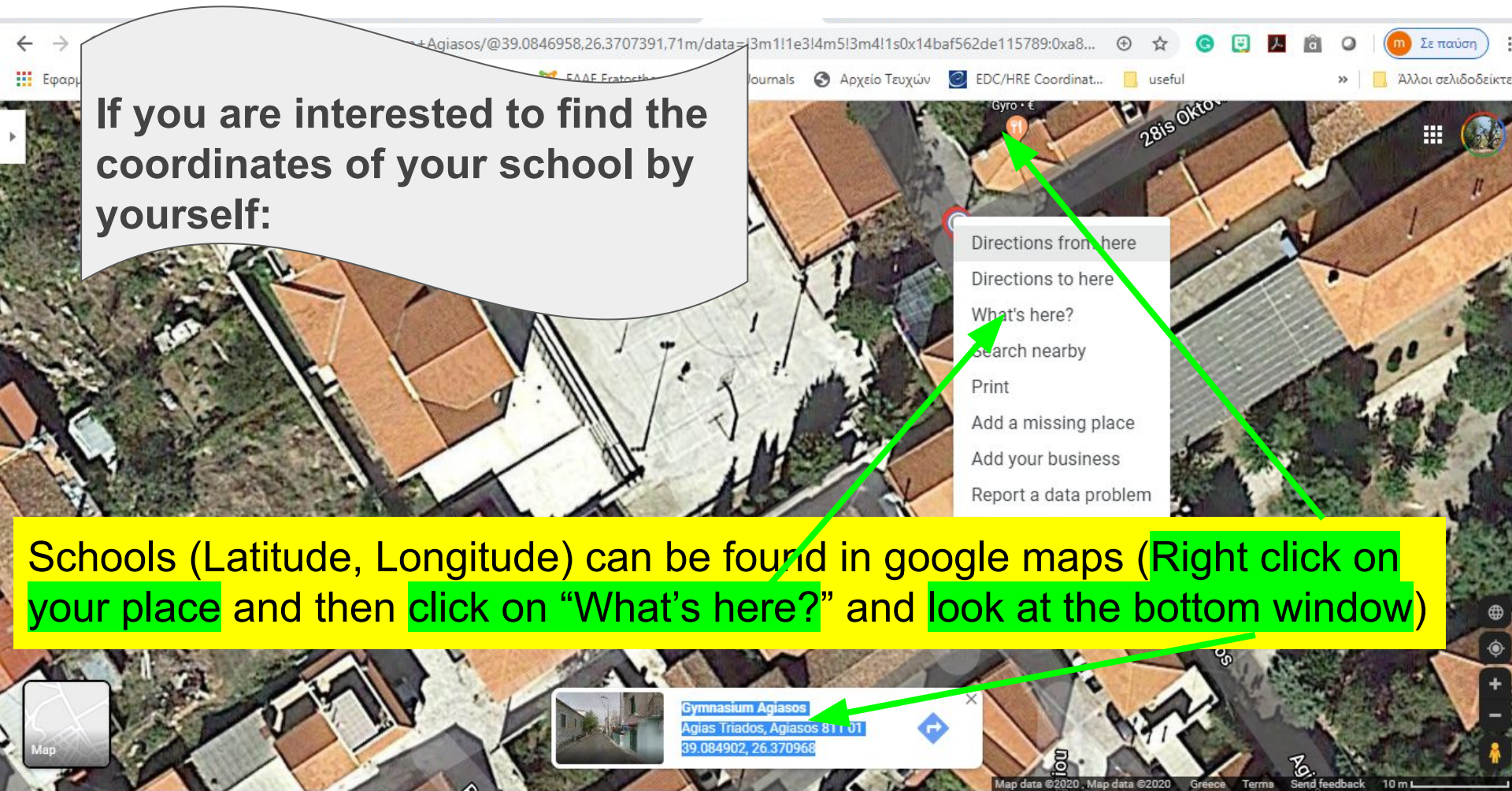
1. Click on an EMPTY page(slide) where you will add the photos
Click on INSERT menu, then choose Image then choose Upload from your computer (you need to have the photos on your device. If it is your cell phone then you must a) have connected the phone to the computer and choose the cell phone's camera folder to find the photo that you upload) or b) access this google presentation though a web browser in your cell phone and upload the photos using the same commands.
3. WORST CASE: send email to your teacher with your data and your photos.

