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Student
Introduction
To
The
Solar
Pathfinder
SOLAR

Part 1:
Introduction to the Solar Pathfinder™ by the Manufacturer

Watch these short videos describing the Solar Pathfinder and how it's used. Write critical notes on the photos and illustrations on this page, and in the space available on the next page.

- Solar Pathfinder, Pathfinder Overview (5:18): http://www.solarpathfinder.com/video/2
- Solar Pathfinder, Fast Accurate Solar Site Analysis (4:34): http://www.solarpathfinder.com/video/6

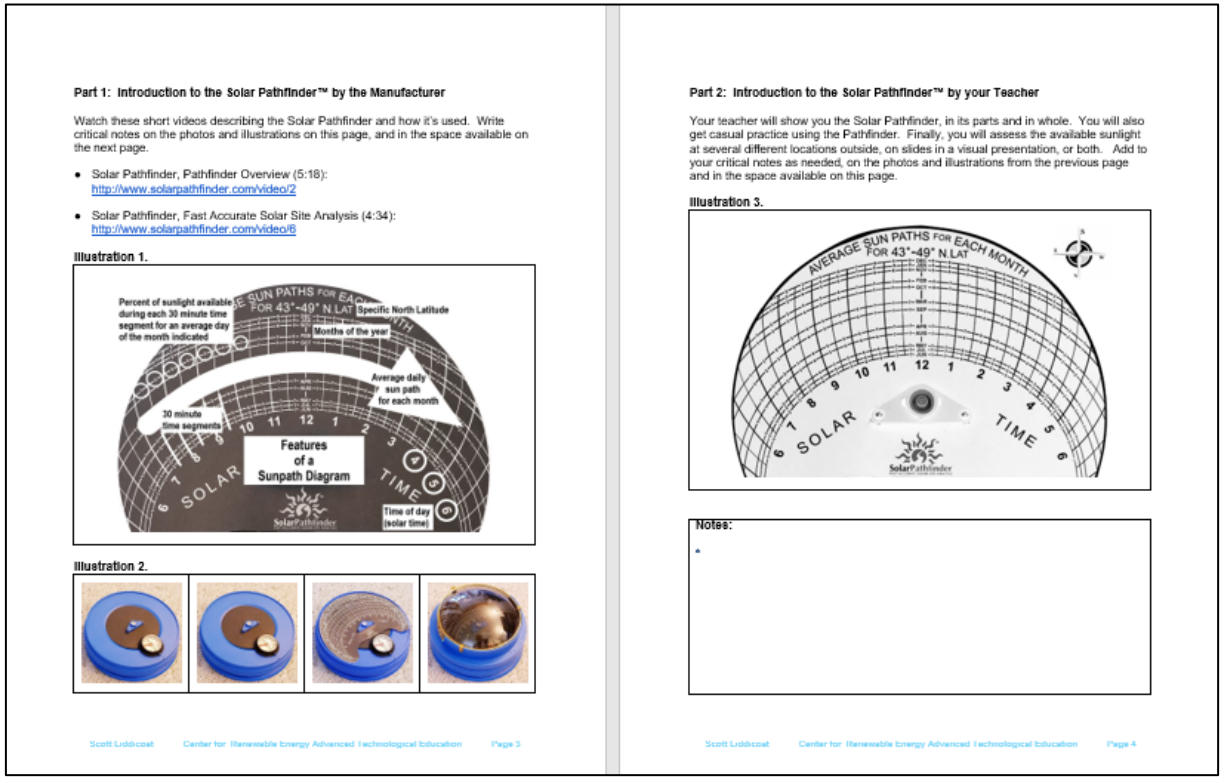

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Illustration 1.

Illustration 2.

Part 2: Introduction to the Solar Pathfinder™ by your Teacher

Your teacher will show you the Solar Pathfinder, in its parts and in whole. You will also get casual practice using the Pathfinder. Finally, you will assess the available sunlight at several different locations outside, on slides in a visual presentation, or both. Add to your critical notes as needed, on the photos and illustrations from the previous page and in the space available on this page.

Illustration 3.

Notes:

Part 2:
Introduction to the Solar Pathfinder™ by your Teacher

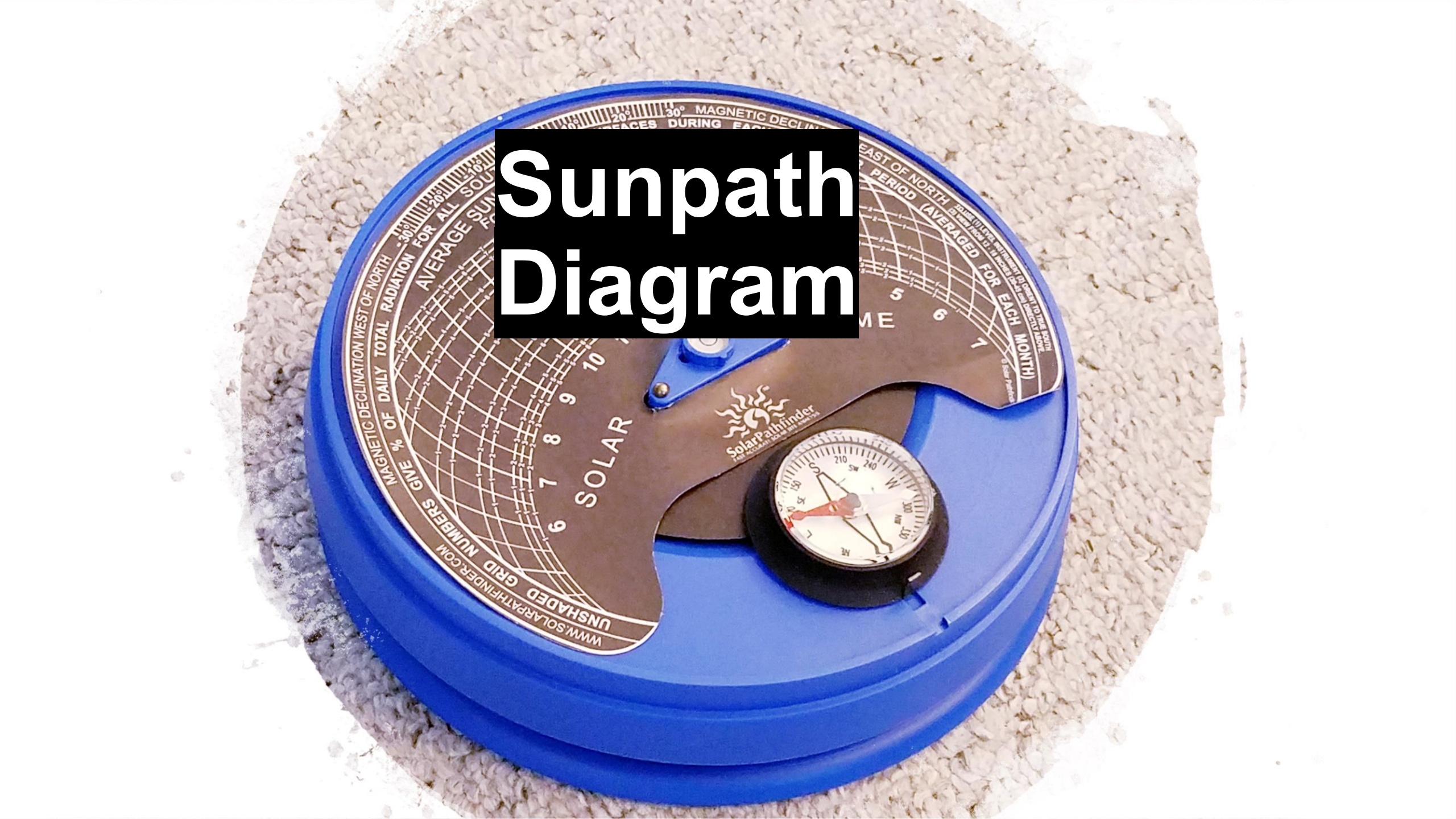
LISTO
No. 162C
AVERAGE SUN PATHS FOR EACH MONTH
FOR 43°-49° N.LAT
SOLAR TIME
SolarPathfinder

Base

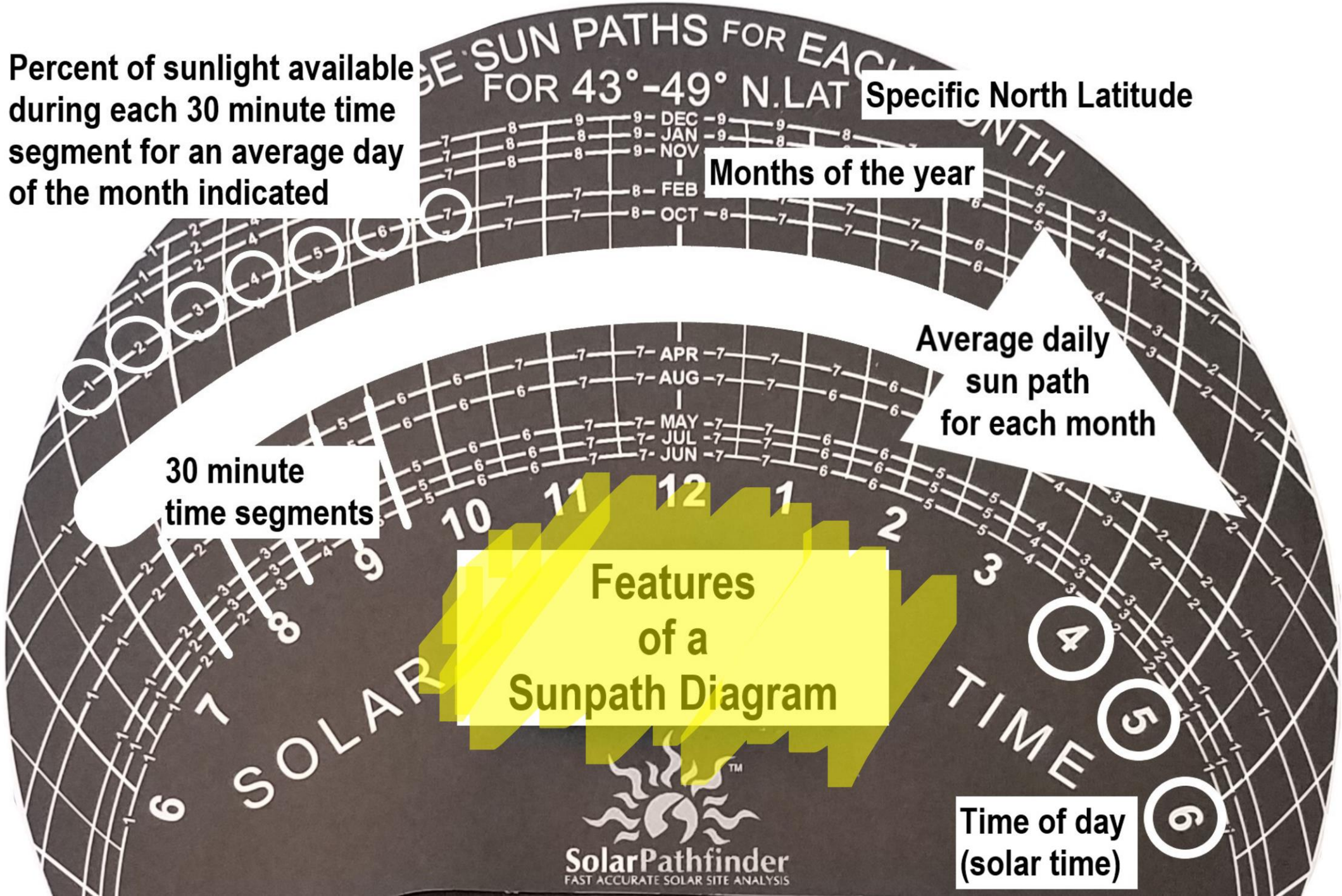
Instrument
Section (1)

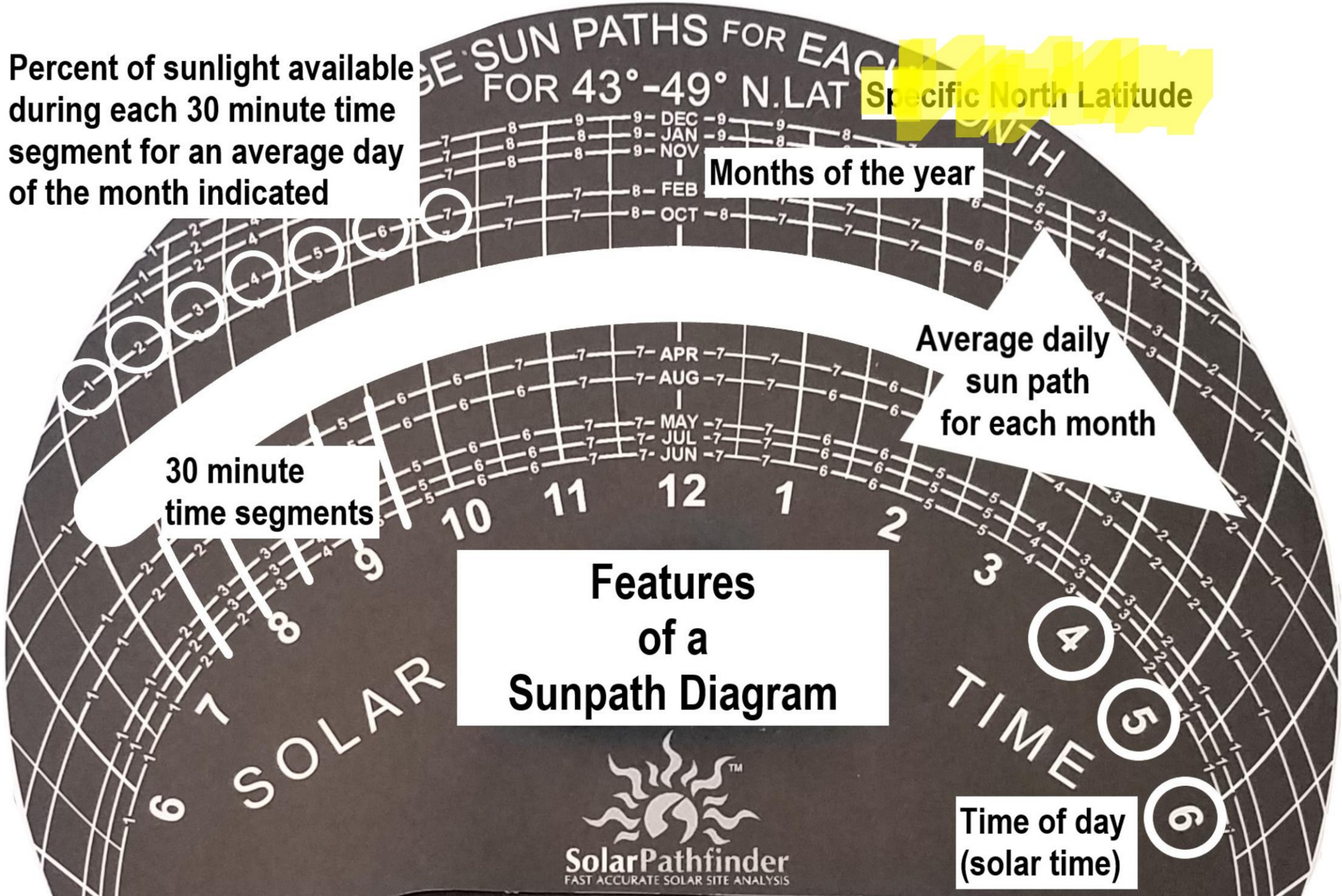
Leveling
Bubble
Instrument
Section (2)

Leveling
Bubble
Instrument
Section (3)
Compass


Sunpath
Diagram
MAGNETIC DECLINATION WEST OF NORTH
AVERAGE SUN
SOLAR
UNSHADED GRID NUMBERS GIVE % OF DAILY TOTAL RADIATION FOR ALL SOU
WWW.SOLARPATHFINDER.COM
SolarPathfinder

Reflective
Dome
SOLAR
PATHFINDER
SOLAR
TIME


Percent of sunlight available during each 30 minute time segment for an average day of the month indicated
SUN PATHS FOR EA
FOR 43°-49° N.LAT
Specific North Latitude
DEC
JAN
NOV
FEB
OCT
Months of the year
Average daily sun path for each month
APR
AUG
MAY
JUL
JUN
30 minute time segments
SOLAR
TIME
Features of a Sunpath Diagram
SolarPathfinder
FAST ACCURATE SOLAR SITE ANALYSIS
Time of day (solar time)


Percent of sunlight available during each 30 minute time segment for an average day of the month indicated
SUN PATHS FOR EAC
FOR 43°-49° N.LAT
Specific North Latitude
DEC
JAN
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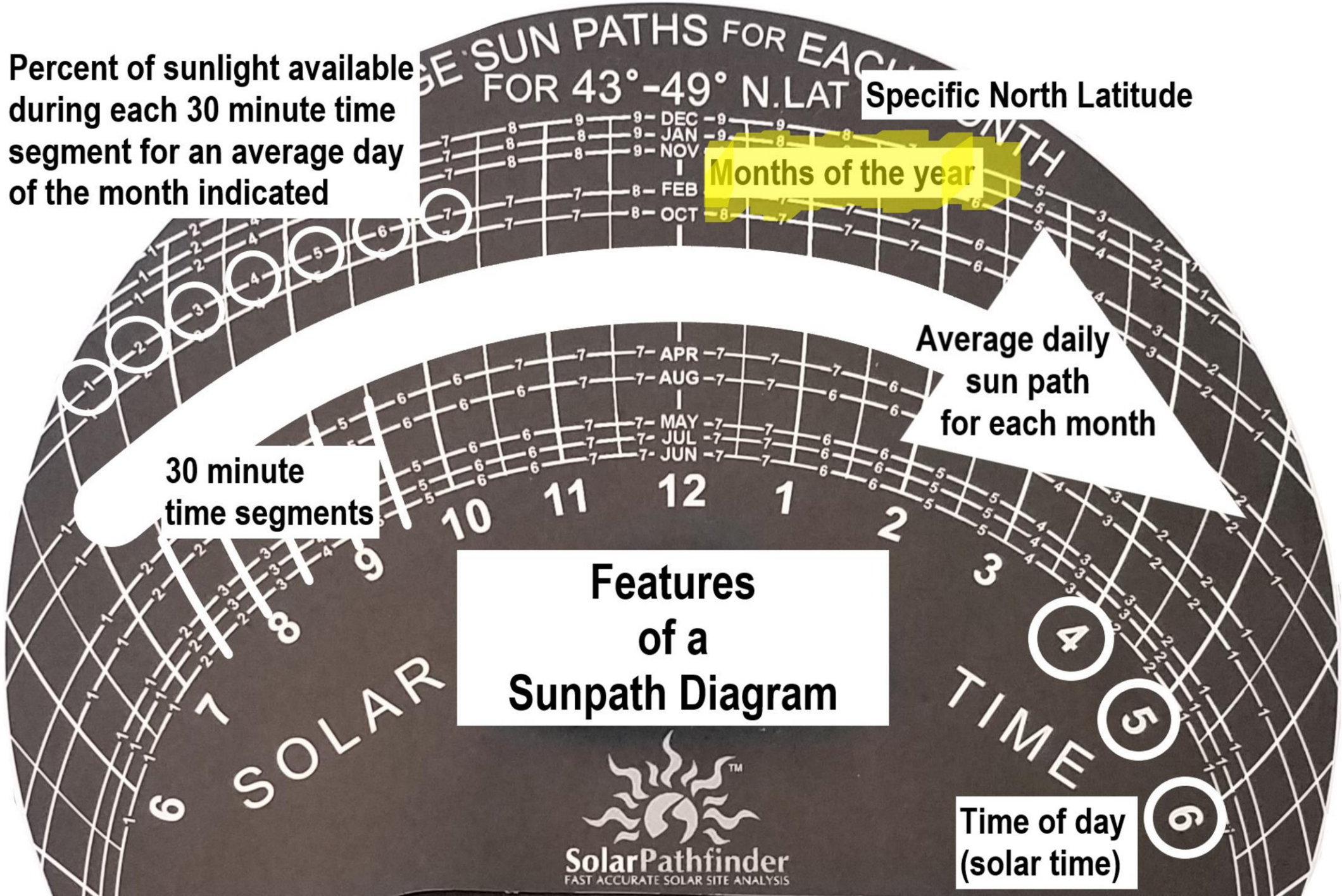
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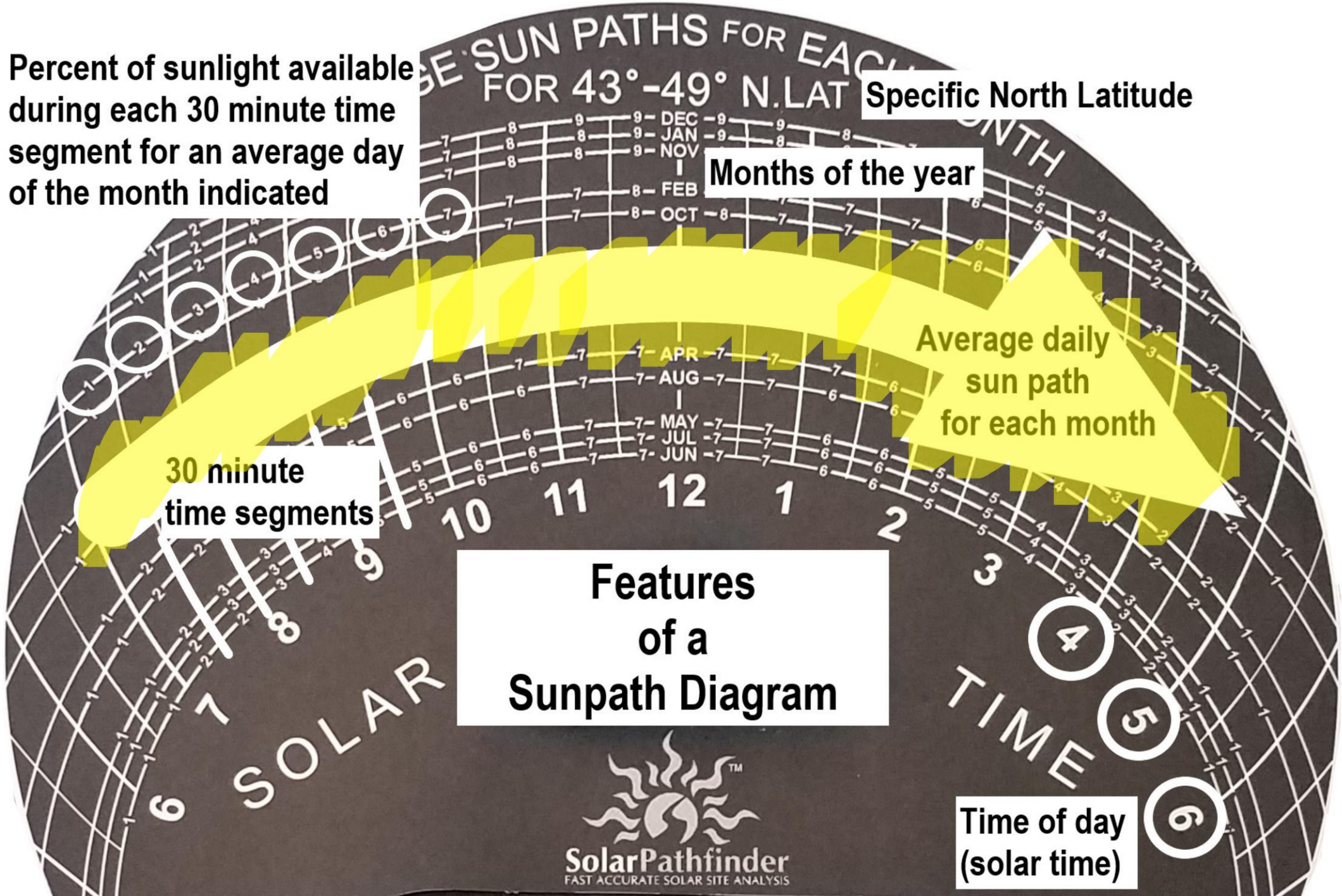
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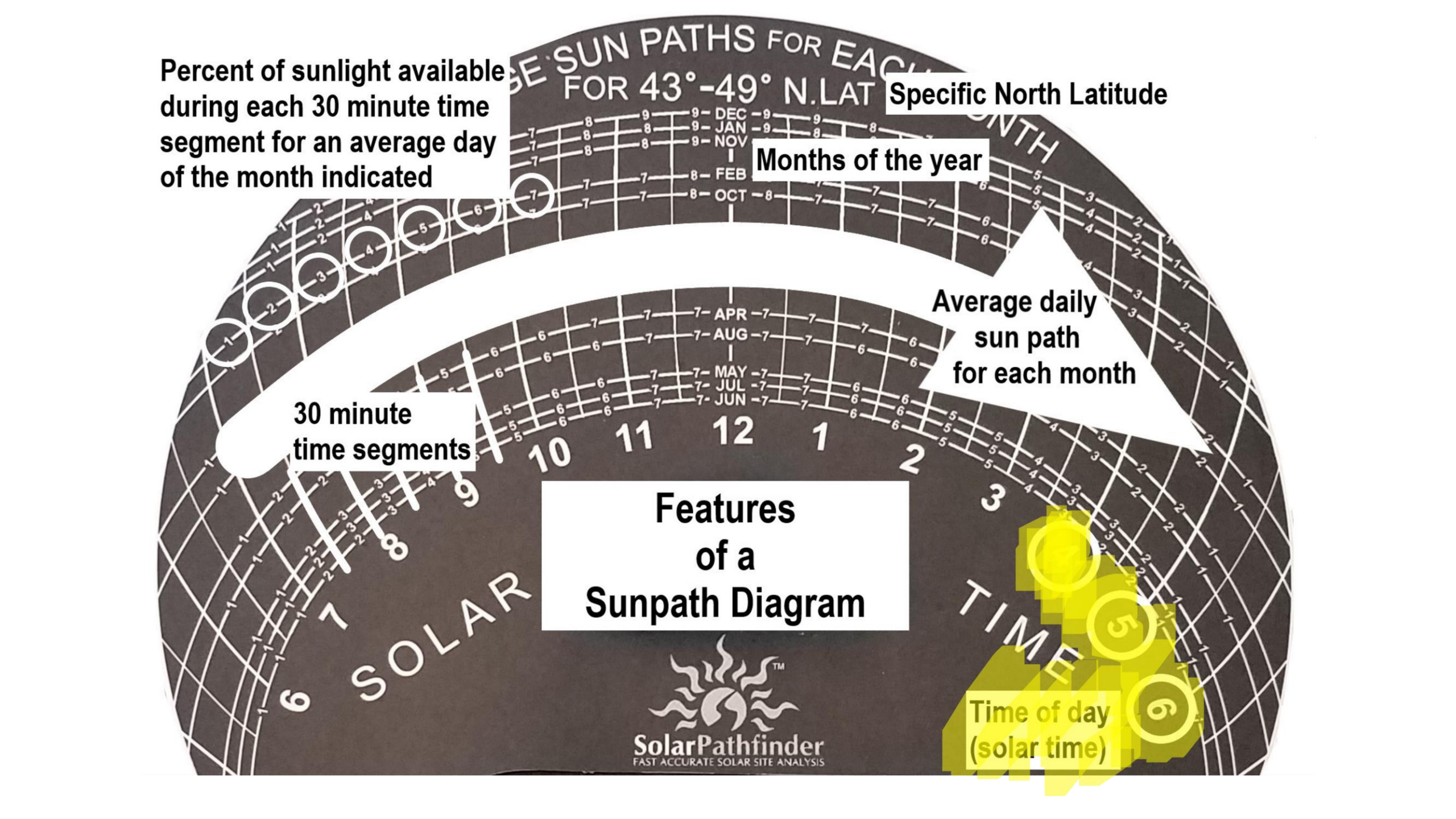
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Specific North Latitude
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OCT
Months of the year
APR
AUG
MAY
JUL
JUN
Average daily sun path for each month
30 minute time segments
10
11
12
1
2
3
9
8
7
6
SOLAR
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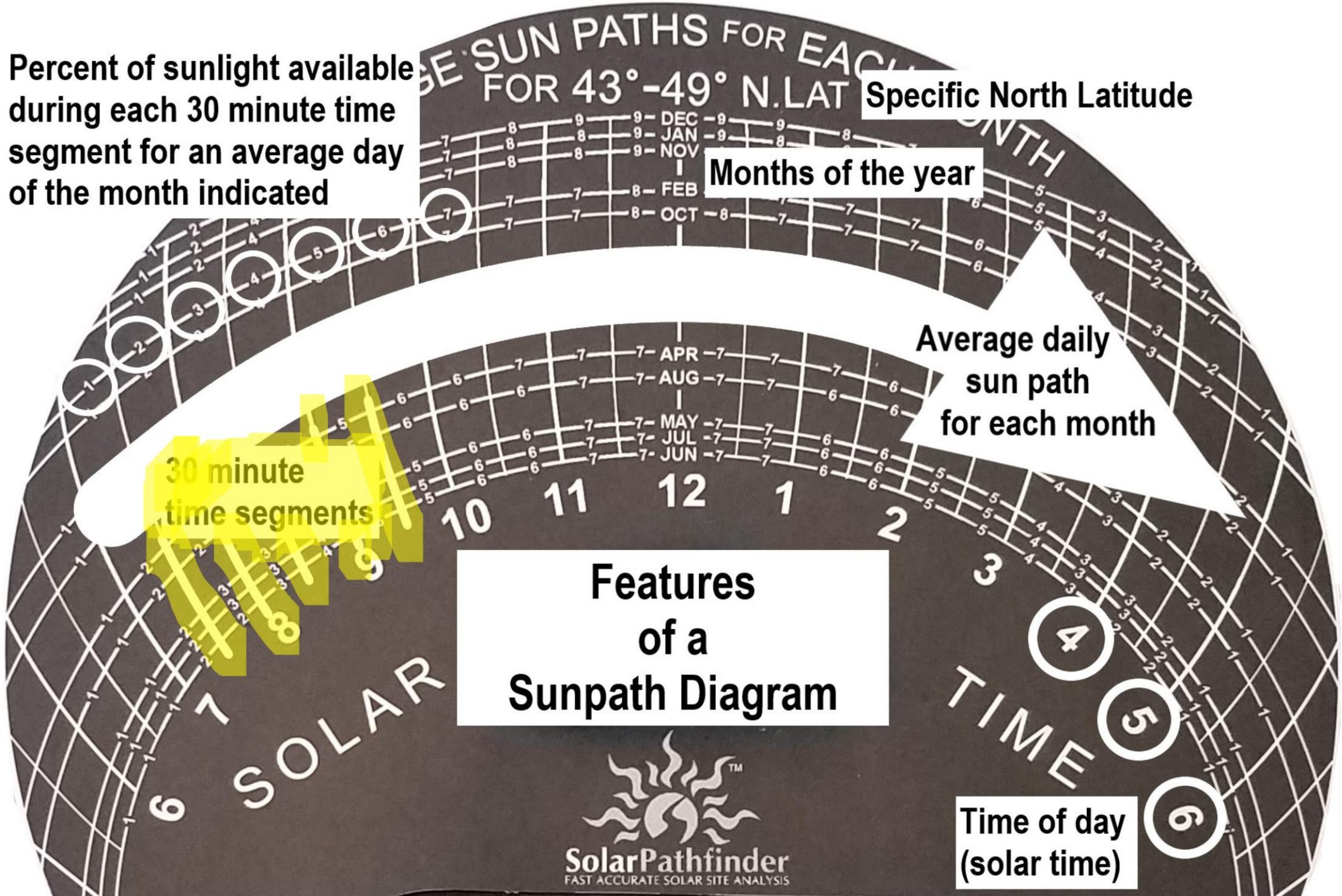
SolarPathfinder
FAST ACCURATE SOLAR SITE ANALYSIS
Time of day (solar time)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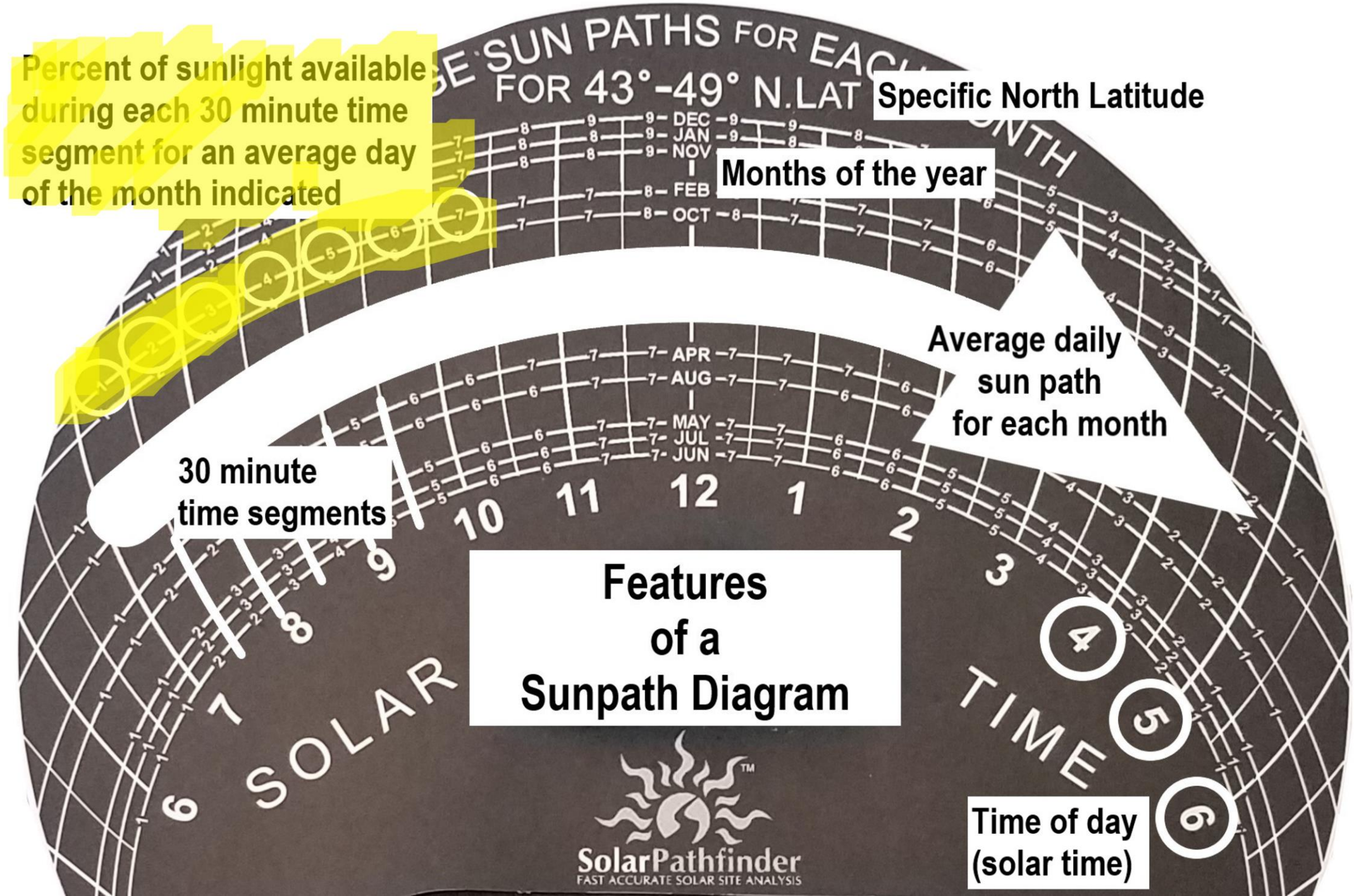
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FOR 43°-49° N.LAT
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Average daily sun path for each month
30 minute time segments
6 7 8 9 10 11 12 1 2 3 4 5 6
SOLAR TIME
Features of a Sunpath Diagram
SolarPathfinder
FAST ACCURATE SOLAR SITE ANALYSIS
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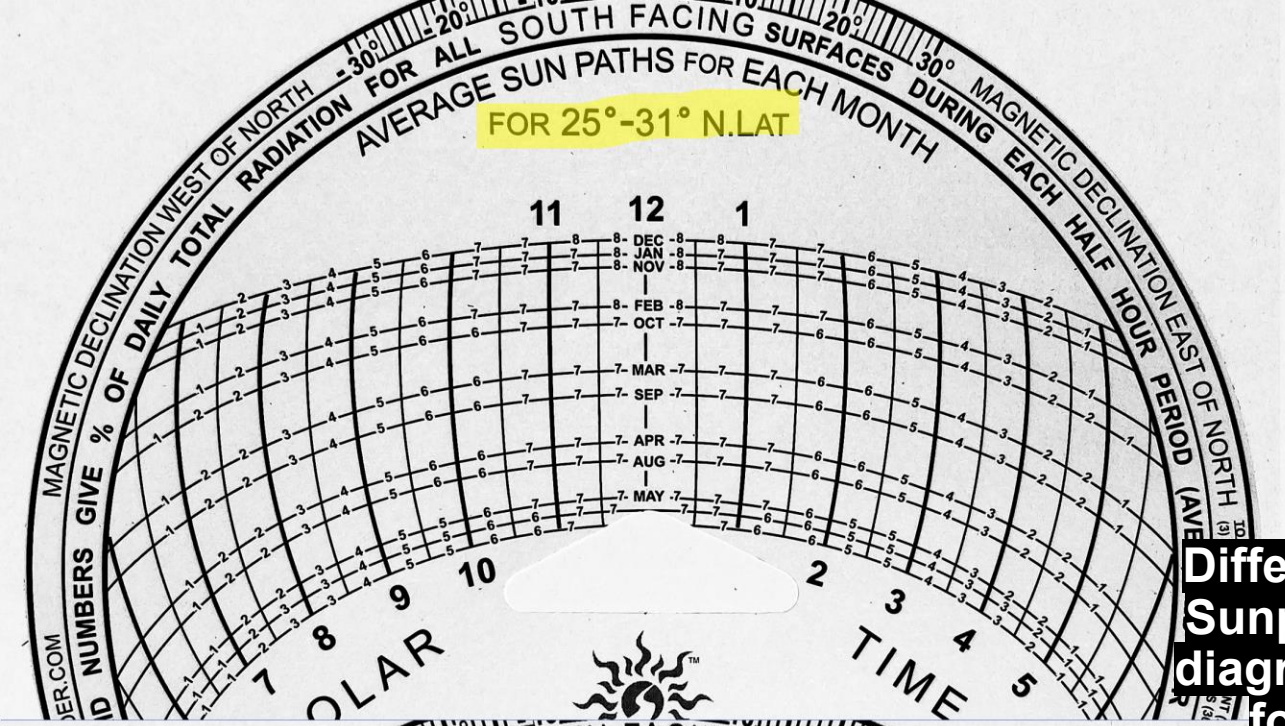
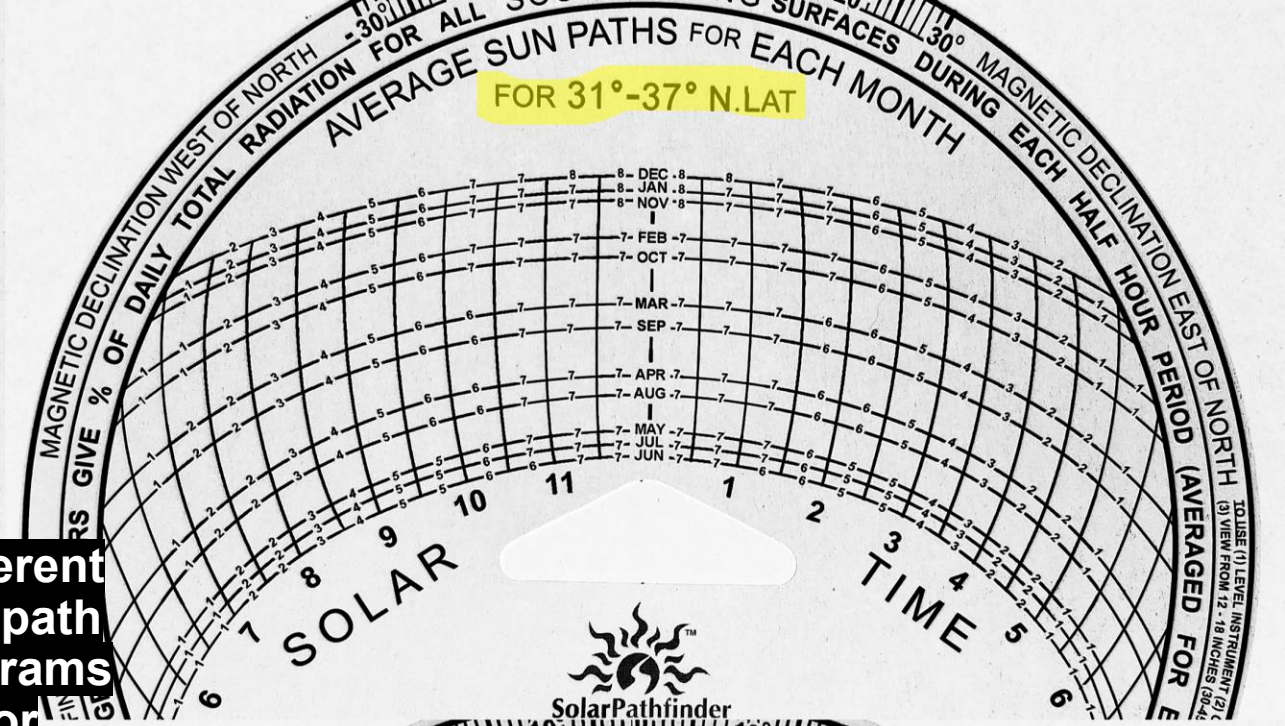
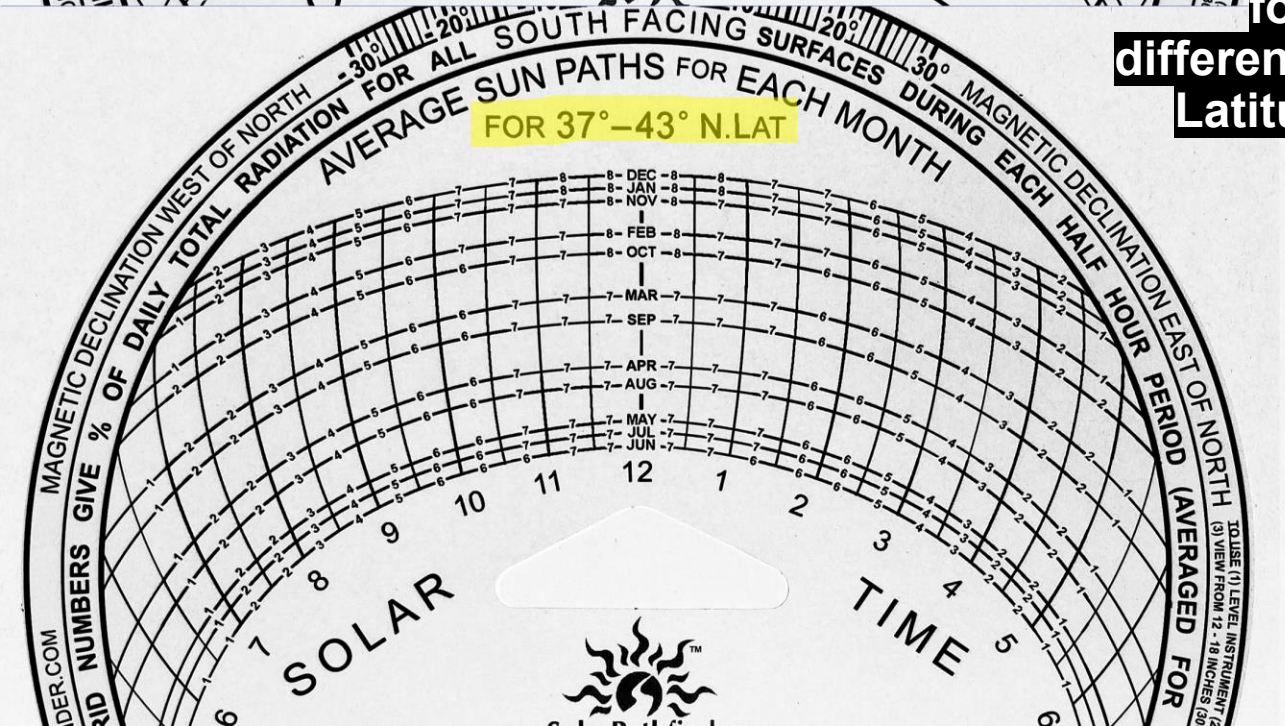
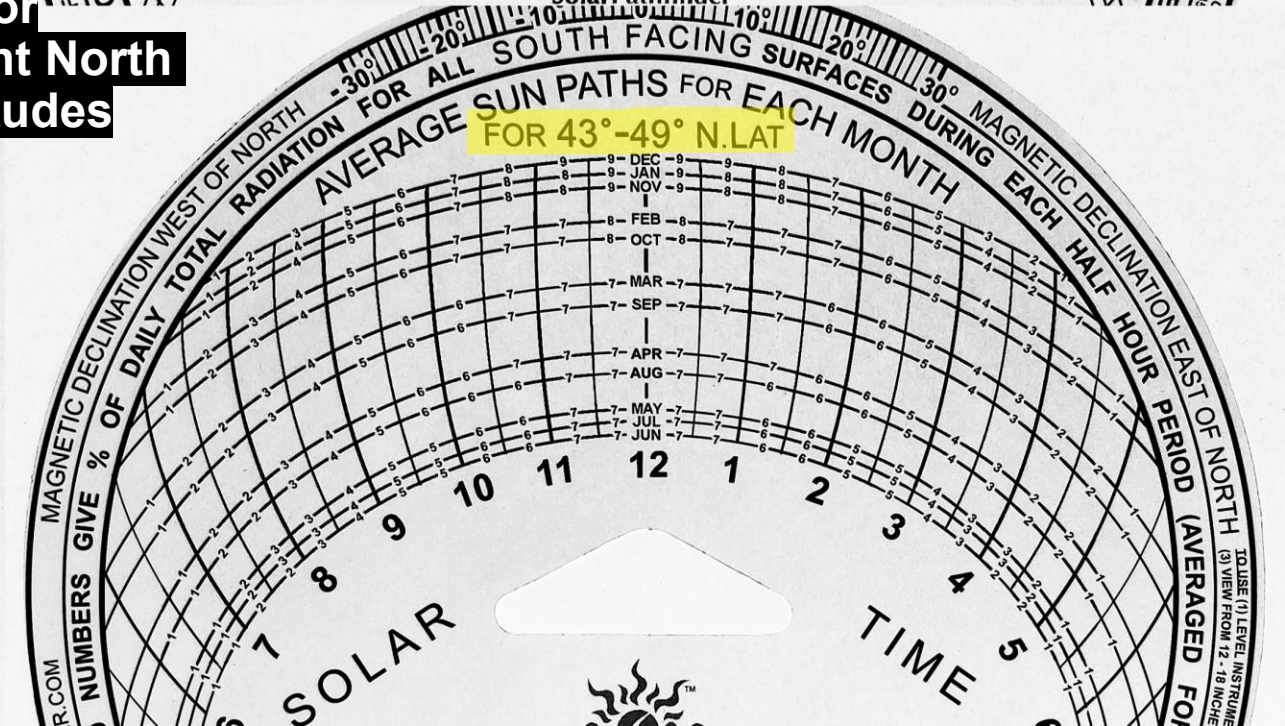
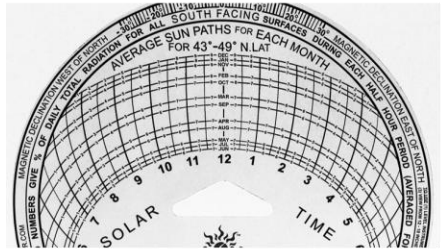