REMEMBER to communicate the data and the photos AS SOON AS POSSIBLE and definitely the same day of the measurement


Some help with school's
coordinates
(Latitude, Longitude)

If you are interested to find the coordinates of your school by yourself:


Schools (Latitude, Longitude) can be found in google maps (Right click on your place and then click on "What's here?" and look at the bottom window)






 Middle School Antonin Perbosc

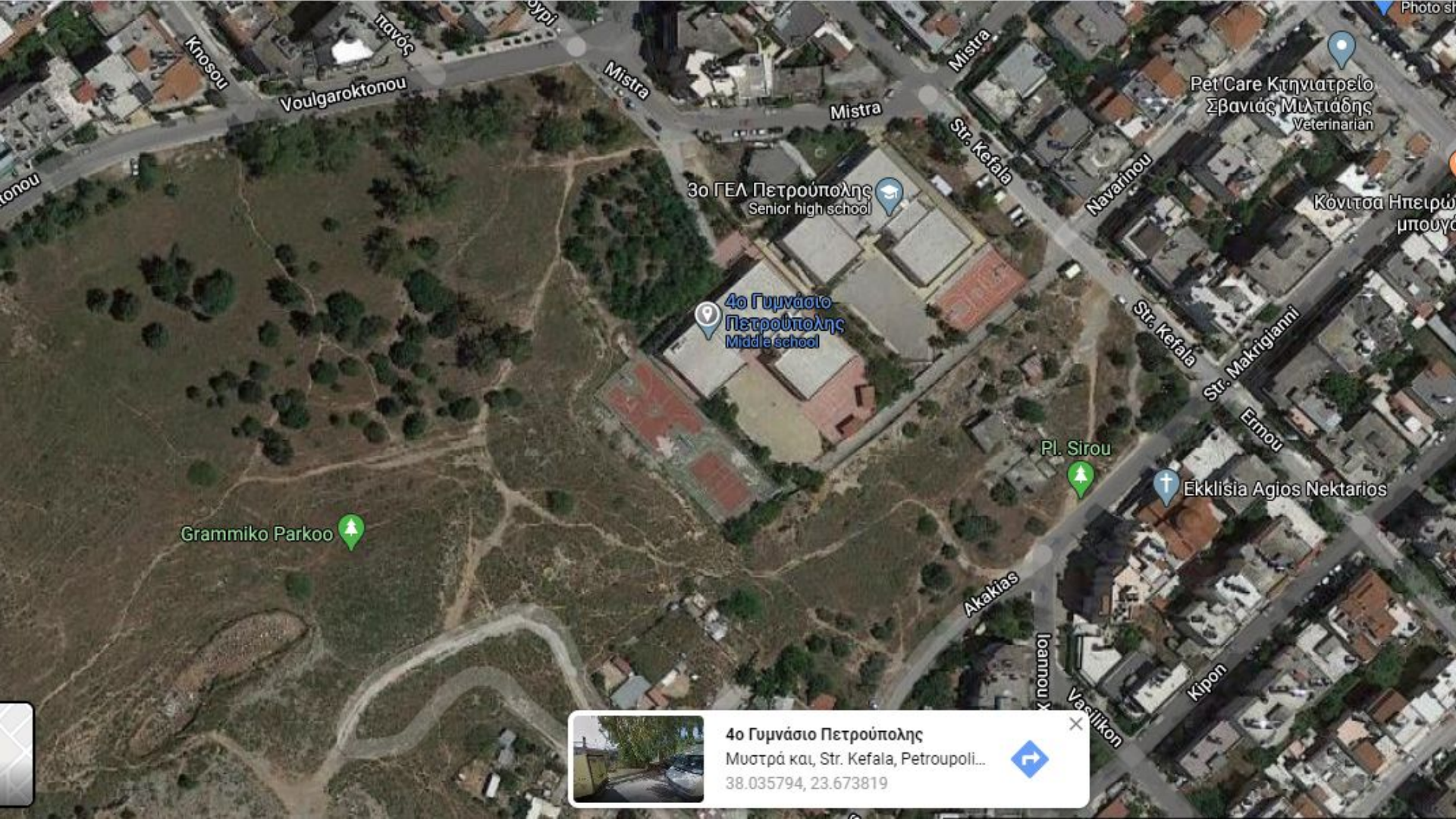
SQLO Badminton,
Tennis de Table, Volley
Temporarily closed



×

Middle School Antonin Perbosc
 Avenue d'Aquitaine, 82130 Lafranç...
 44.127264, 1.237222