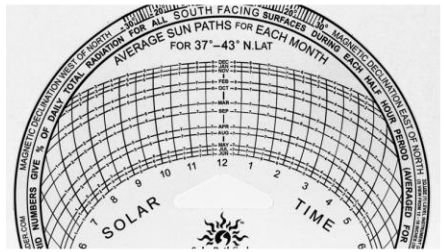


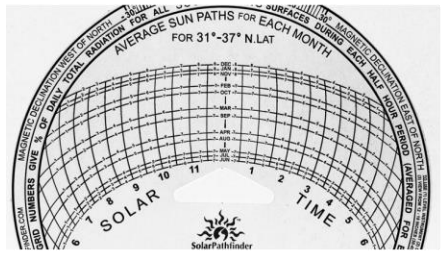
Different Sunpath diagrams for different North Latitudes

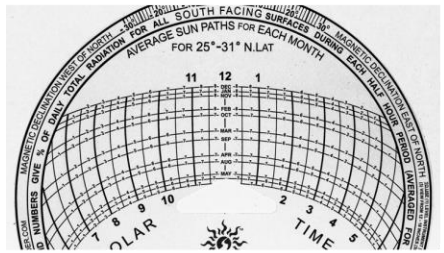


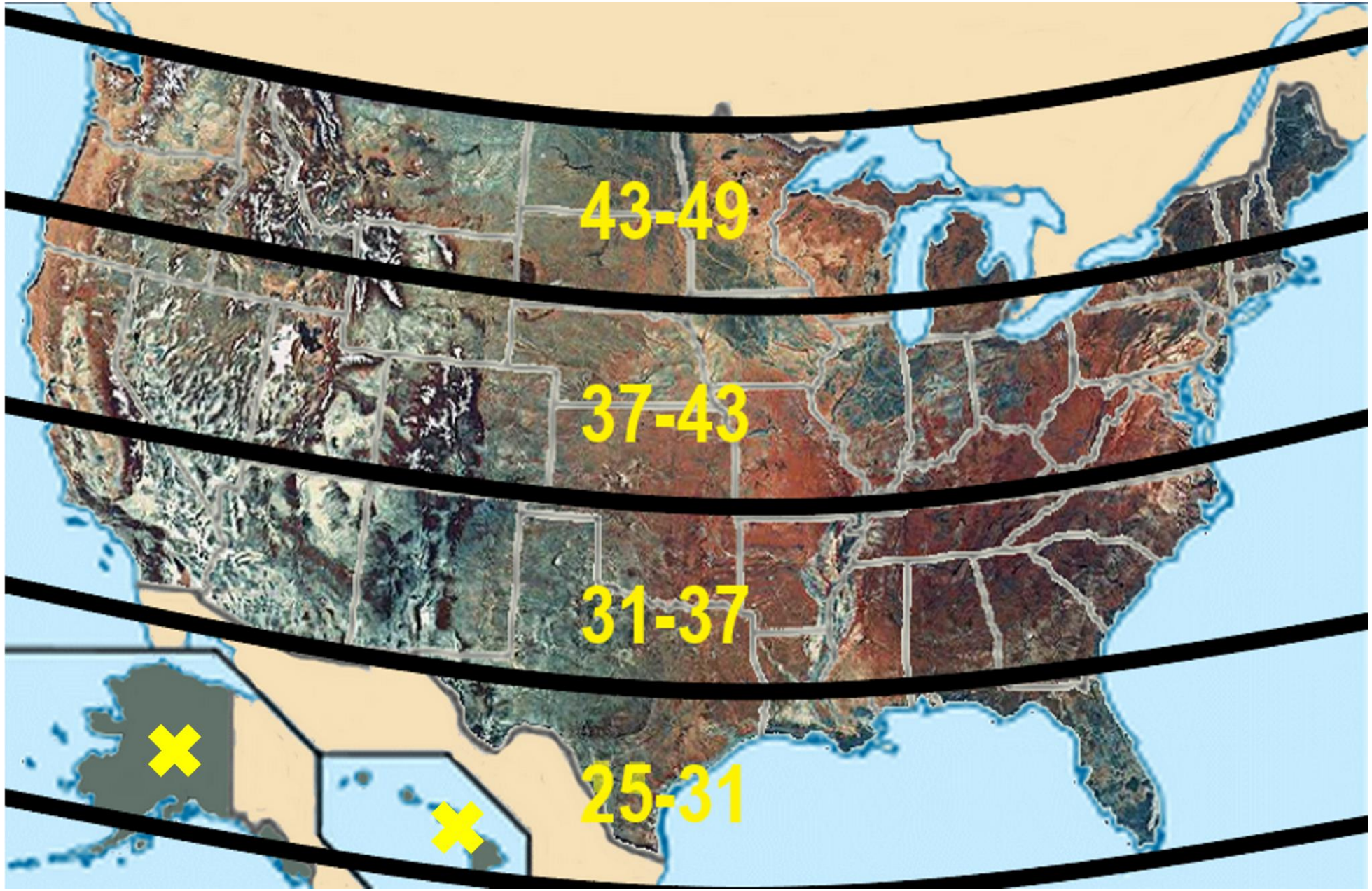



AVERAGE SUN PATHS FOR EACH MONTH
FOR 43°-49° N.LAT
SOLAR
TIME

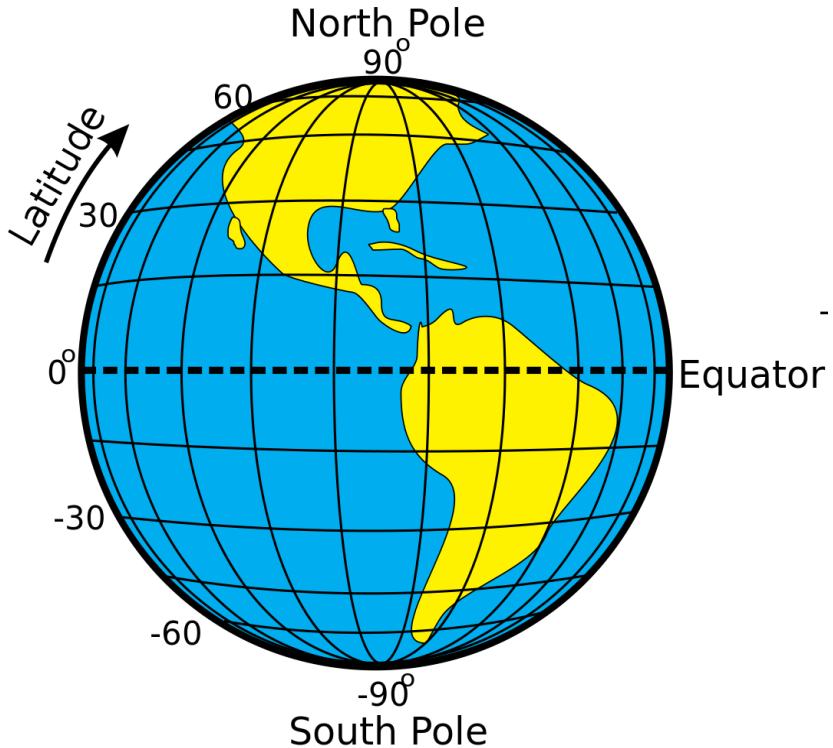

AVERAGE SUN PATHS FOR EACH MONTH
FOR 37°-43° N.LAT
SOLAR
TIME


AVERAGE SUN PATHS FOR EACH MONTH
FOR 31°-37° N.LAT
SOLAR
TIME
SolarPathfinder


AVERAGE SUN PATHS FOR EACH MONTH
FOR 25°-31° N.LAT
TIME


43-49
37-43
31-37
25-31

Part 3:
Critical Definitions



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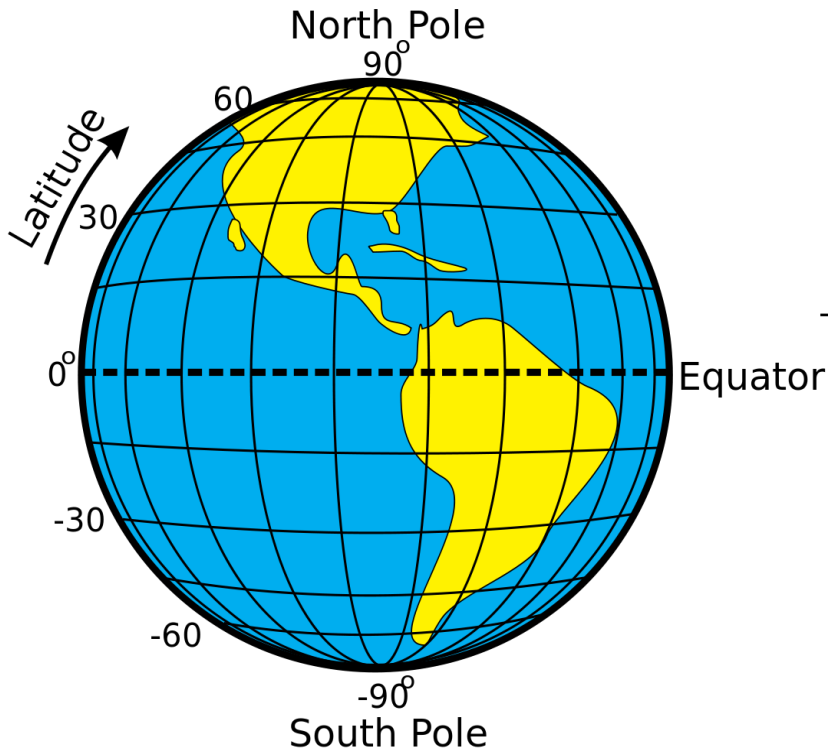
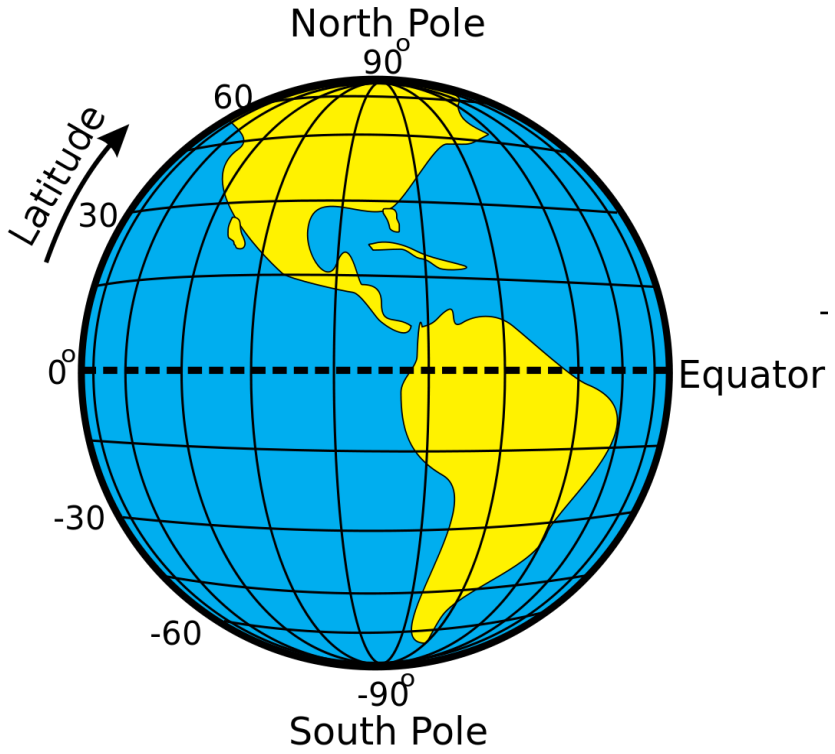
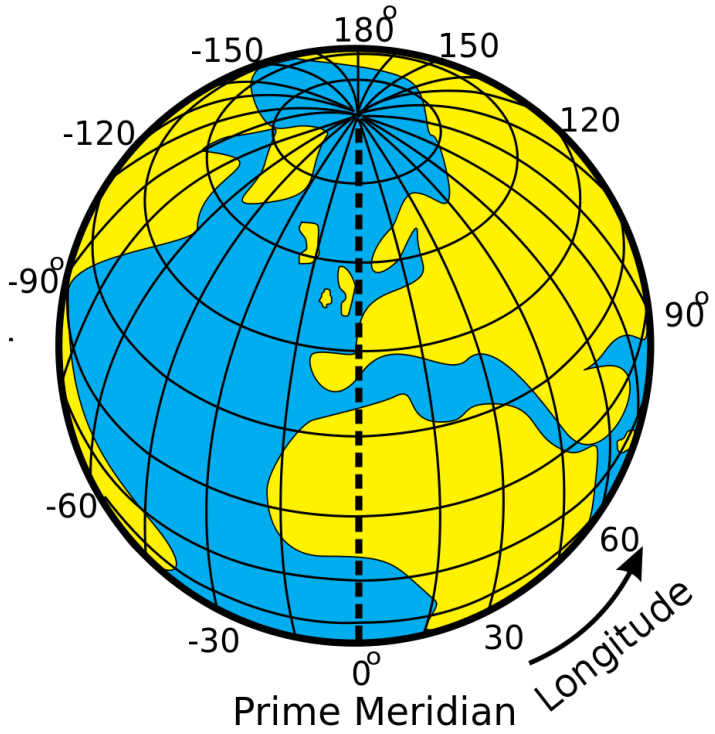
Latitude:



Latitude: **The angular distance of a location north or south of the earth's equator.** Latitude ranges from 0° at the Equator to 90° at either North or South Pole. Lines of latitude run as circles parallel to the equator. **Latitude enables us to specify an exact north or south position on the surface of the Earth (0°- 90° North Latitude or 0°- 90° South Latitude).**





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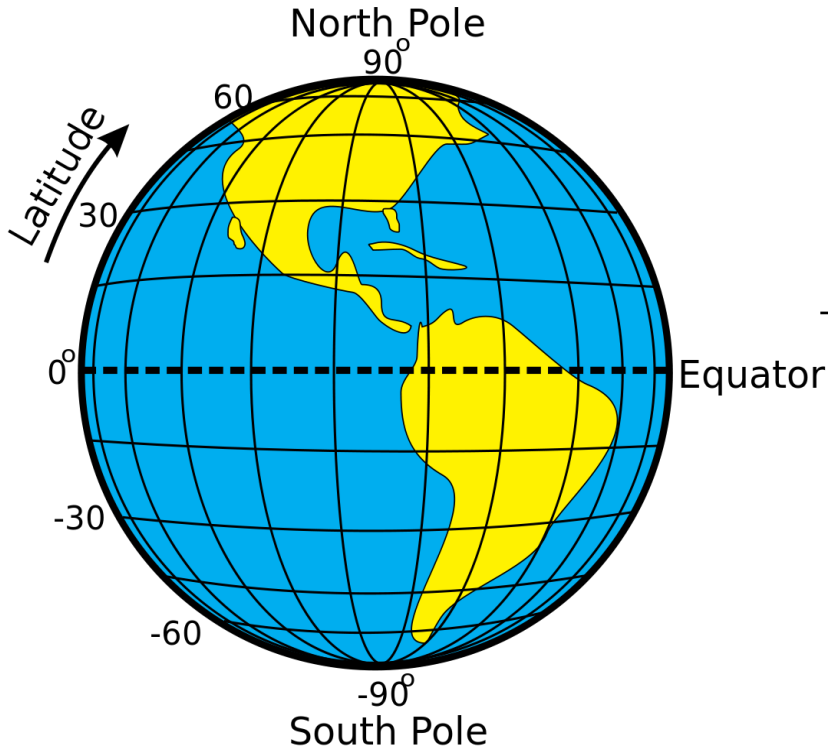
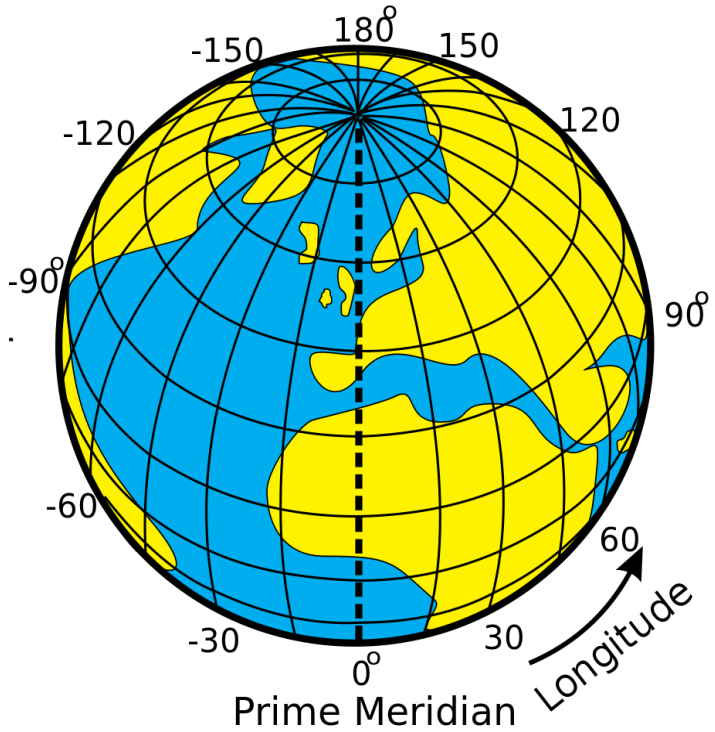
Longitude:





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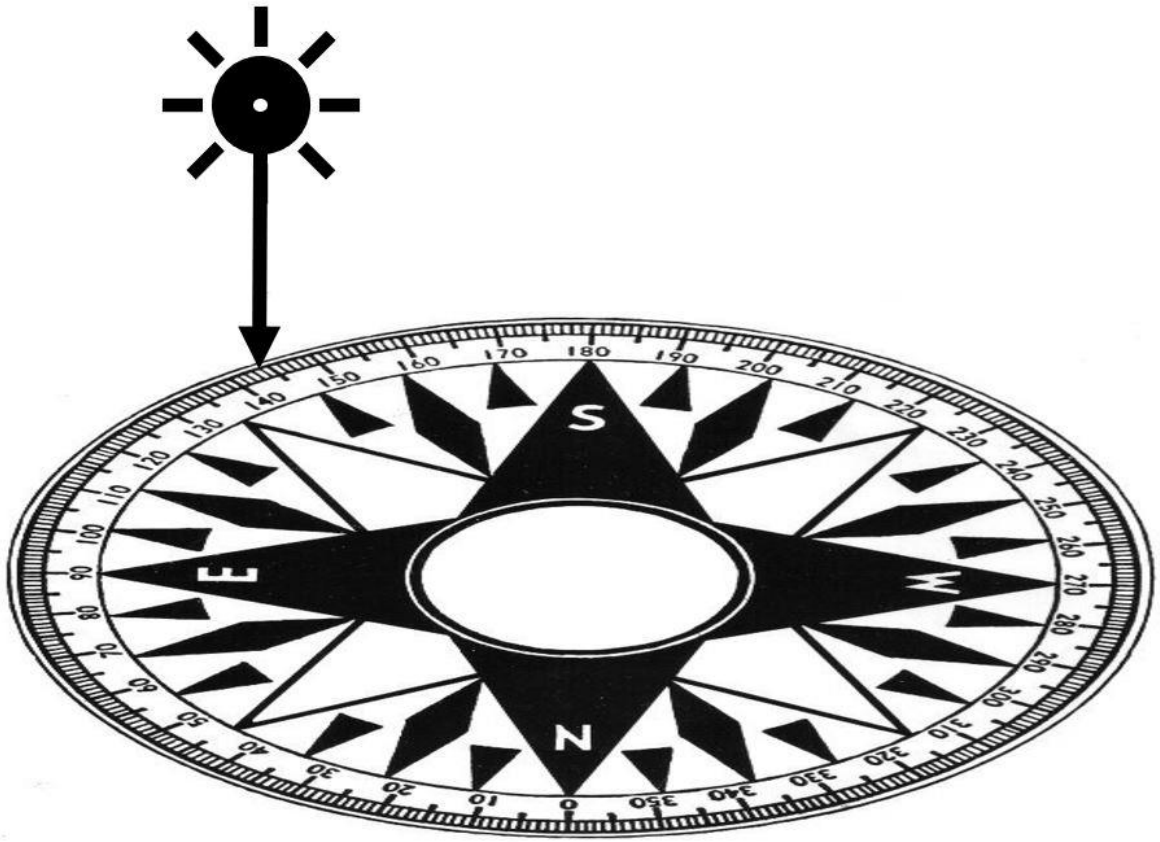
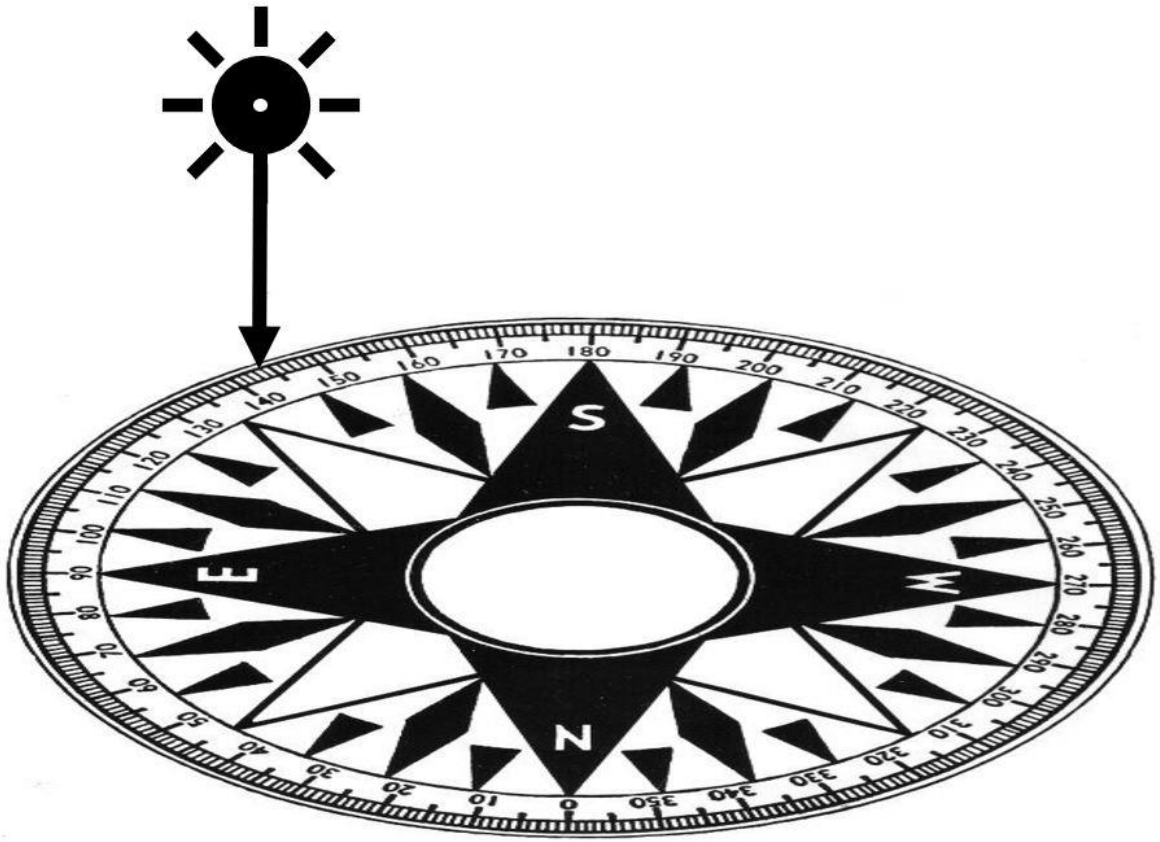
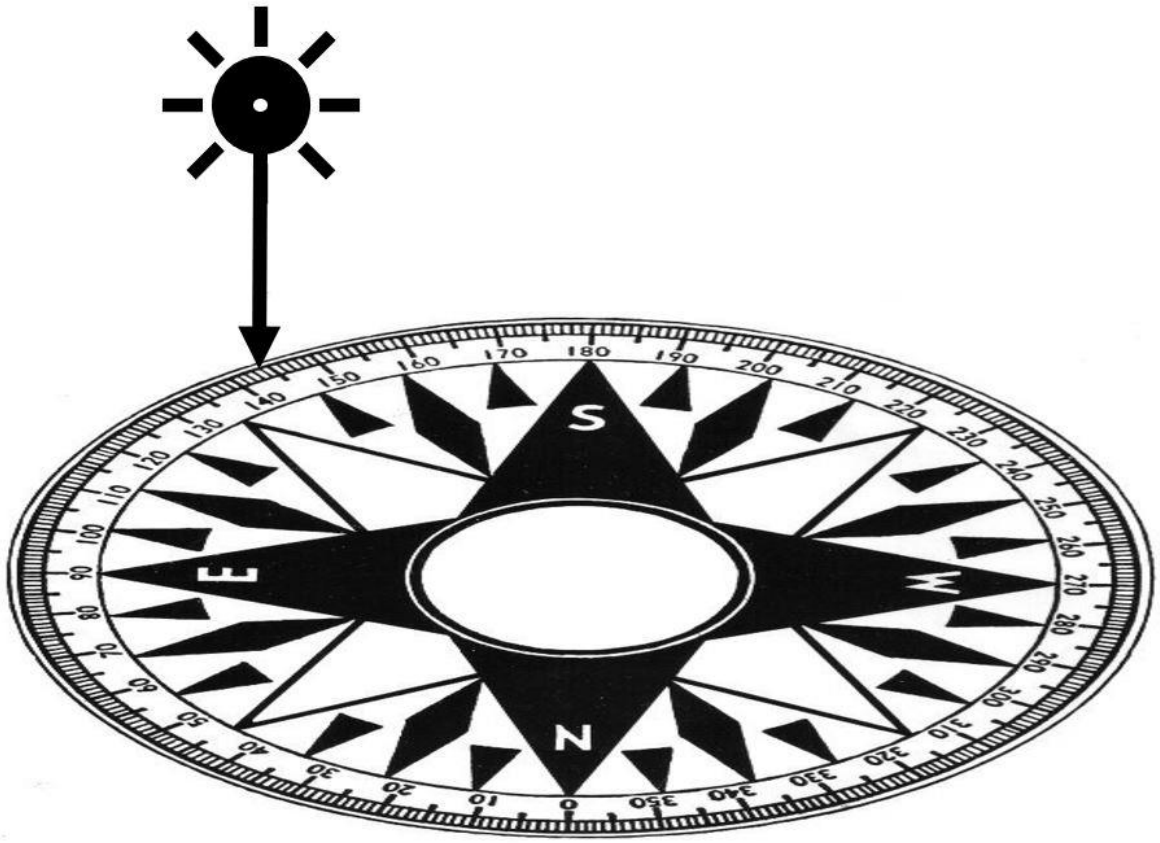
Longitude: **The angular distance of a location east or west of an established prime meridian** (passing through Greenwich, England) **that runs from the North Pole to the South Pole. Longitude enables us to specify an exact east or west position on the surface of the earth (0°- 180° East Longitude or 0°- 180° West Longitude).**

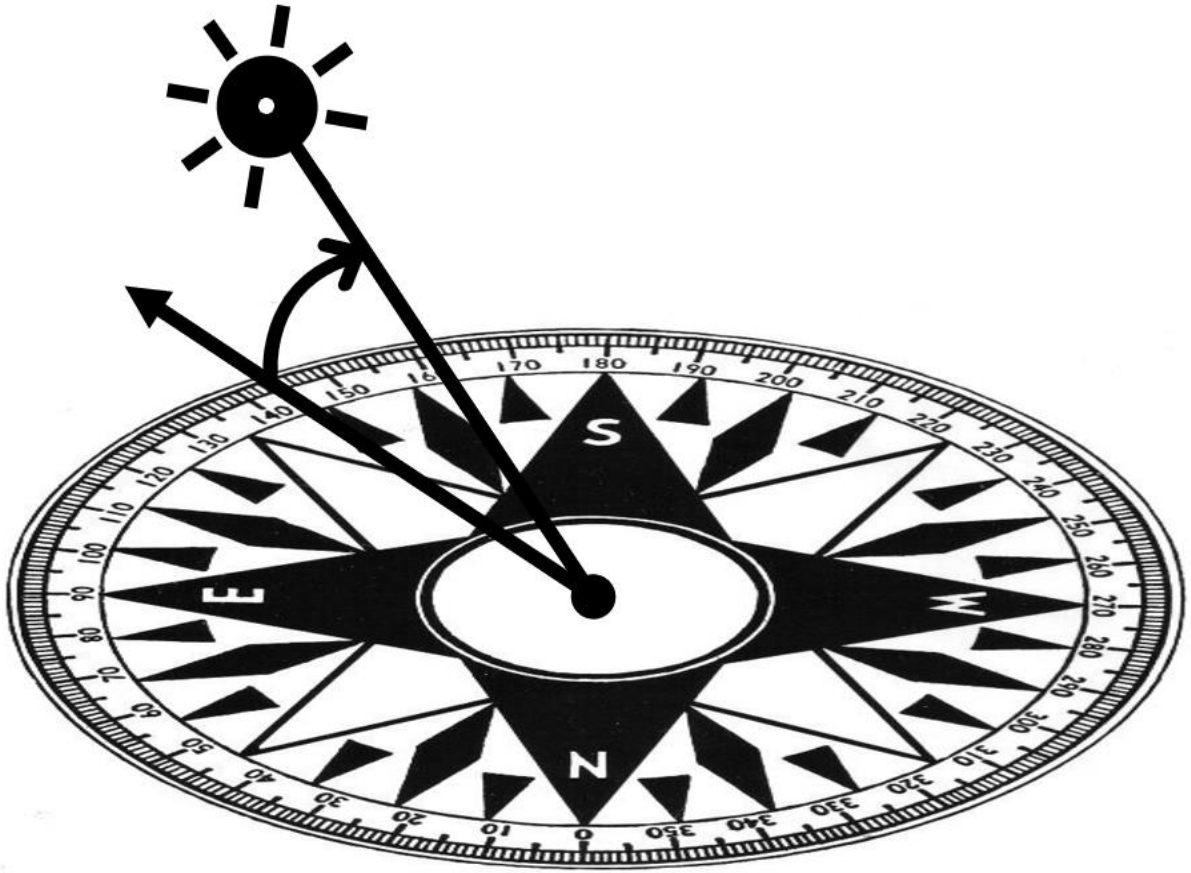


Solar azimuth:



Solar azimuth: **Solar azimuth is the compass degree (0° - 360°) that describes the position of the sun along the horizon at any given time.**





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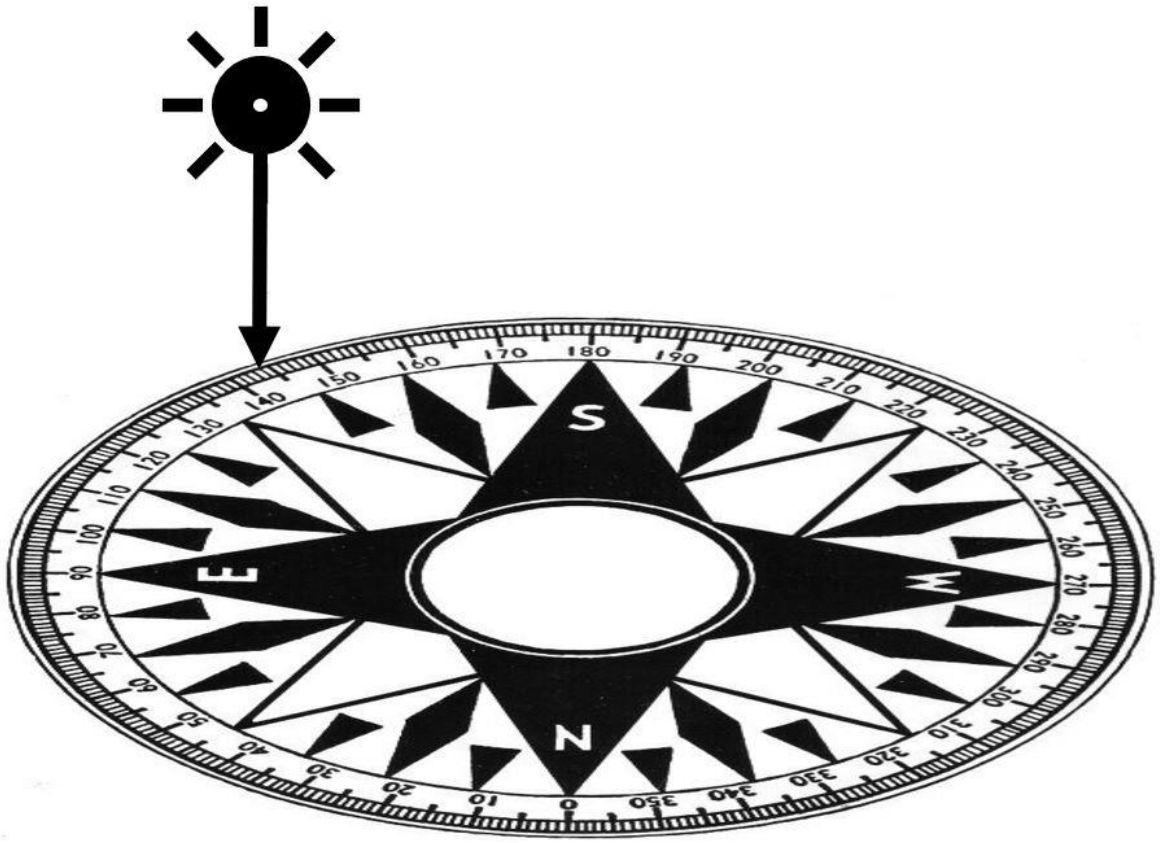
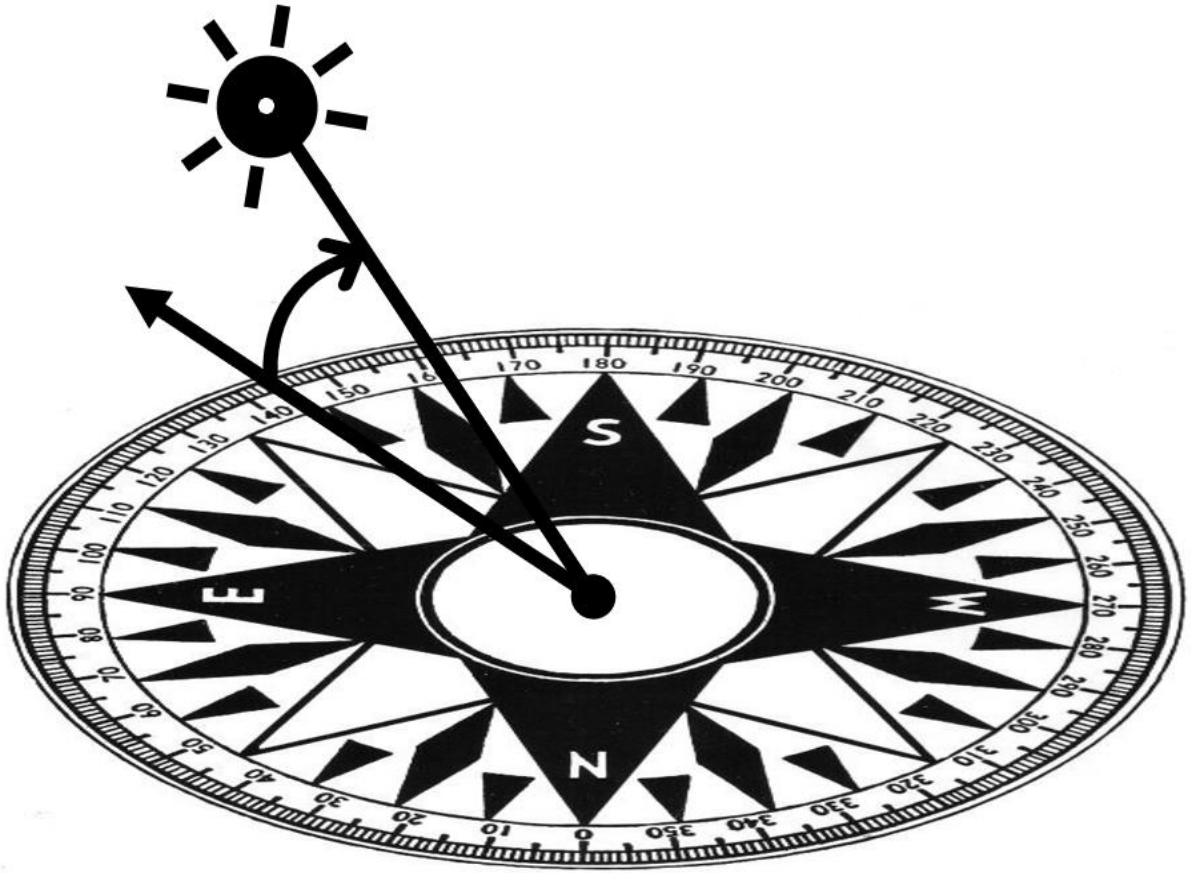
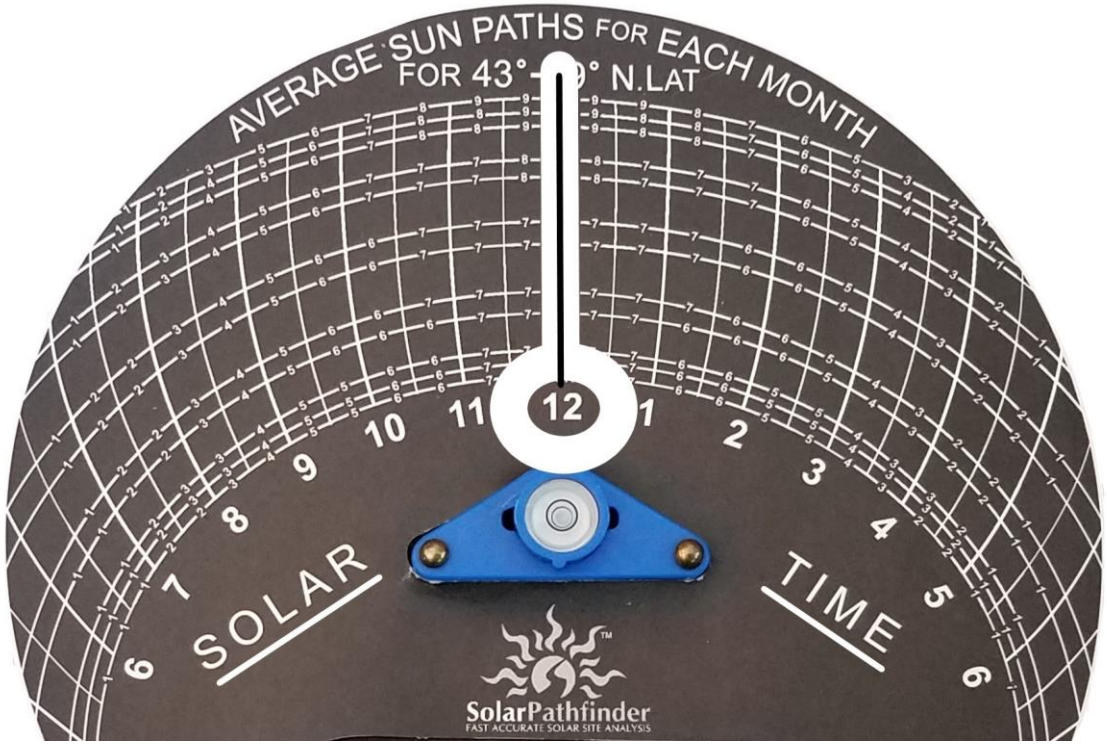
Solar altitude or solar elevation:





Solar azimuth: Solar azimuth is the compass degree (0° - 360°) that describes the position of the sun along the horizon at any given time.

Solar altitude or solar elevation: The vertical angle formed between the horizon and the center of the sun's disc at any given time.


AVERAGE SUN PATHS FOR EACH MONTH
FOR 43° N.LAT
12
11
10
9
8
7
6
1
2
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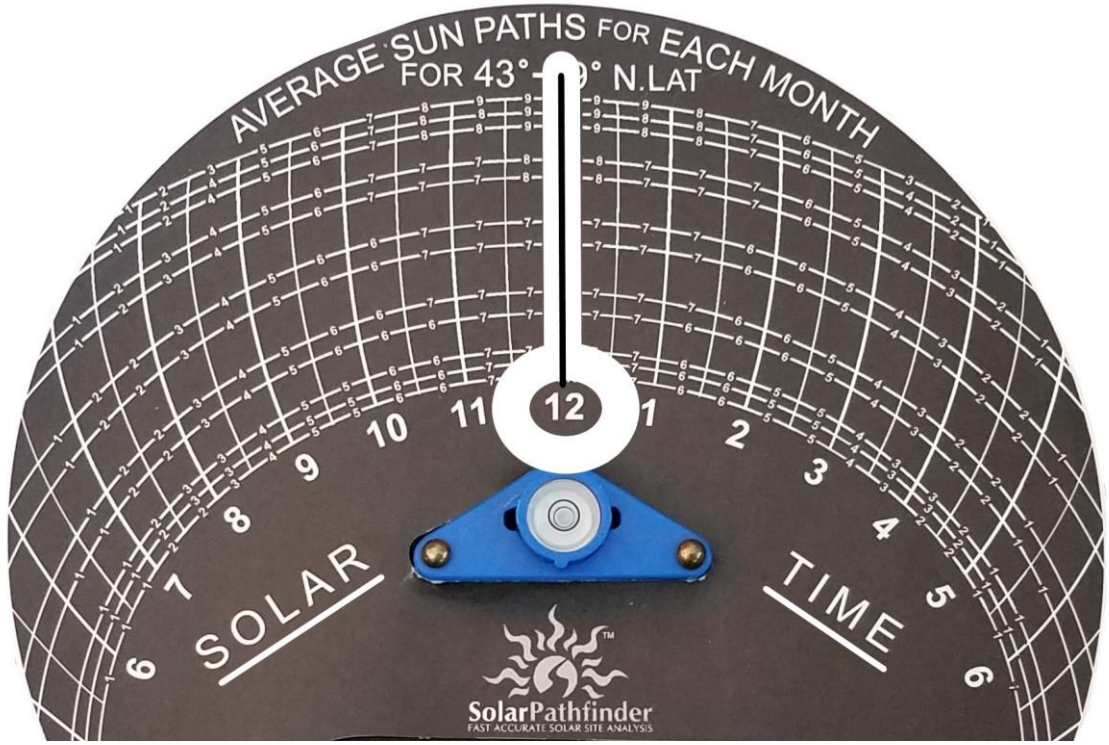
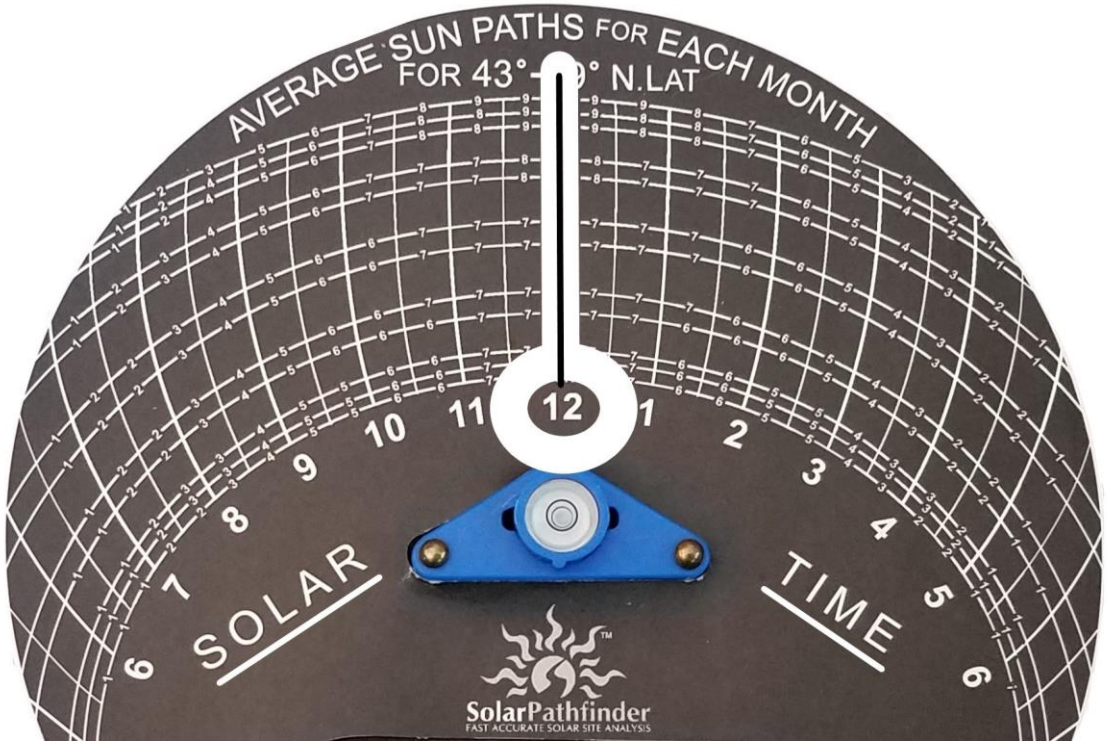
4
5
6
SOLAR
TIME
SolarPathfinder
FAST ACCURATE SOLAR SITE ANALYSIS

Solar noon:



Solar noon: **The moment during the day when the sun reaches its highest point in the sky--its maximum elevation or zenith. This is also the moment during the day when the sun is due south--its azimuth is 180° on a compass dial.** At this moment, the length of time from sunrise to solar noon is equal to the length of time from solar noon to sunset. Solar noon is usually close to, but is seldom the same as clock noon.