Grammiko Parko

3ο ΓΕΛ Πετρούπολης
Senior high school

4ο Γυμνάσιο
Πετρούπολης
Middle school

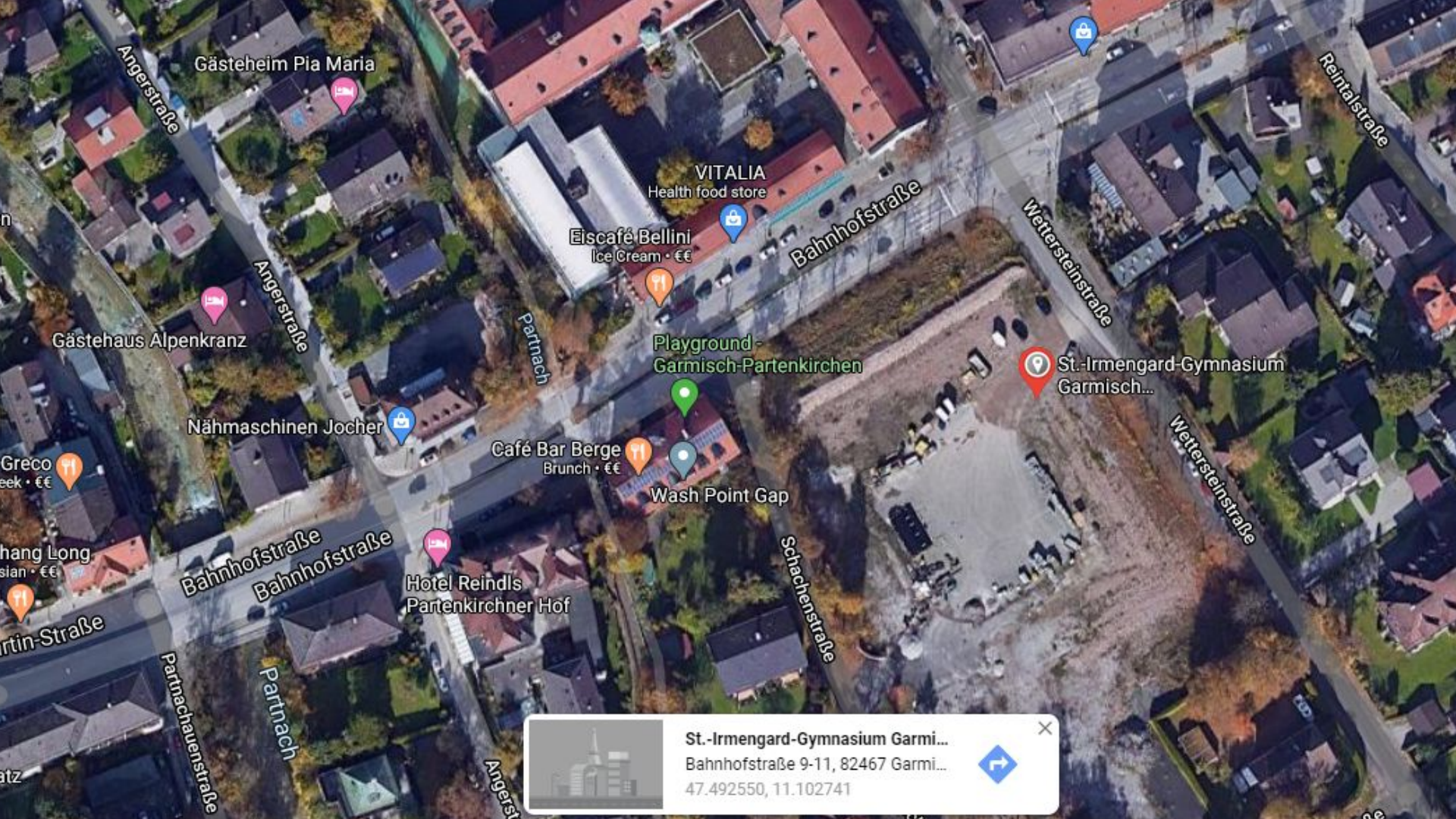
Pl. Sirou

Εκκλῆσια Αγίου Νεκταρίου



4ο Γυμνάσιο Πετρούπολης
Μυστρά και, Str. Kefala, Petroupoli...
38.035794, 23.673819





Gästehaus Alpenkranz

Eiscafé Bellini
Ice Cream · €€

VITALIA
Health food store

Playground-
Garmisch-Partenkirchen

St.-Irmengard-Gymnasium
Garmisch...

Nähmaschinen Jocher

Café Bar Berge
Brunch · €€

Wash Point Gap

Hotel Reindls
Partenkirchner Hof



St.-Irmengard-Gymnasium Garmi...
Bahnhofstraße 9-11, 82467 Garmi...
47.492550, 11.102741





Konsullata e Përgjithshme
e Shqipërisë në Janinë/...
Konsullata e përgjithshme
e shqiperise ne janine/...

Σιώζος αρτοποιασμοί
Bakery

"FATUS OLOUS"
Fast Food

Αρχιμανδρείο Εκκλησία
Orthodox church

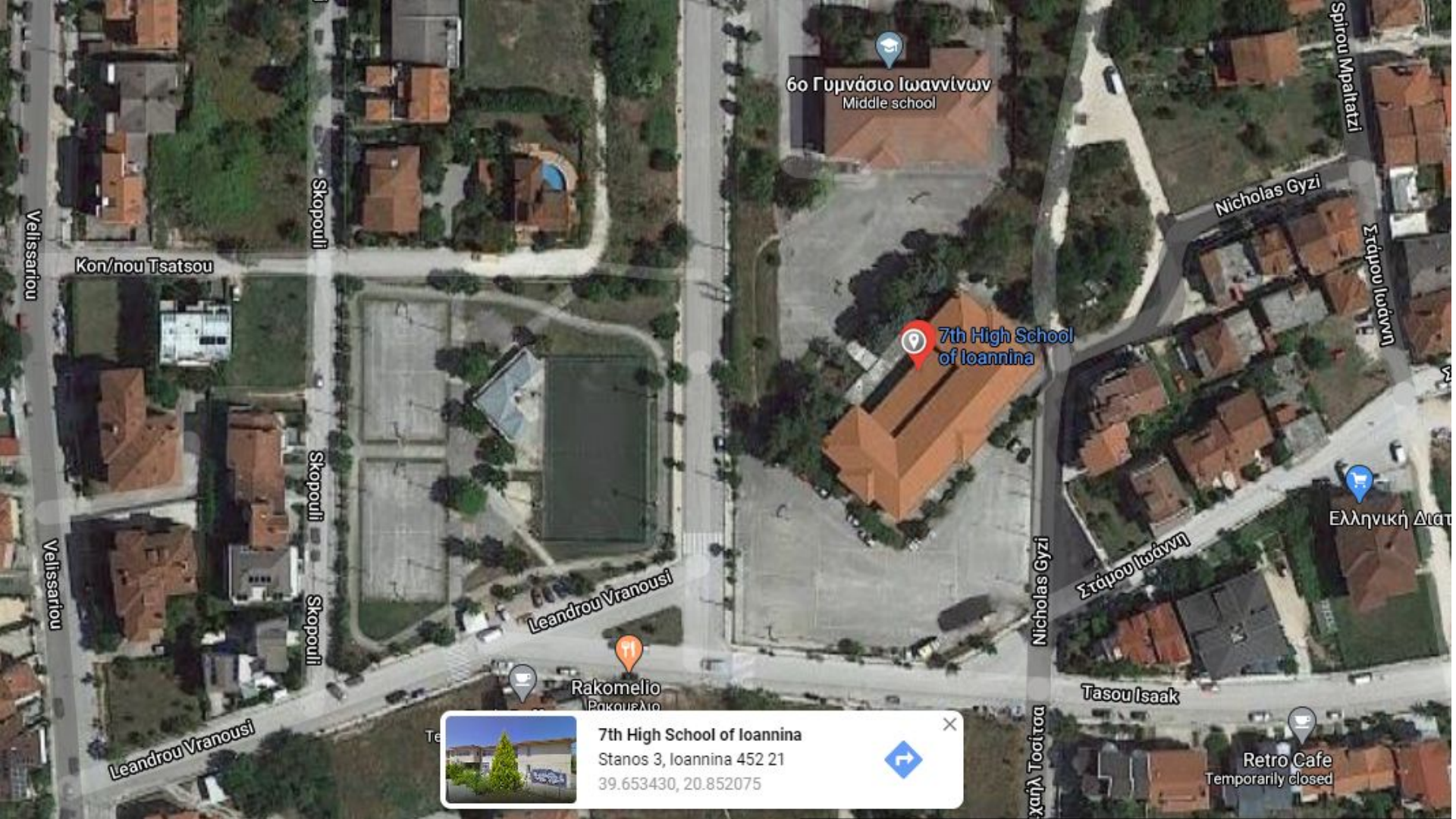
Με ρακι
Small Plates

ΟΒΕΛΙΣΤΗΡΙΟ
Ο ΠΙΑΝΝΑΚΗΣ
Πινακάκης Ψητοπωλείο



Ζωσιμαία σχολή
Ζωσιμαία Σχολή, Ioannina 454 44
39.671174, 20.846210





6ο Γυμνάσιο Ιωαννίνων
Middle school

7th High School of Ioannina

Leandrou Vranousi

Rakomelio
Ρακομελίο

Nicholas Gyzi

Στάμου Ιωάννη

Tasou Isaak



7th High School of Ioannina
Stanos 3, Ioannina 452 21
39.653430, 20.852075



Retro Cafe
Temporarily closed



Γυμνάσιο Αγιάσου