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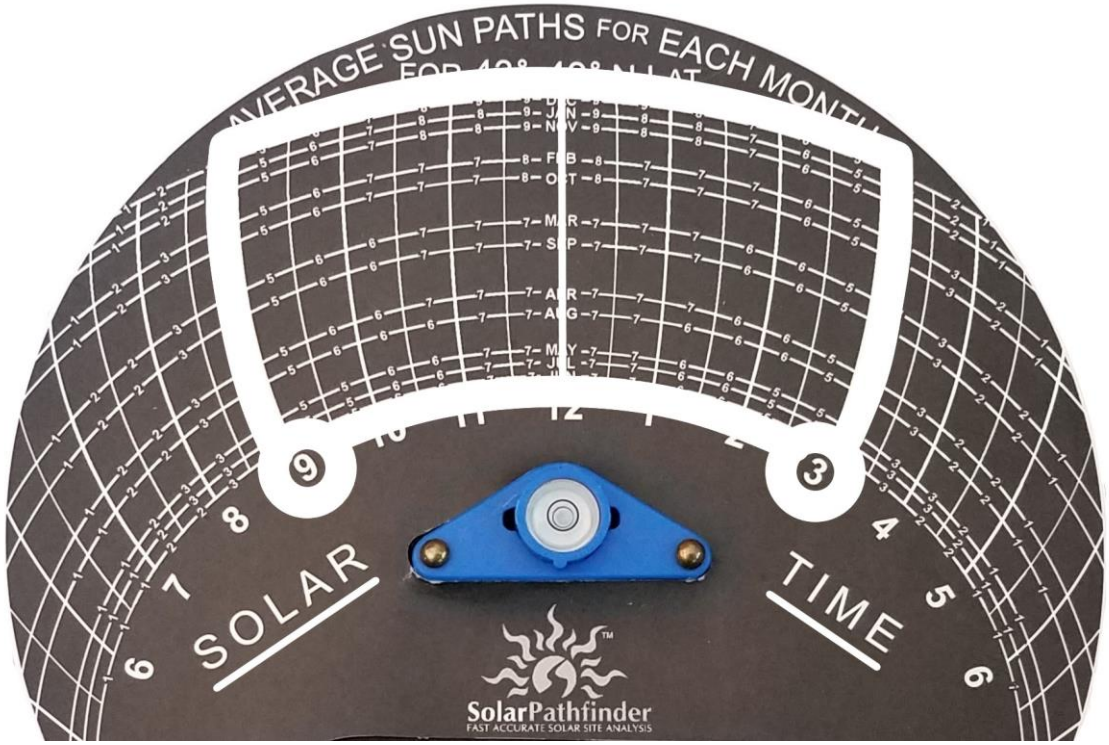
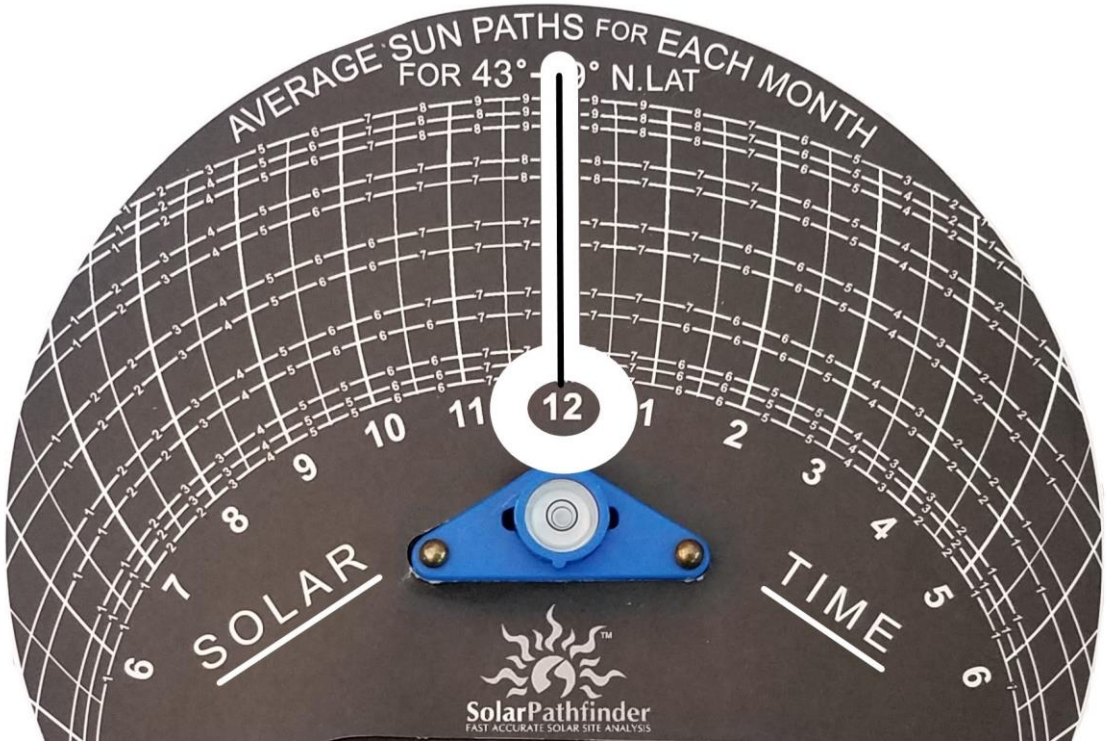
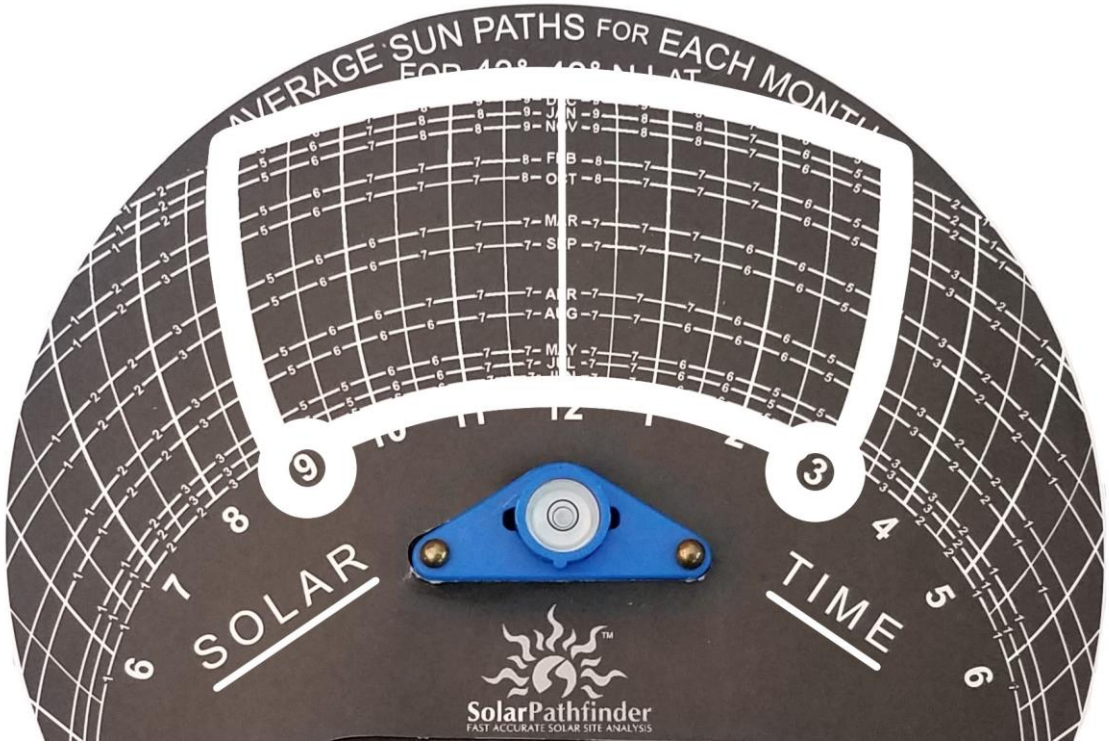


Solar window:





Solar noon: **The moment during the day when the sun reaches its highest point in the sky--its maximum elevation or zenith. This is also the moment during the day when the sun is due south--its azimuth is 180° on a compass dial.** At this moment, the length of time from sunrise to solar noon is equal to the length of time from solar noon to sunset. Solar noon is usually close to, but is seldom the same as clock noon.

Solar window (definition used most commonly in the solar PV industry): **The critical hours of 9am to 3pm that are the most important for the conversion of sunlight into electricity for well-positioned, fixed solar array.**

Part 4:
Applying What You've Learned

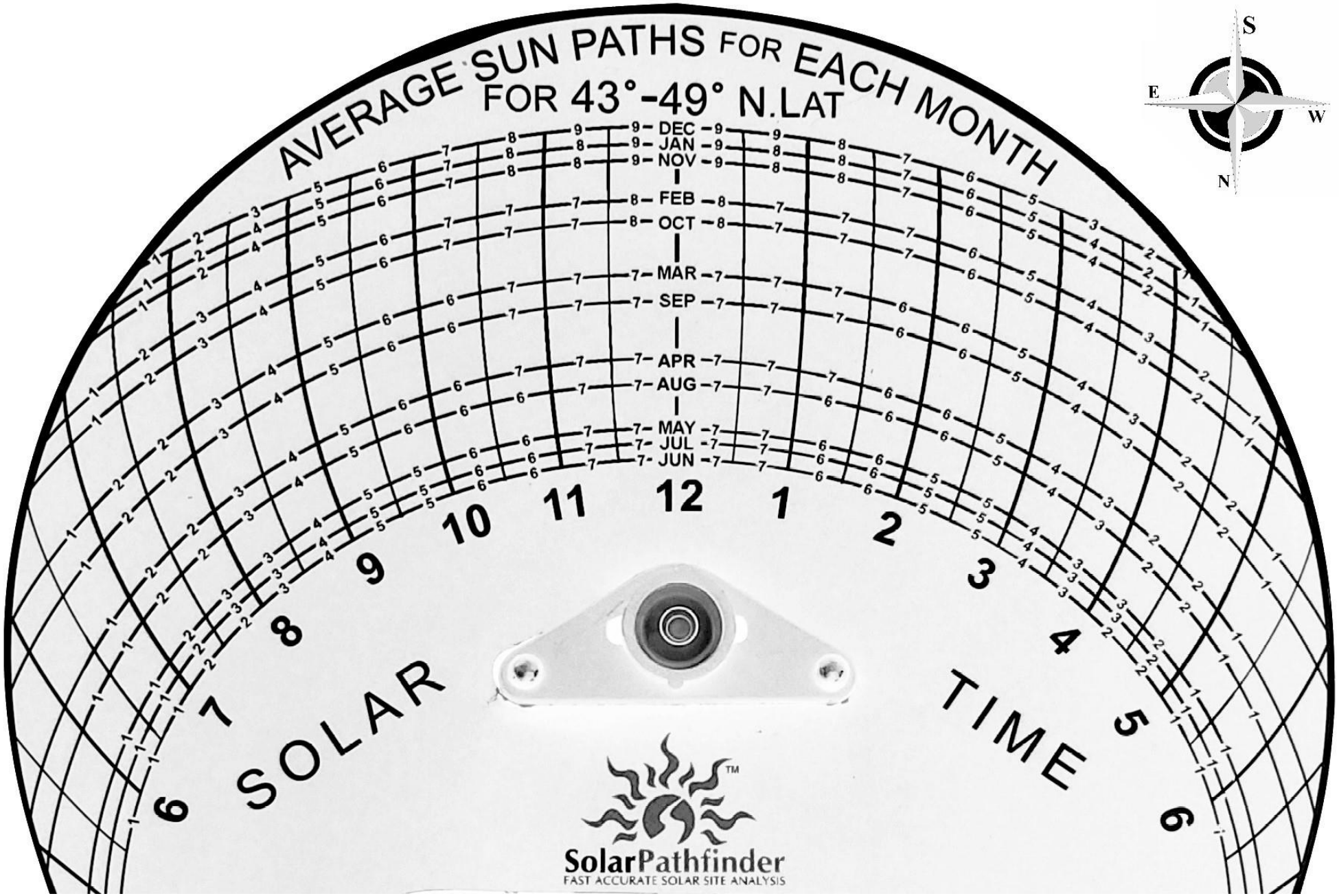
Part 4: Applying What You've Learned

Answer the questions in the tables that follow according to your teacher's directions. You will need to consult two things to complete them.

4-1. Your teacher will provide you with a hard copy of a Sunpath Diagram appropriate for your latitude.

4-2. Your teacher will have you view the sun's azimuth, altitude, day length, and solar noon information online for your city, or one close to where you are located.

- Go to: https://www.timeanddate.com/sun/
- Type your state in the search box
- Select your city, or the city closest to your location
- Use the navigation tools to obtain the information needed


AVERAGE SUN PATHS FOR EACH MONTH
FOR 43°-49° N.LAT
S
E
W
N
DEC
JAN
NOV
FEB
OCT
MAR
SEP
APR
AUG
MAY
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5
6
SOLAR TIME
SolarPathfinder
FAST ACCURATE SOLAR SITE ANALYSIS

October 2021 — Sun in Green Bay

< September | October | November >

Month: October Year: 2021 Go

2021	Sunrise/Sunset		Daylength		Astronomical Twilight		Nautical Twilight		Civil Twilight		Solar Noon	
Oct	Sunrise	Sunset	Length	Diff.	Start	End	Start	End	Start	End	Time	Mil. mi
1	6:50 am → (94°)	6:32 pm ← (266°)	11:41:48	−3:03	5:13 am	8:08 pm	5:47 am	7:34 pm	6:21 am	7:01 pm	12:41 pm (42.0°)	93.055
2	6:51 am → (94°)	6:30 pm ← (265°)	11:38:45	−3:03	5:14 am	8:07 pm	5:48 am	7:32 pm	6:22 am	6:59 pm	12:41 pm (41.6°)	93.029
3	6:52 am → (95°)	6:28 pm ← (265°)	11:35:42	−3:03	5:15 am	8:05 pm	5:49 am	7:31 pm	6:23 am	6:57 pm	12:40 pm (41.2°)	93.003
4	6:53 am → (96°)	6:26 pm ← (264°)	11:32:39	−3:02	5:17 am	8:03 pm	5:51 am	7:29 pm	6:24 am	6:55 pm	12:40 pm (40.9°)	92.976
5	6:55 am → (96°)	6:24 pm ← (264°)	11:29:36	−3:02	5:18 am	8:01 pm	5:52 am	7:27 pm	6:26 am	6:53 pm	12:40 pm (40.5°)	92.950
6	6:56 am → (97°)	6:22 pm ← (263°)	11:26:34	−3:02	5:19 am	7:59 pm	5:53 am	7:25 pm	6:27 am	6:52 pm	12:40 pm (40.1°)	92.923

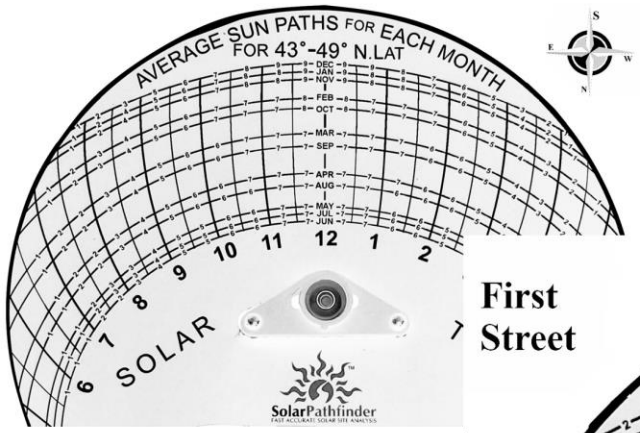
12:40 pm

Altitude
40°

Heading
↓ 180° S

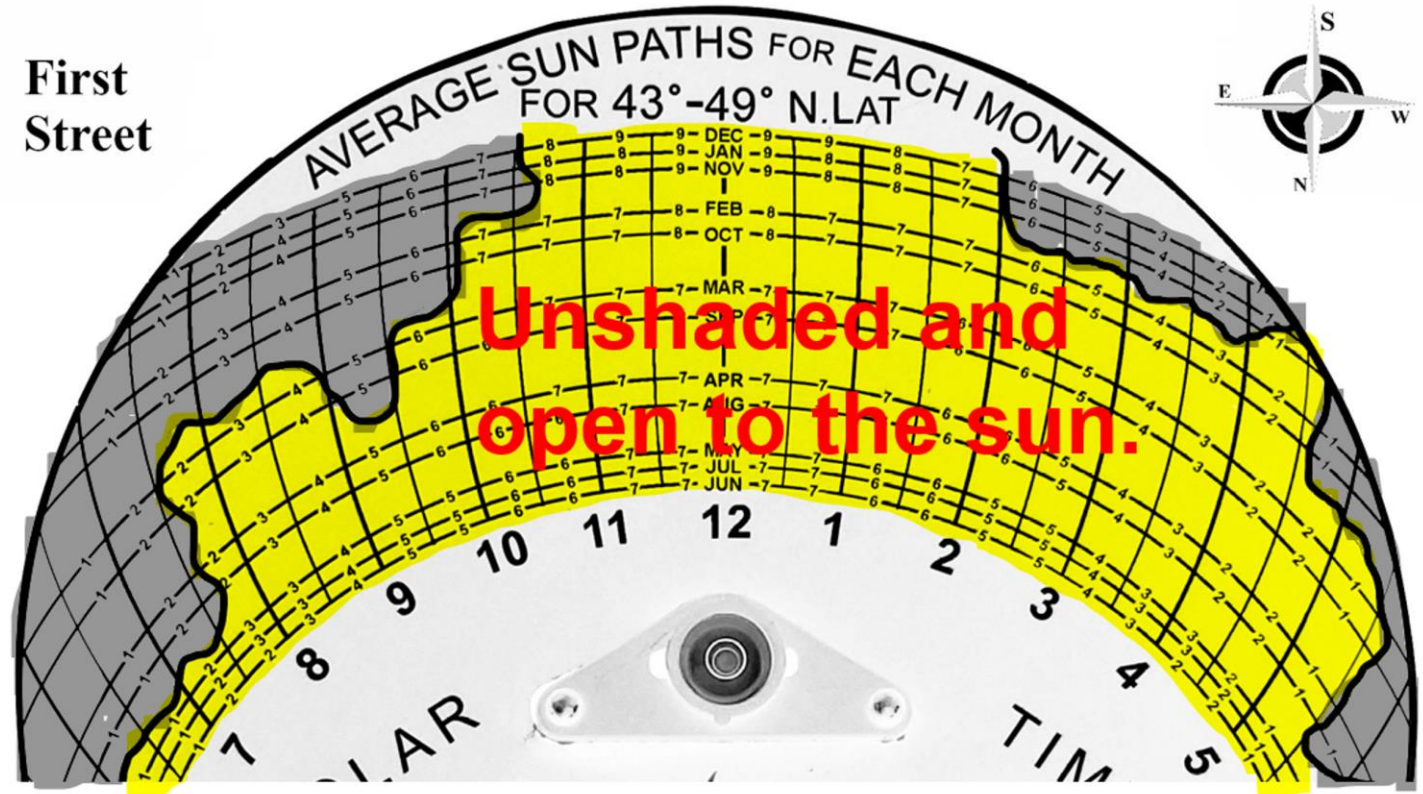
Position
Day

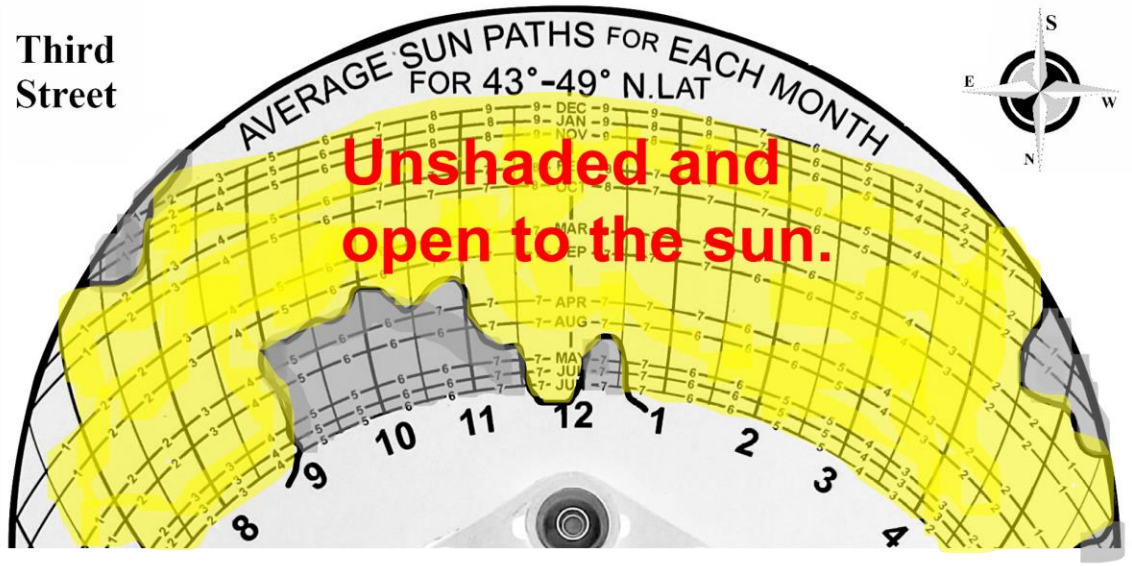
Part 5:
Shade and Sun Evaluation for a Specific Site