Gymnasium Agiasos

Σχολείο



Directions



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Verify info with this place

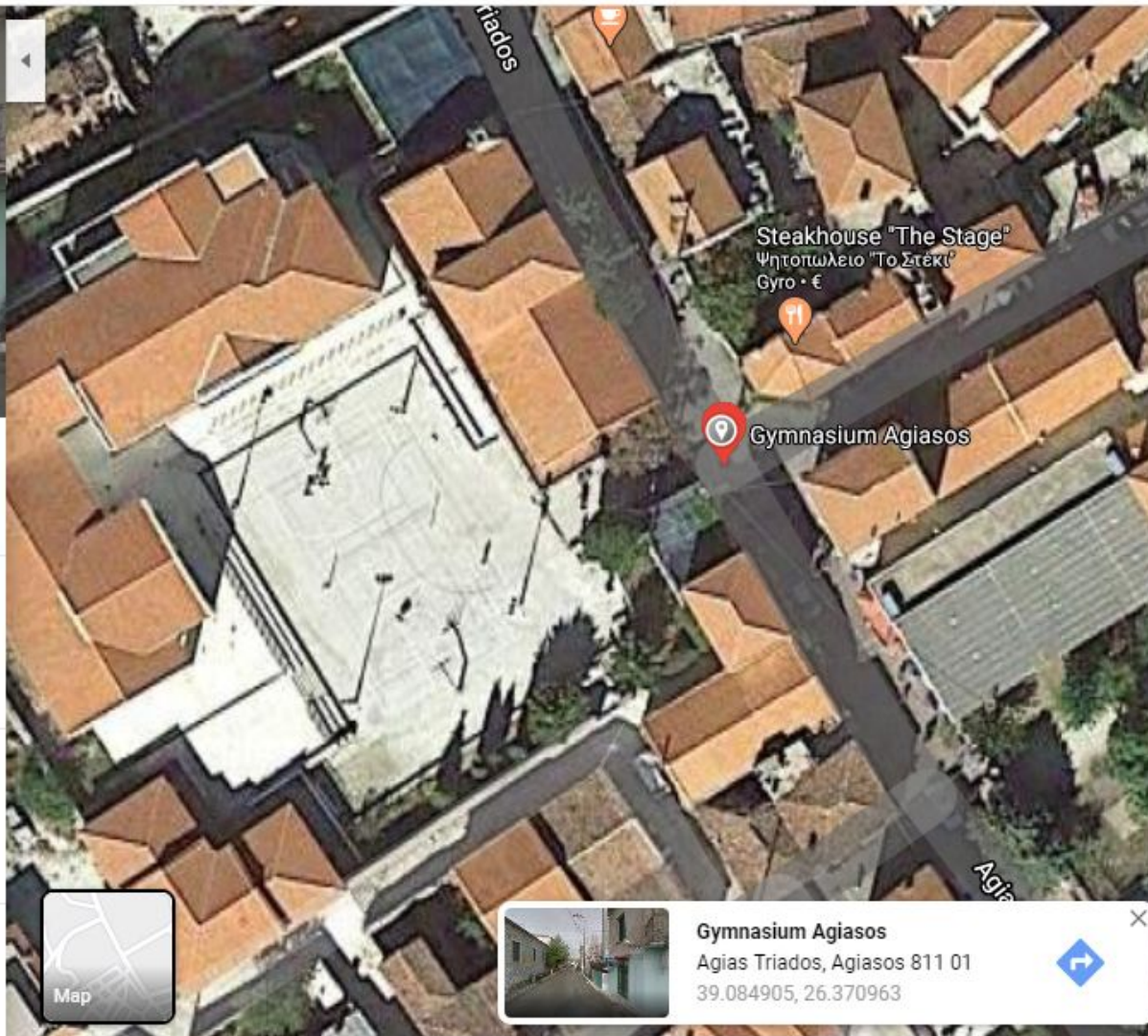
Hours or services may differ due to COVID-19



Agias Triados, Agiasos 811 01



Αγίας Τριάδος, Αγιάσος 811 01



Steakhouse "The Stage"

Ψητοπωλείο "Το Στεκι"
Gyro • €



Gymnasium Agiasos



Gymnasium Agiasos

Agias Triados, Agiasos 811 01

39.084905, 26.370963



☰ National College "Grigore Ghica" 🔍 ✕



National College "Grigore Ghica" Dorohoi

Colegiul Național "Grigore Ghica" Dorohoi

3.8 ★★★★★ (10)

High school

Temporarily closed



Directions



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Nearby



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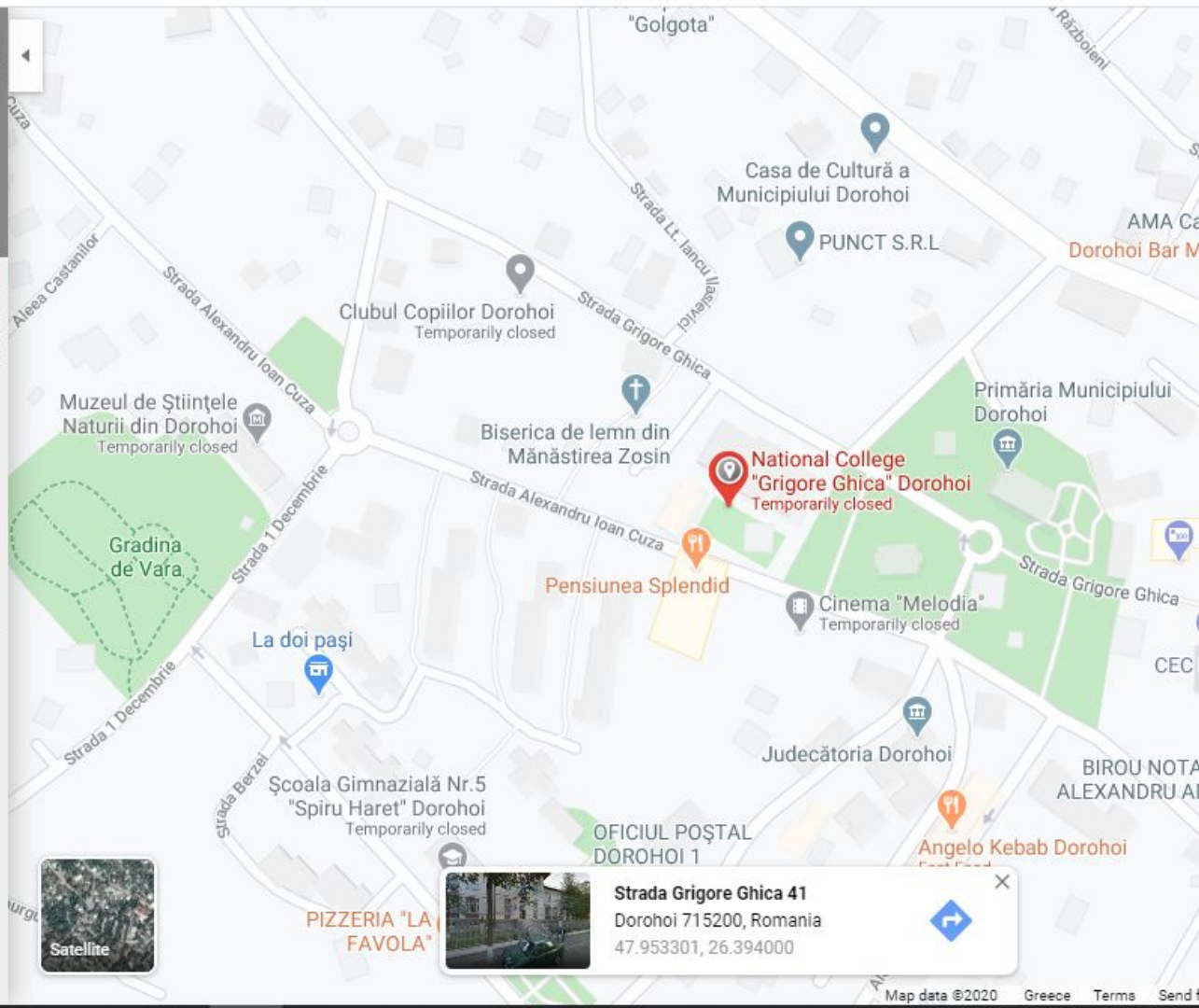


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📍 Strada Grigore Ghica 41, Dorohoi 715200, Romania

⋮ X93V+7H Dorohoi, Romania

🌐 colegiulghica.ro



Satellite



Strada Grigore Ghica 41
Dorohoi 715200, Romania
47.953301, 26.394000





High School "Mesterul Manole" Săl



Liceul Teoretic Mesterul Manole

5.0 ★★★★★ (10)