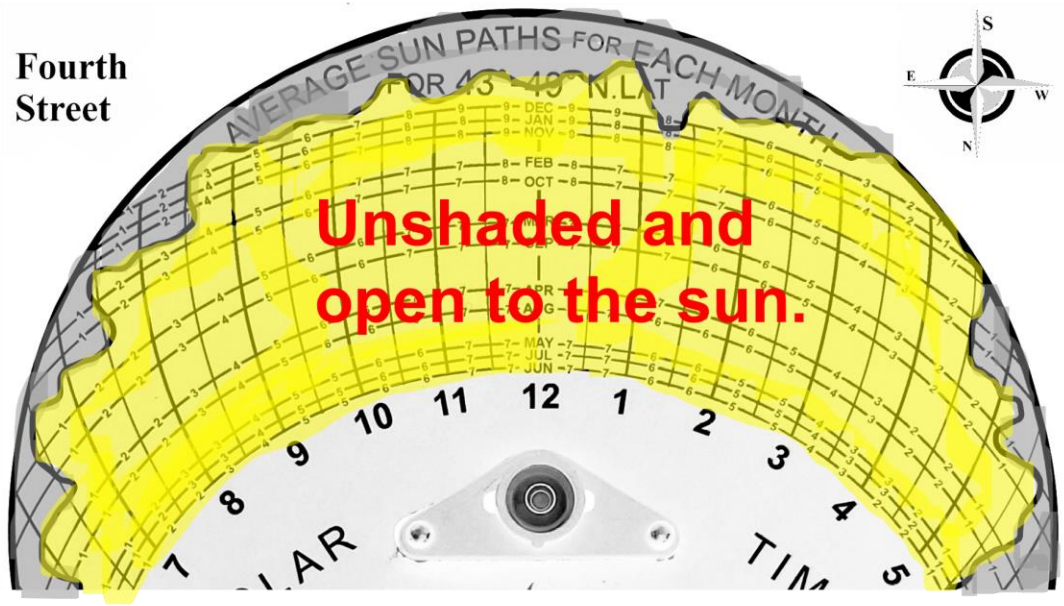


First
Street

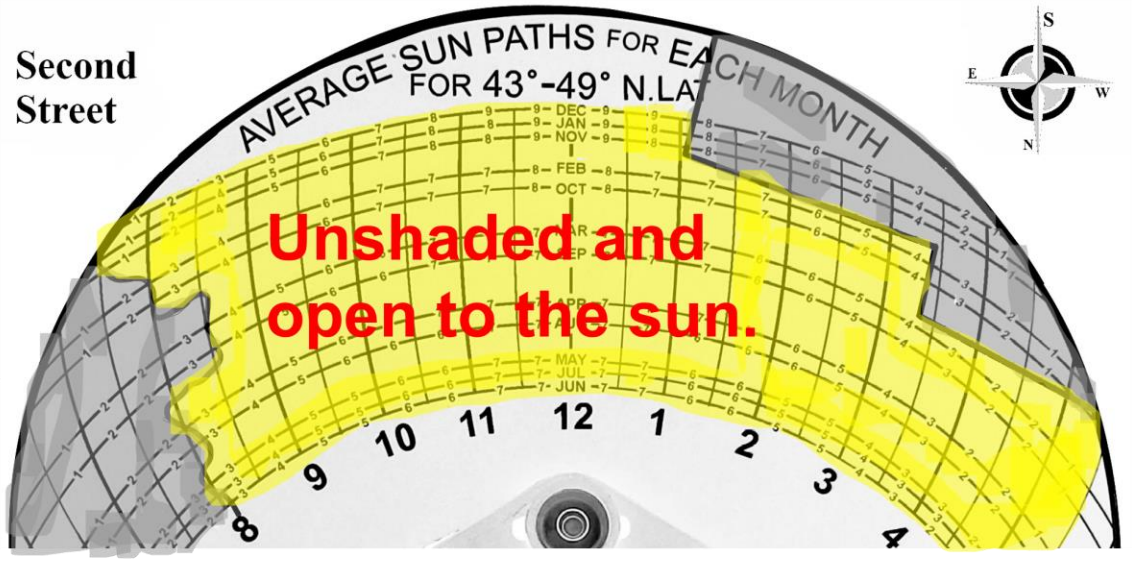
First
Street

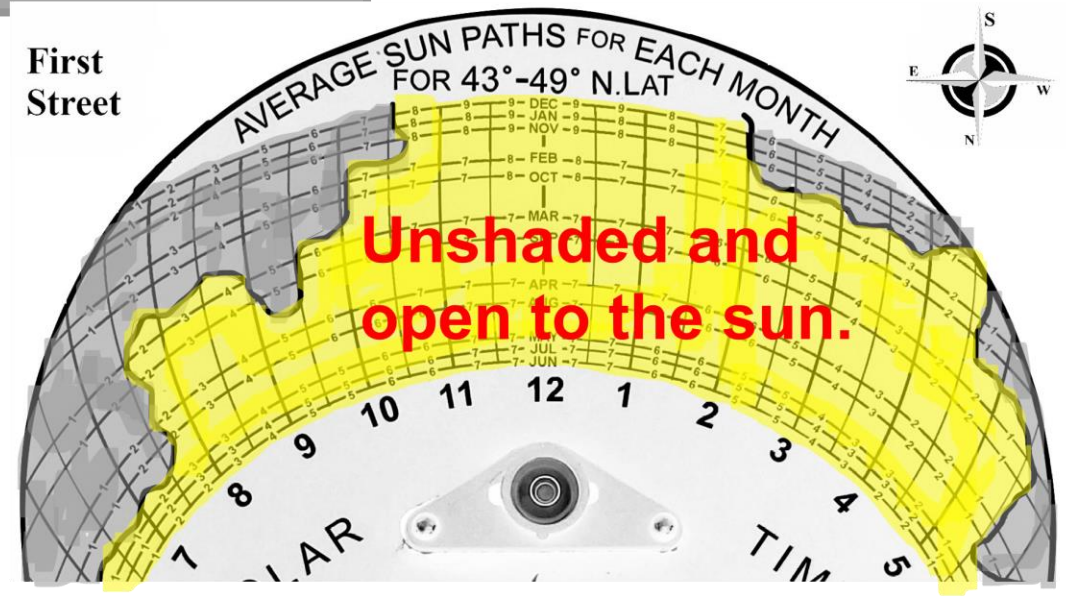






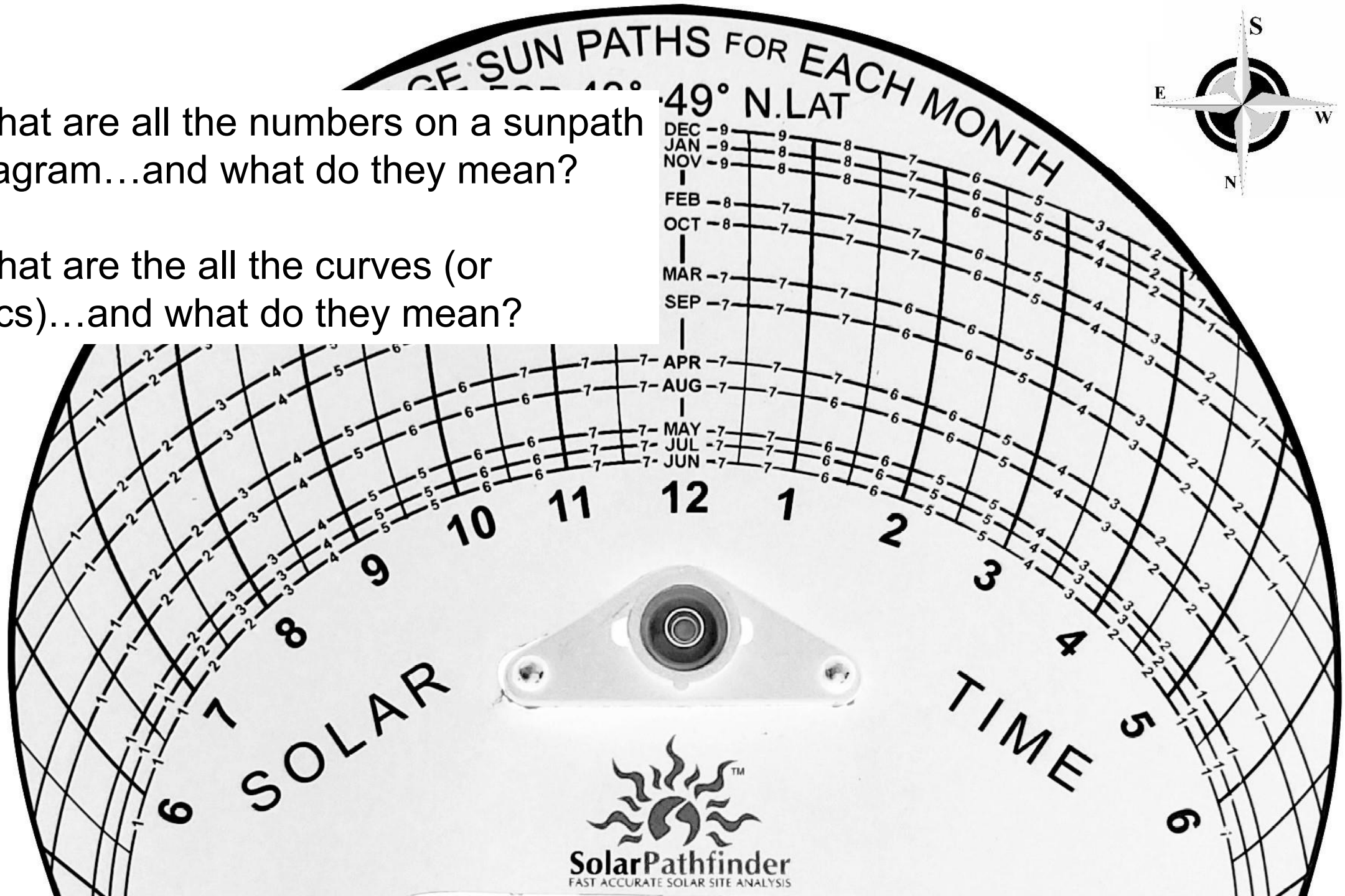
Grey areas and numbers are shaded.

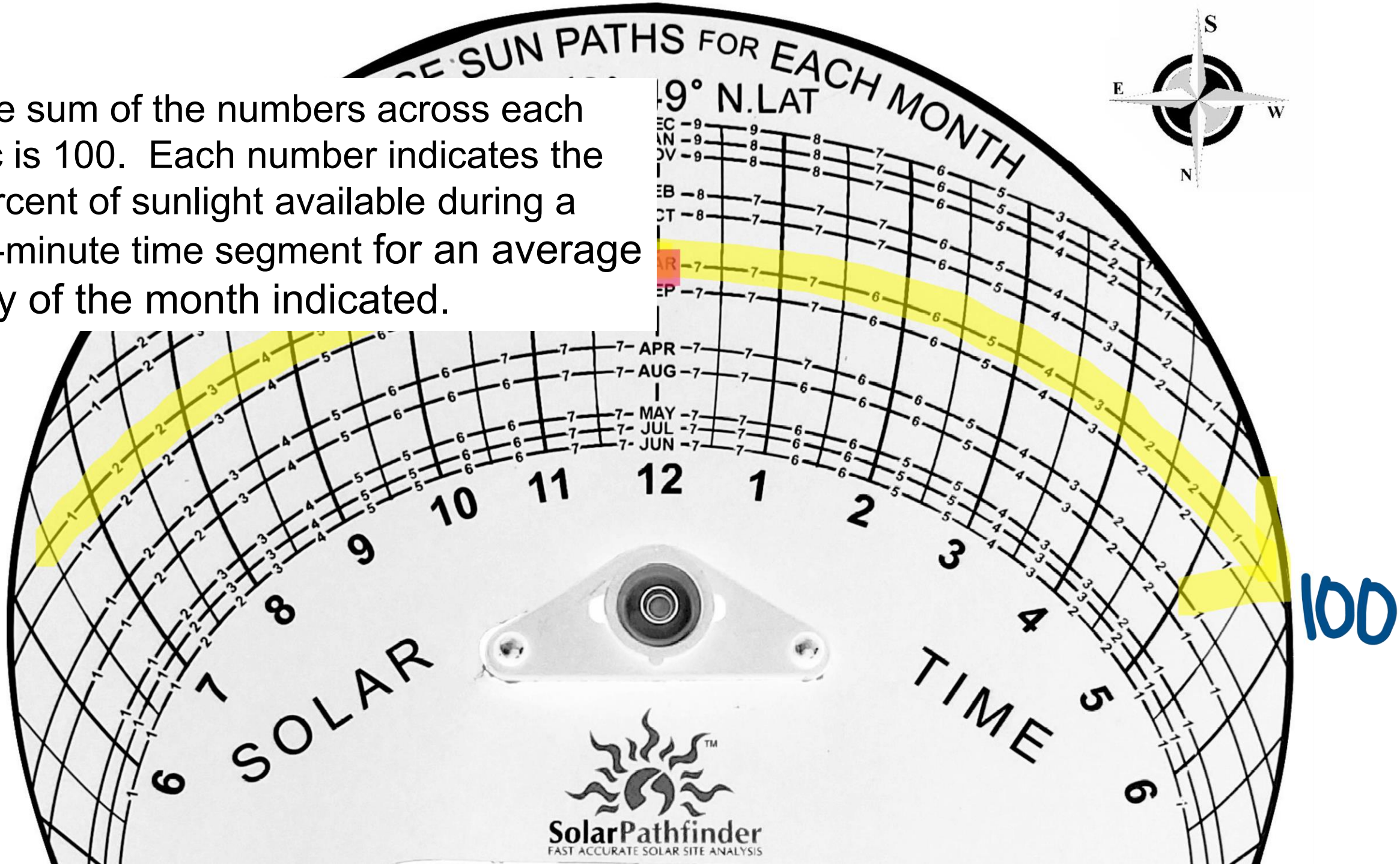




What are all the numbers on a sunpath diagram…and what do they mean?

What are the all the curves (or arcs)…and what do they mean?

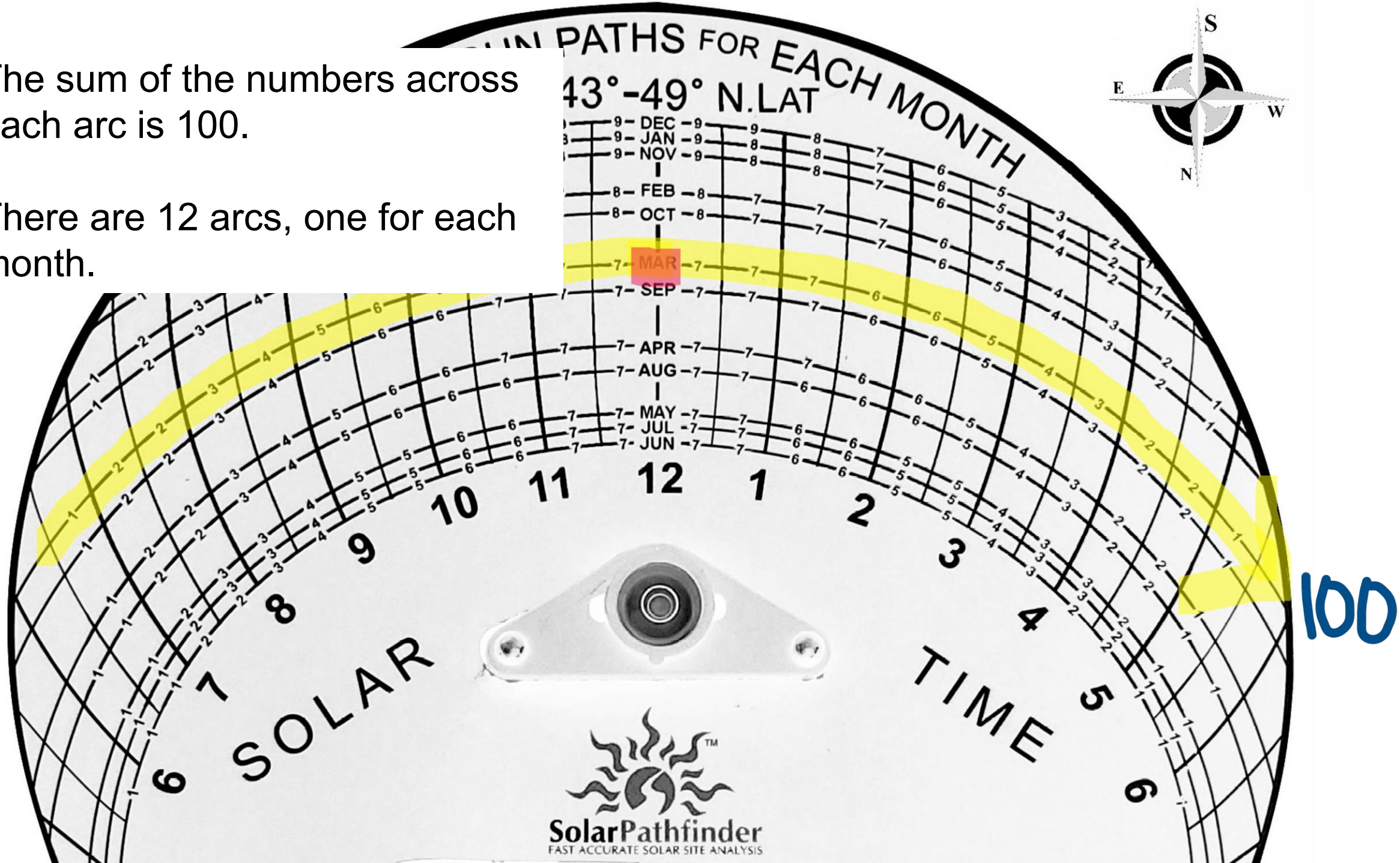


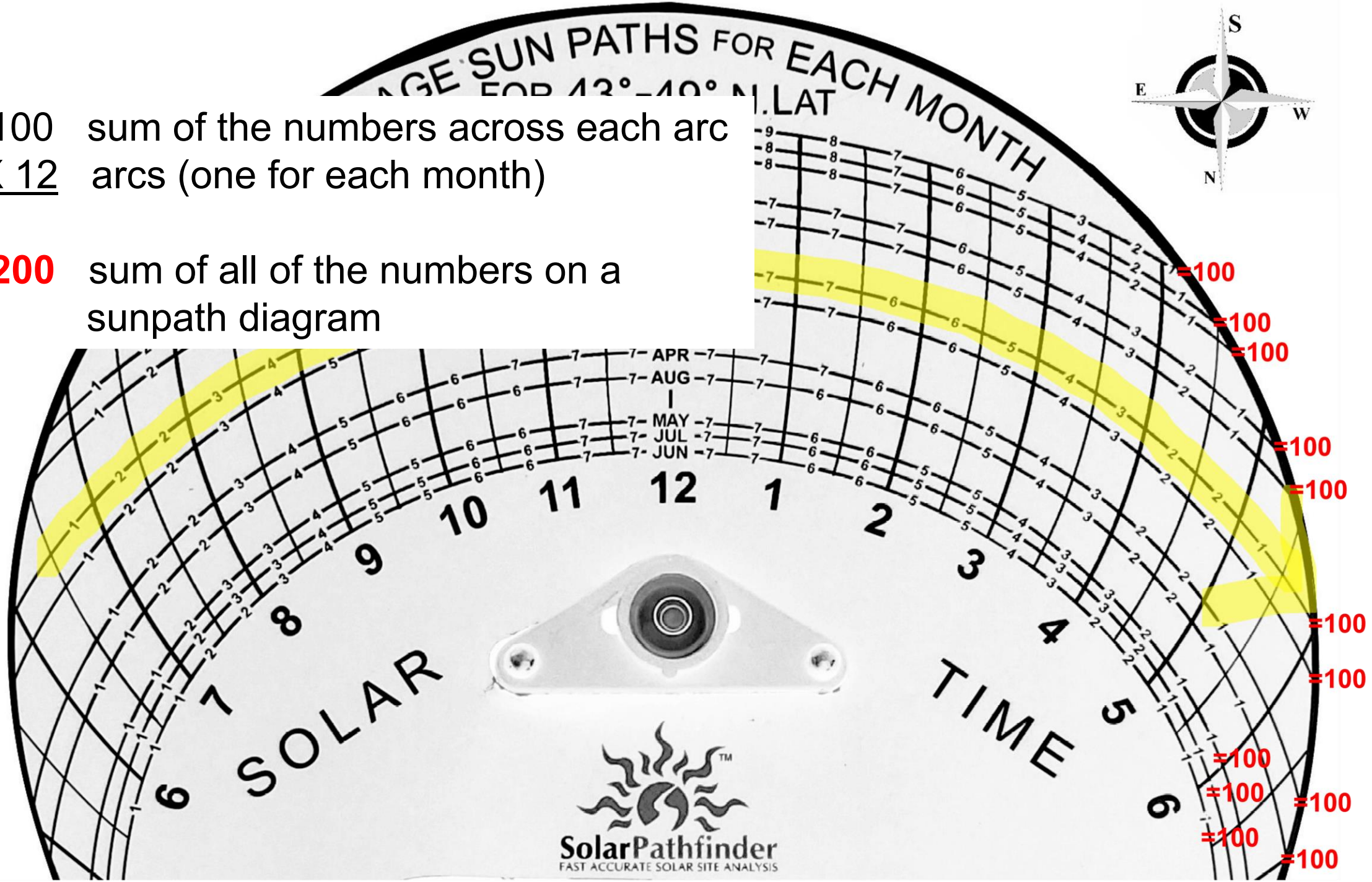


The sum of the numbers across each arc is 100. Each number indicates the percent of sunlight available during a 30-minute time segment for an average day of the month indicated.