High school



Directions



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Nearby



Send to your
phone



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R26, Sălcuța, Moldova



Copy address



H6XX+G5 Sălcuța, Moldova

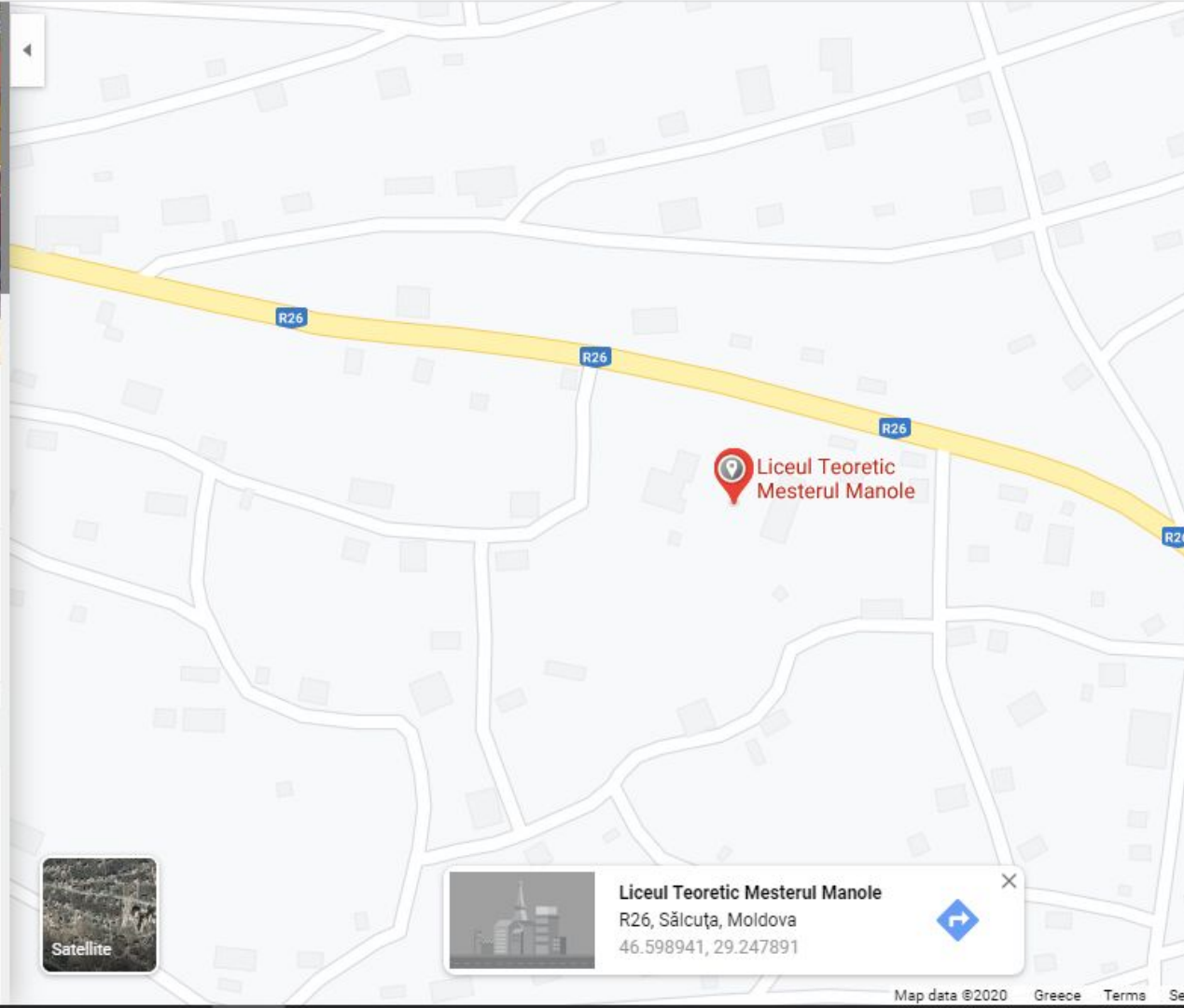


+373 243 41 247



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Liceul Teoretic
Mesterul Manole



Satellite



Liceul Teoretic Mesterul Manole

R26, Sălcuța, Moldova

46.598941, 29.247891





Search nearby 48.893659, 3



Restaurants nearby



Hotels nearby



Bars and pubs nearby

Lozova



Kharkiv Oblast
Ukraine

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Google Maps?

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Satellite



Show route preview



Khlibne
Хлібне

P51

P51

48.893659, 36.307936

Ukrains'ke
Українське

P51

P51

Lozova
Лозова



Вулиця Дідука
Вулиця Василяка

T2113

Пам'ятник Героям
Афганістана

Druzhiba

Вулиця Зорічного



Lozova

Kharkiv Oblast, Ukraine

48.893659, 36.307936





Specialized School No 3, khust, U



Verify info with this place

Hours or services may differ due to COVID-19



Vulytsya Shkil'na, Khust, Zakarpattia Oblast, Ukraine, 90400



вулиця Шкільна, Хуст, Закарпатська область, 90400



57MV+X2 Khust, Zakarpattia Oblast, Ukraine



specializ.ucoz.com



+380 3142 53112



Closed. Opens at 8:00 AM



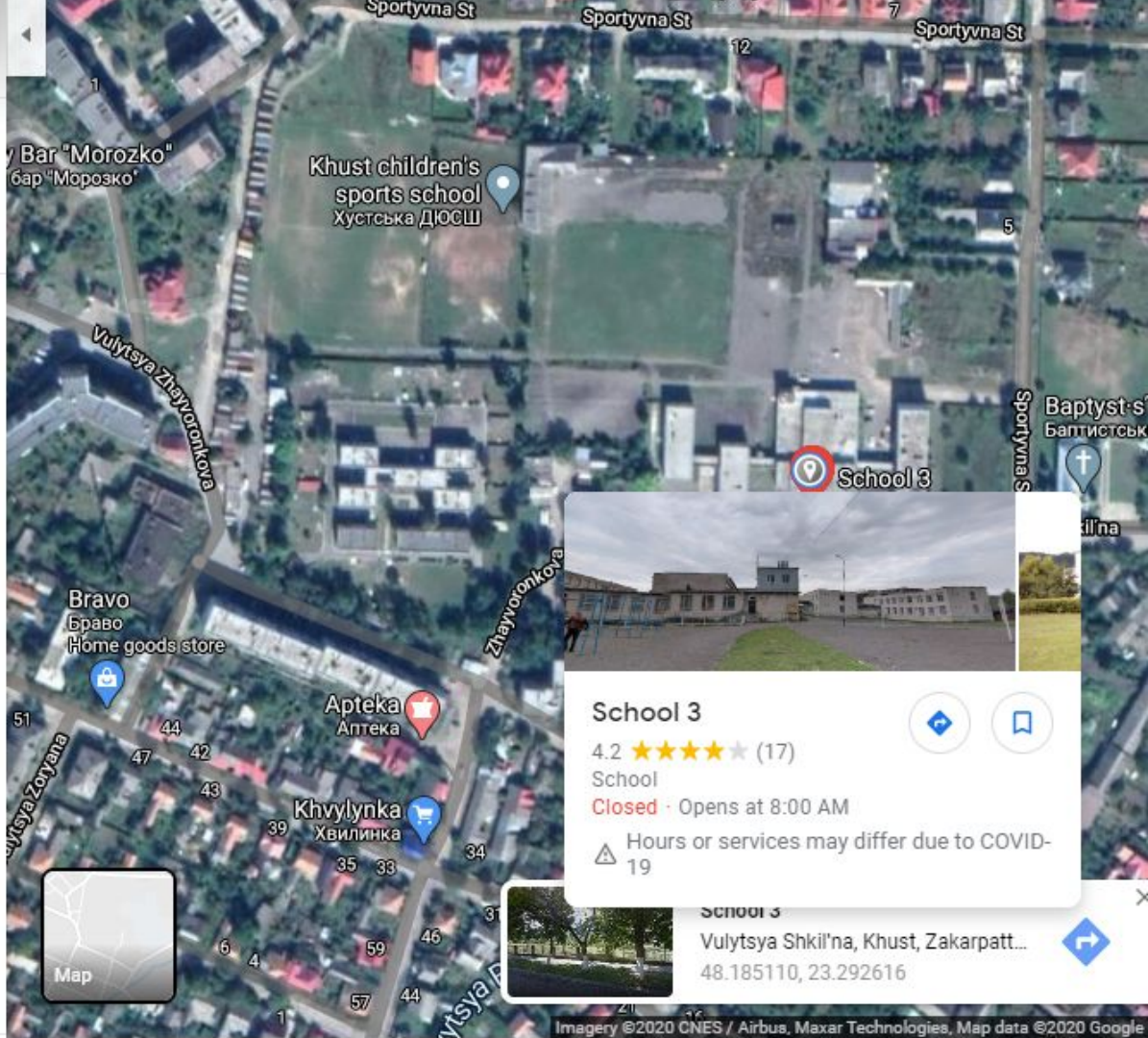
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School 3

4.2 ★★★★★ (17)

School

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Hours or services may differ due to COVID-19



School 3

Vulytsya Shkil'na, Khust, Zakarpatt...
48.185110, 23.292616



“360 Big European Solar Tour”
2019-2020