The sum of the numbers across each arc is 100.

There are 12 arcs, one for each month.





100 sum of the numbers across each arc

X 12 arcs (one for each month)

= **1200** sum of all of the numbers on a sunpath diagram

Chart 1: Shade and Sun Evaluation

Sunpath Diagram for _____ Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X		=	
2	X		=	
3	X		=	
4	X		=	
5	X		=	
6	X		=	
7	X		=	
8	X		=	
9	X		=	
				_____ Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..
_____ **Percentage of sunlight available for the year at this location.**

First Street

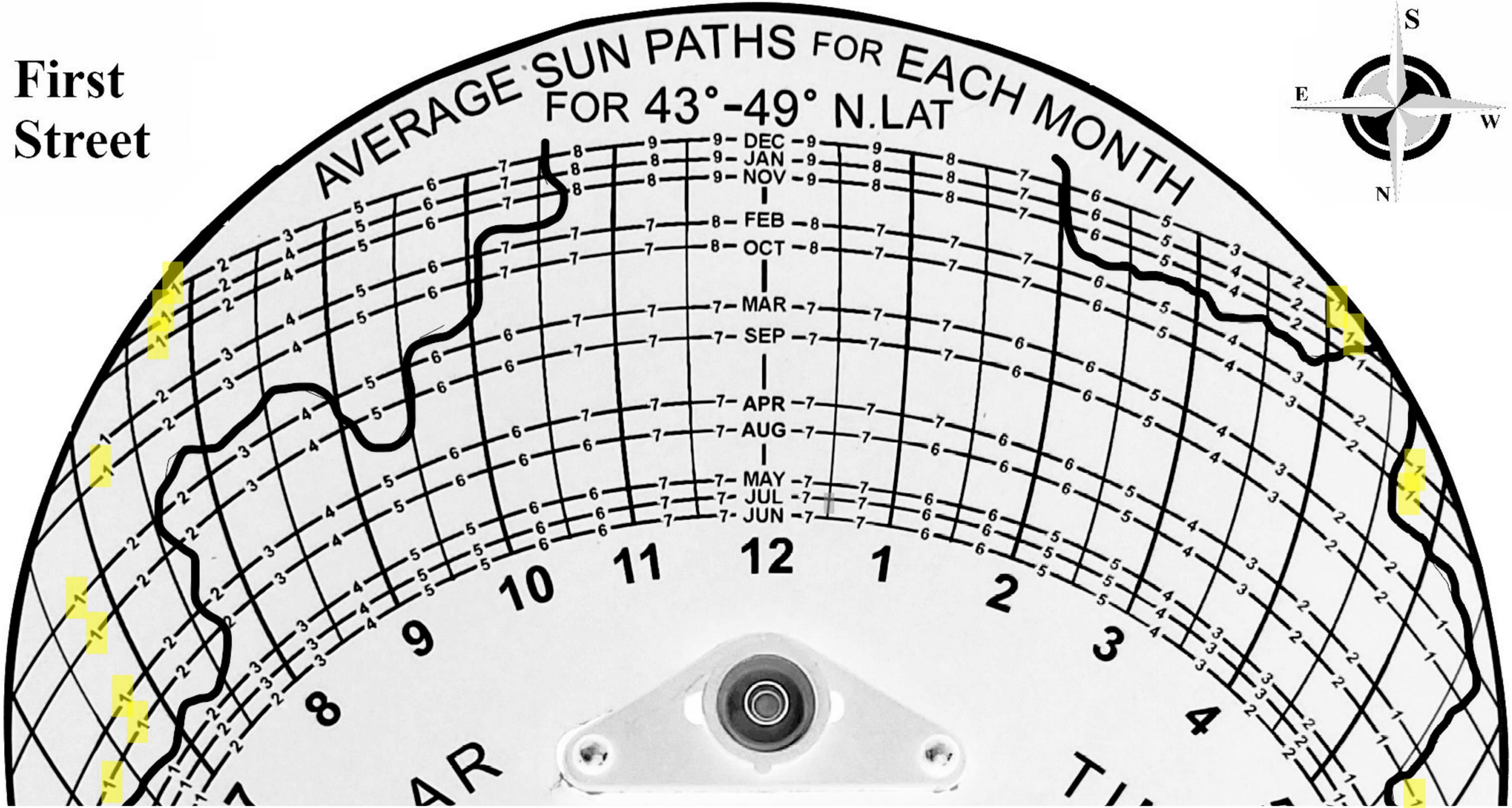


Chart 1: Shade and Sun Evaluation

Sunpath Diagram for FIRST Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	16	=	16
2	X		=	
3	X		=	
4	X		=	
5	X		=	
6	X		=	
7	X		=	
8	X		=	
9	X		=	
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

Percentage of sunlight available for the year at this location.

First Street

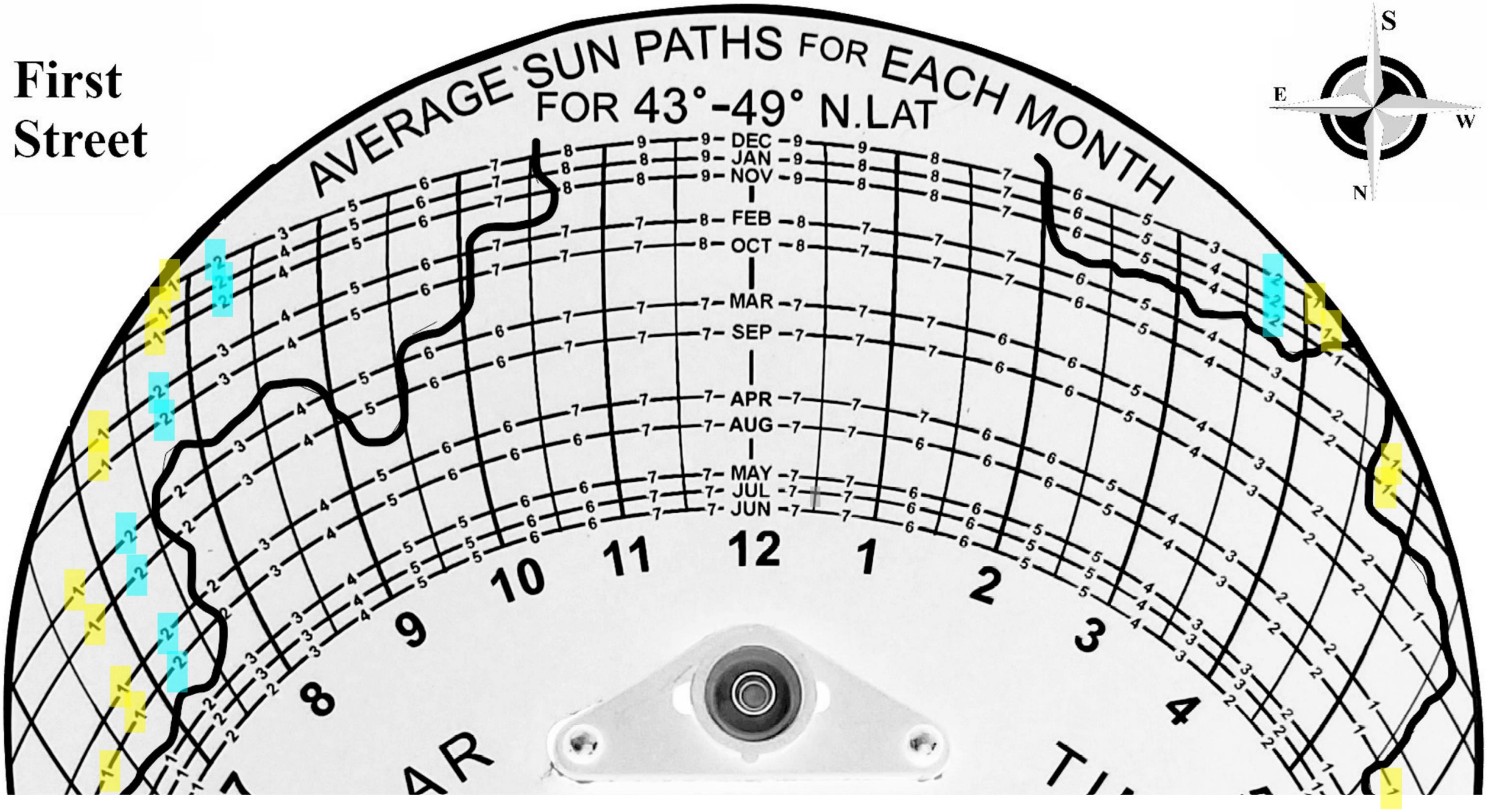


Chart 1: Shade and Sun Evaluation

Sunpath Diagram for FIRST Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	16	=	16
2	X	12	=	24
3	X		=	
4	X		=	
5	X		=	
6	X		=	
7	X		=	
8	X		=	
9	X		=	
				_____
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

_____

Percentage of sunlight available for the year at this location.

First Street

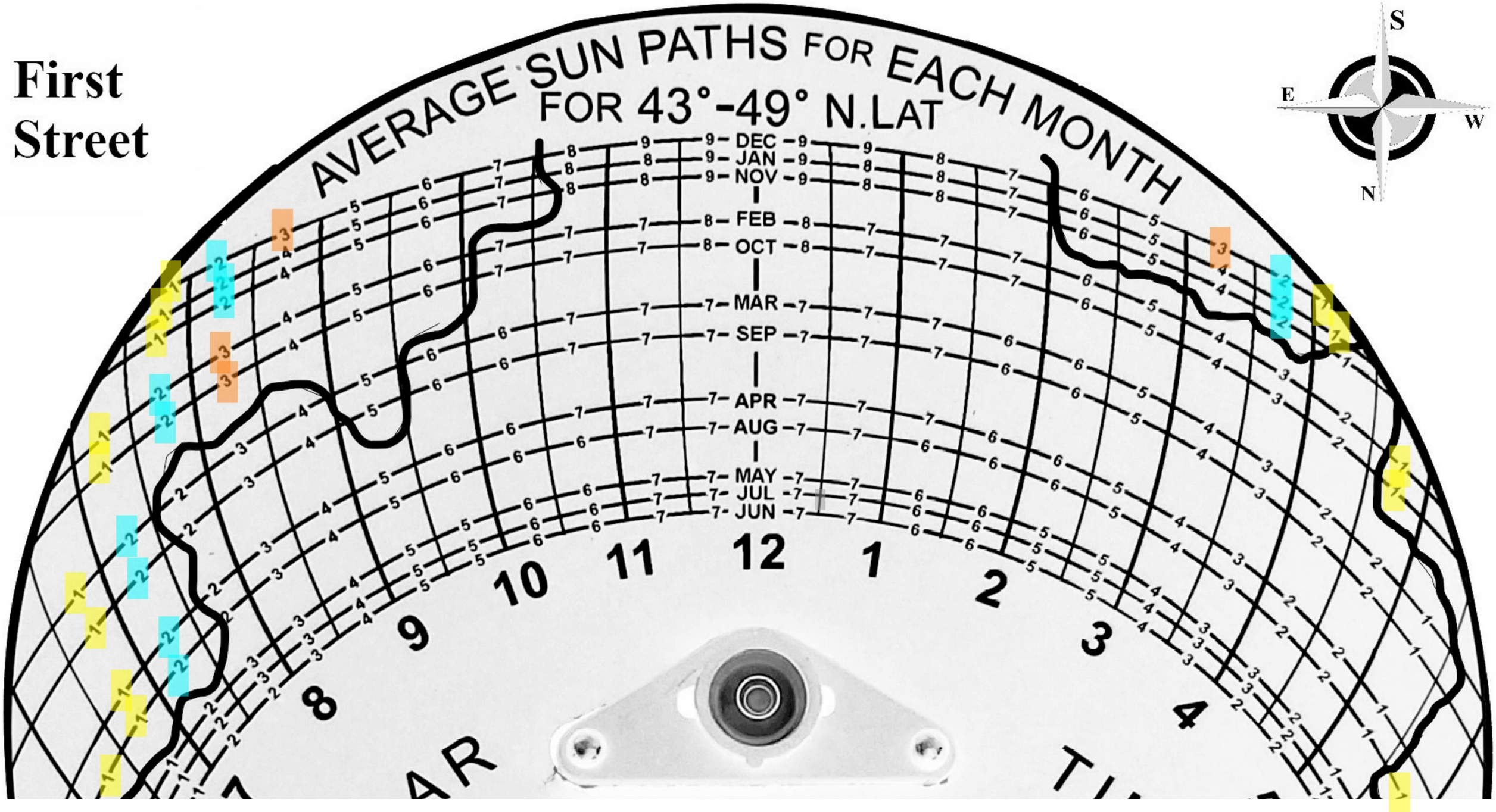


Chart 1: Shade and Sun Evaluation

Sunpath Diagram for FIRST Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	16	=	16
2	X	12	=	24
3	X	4	=	12
4	X		=	
5	X		=	
6	X		=	
7	X		=	
8	X		=	
9	X		=	
				_____
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

_____

Percentage of sunlight available for the year at this location.

Chart 1: Shade and Sun Evaluation

Sunpath Diagram for FIRST Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	16	=	16
2	X	12	=	24
3	X	4	=	12
4	X		=	
5	X		=	
6	X		=	
7	X		=	
8	X		=	
9	X		=	
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

Percentage of sunlight available for the year at this location.

Continue in this way...

Chart 1: Shade and Sun Evaluation

Sunpath Diagram for FIRST Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	16	=	16
2	X	12	=	24
3	X	4	=	12
4	X		=	
5	X		=	
6	X		=	
7	X		=	
8	X		=	
9	X		=	
				120
				Sum total of sunpath diagram shaded numbers

Example Number →

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

_____

Percentage of sunlight available for the year at this location.

Chart 1: Shade and Sun Evaluation

Sunpath Diagram for FIRST Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	16	=	16
2	X	12	=	24
3	X	4	=	12
4	X		=	
5	X		=	
6	X		=	
7	X		=	
8	X		=	
9	X		=	
				120

Example Number →

Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

1200
- 120
= 1080

Sum total of sunpath diagram unshaded numbers

_____

Percentage of sunlight available for the year at this location.

Chart 1: Shade and Sun Evaluation

Sunpath Diagram for FIRST Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	16	=	16
2	X	12	=	24
3	X	4	=	12
4	X		=	
5	X		=	
6	X		=	
7	X		=	
8	X		=	
9	X		=	
				120

Example Number →

Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

$1200 - 120 = 1080$

$\left(\frac{1080}{1200}\right) \times 100 = 90\%$

Sum total of sunpath diagram unshaded numbers

Percentage of sunlight available for the year at this location.

Chart 1: Shade and Sun Evaluation

Sunpath Diagram for FIRST Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	16	=	16
2	X	12	=	24
3	X	4	=	12
4	X		=	
5	X		=	
6	X		=	
7	X		=	
8	X		=	
9	X		=	
				120

Example Number →

Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

1200
- 120
= 1080

$\left(\frac{1080}{1200}\right) \times 100$

= 90%

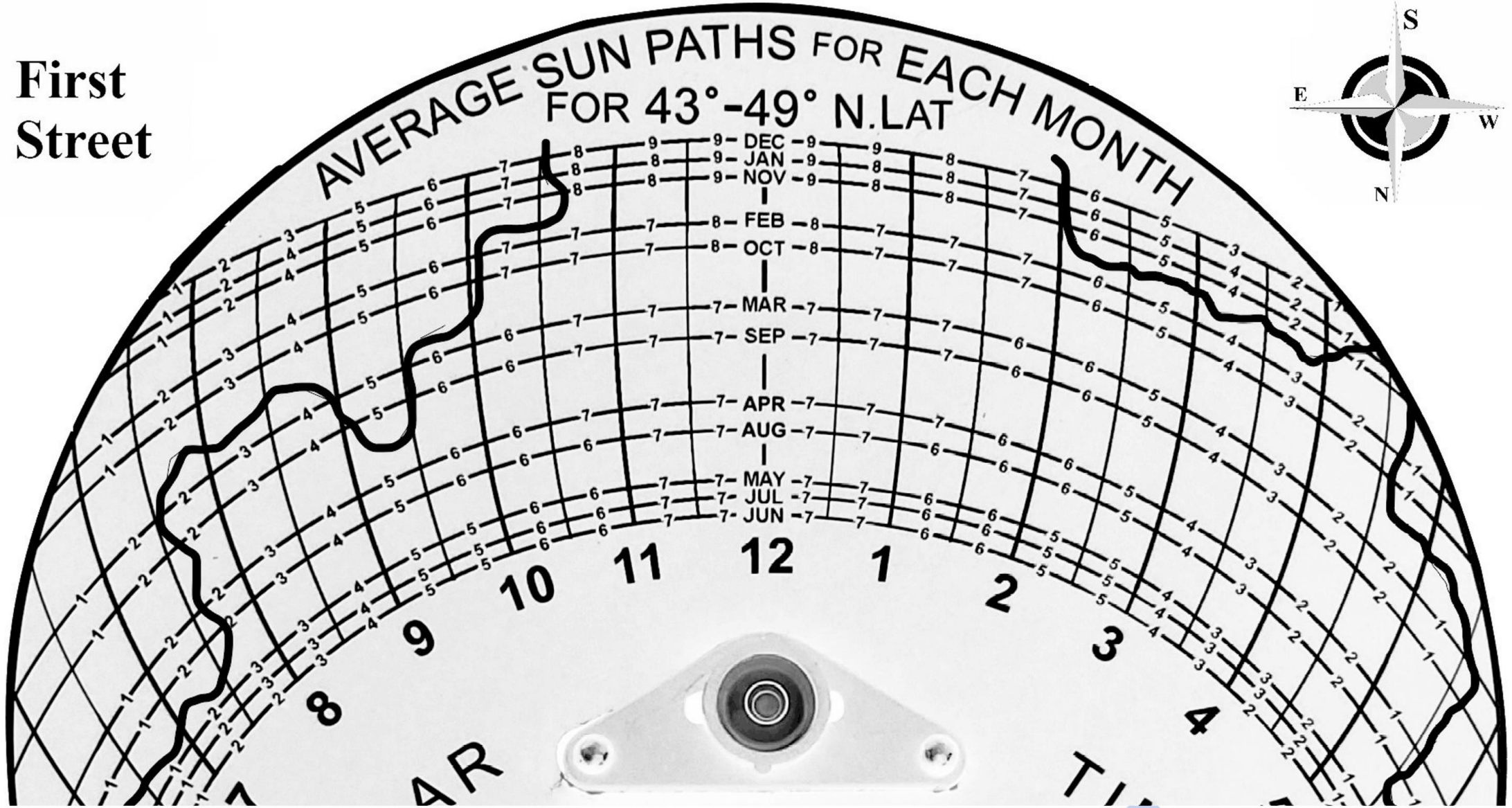
90%

Percentage of sunlight available for the year at this location.

Sum total of sunpath diagram unshaded numbers

Part 5:
Shade and Sun Evaluation for a Specific Site Street by Street Answer Key

First Street



Sunpath Diagram for **First** Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	16	=	16
2	X	12	=	24
3	X	4	=	12
4	X	6	=	24
5	X	10	=	50
6	X	8	=	48
7	X	3	=	21
8	X		=	
9	X		=	
				195
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

1200

<u>- 195</u>

=**1005**

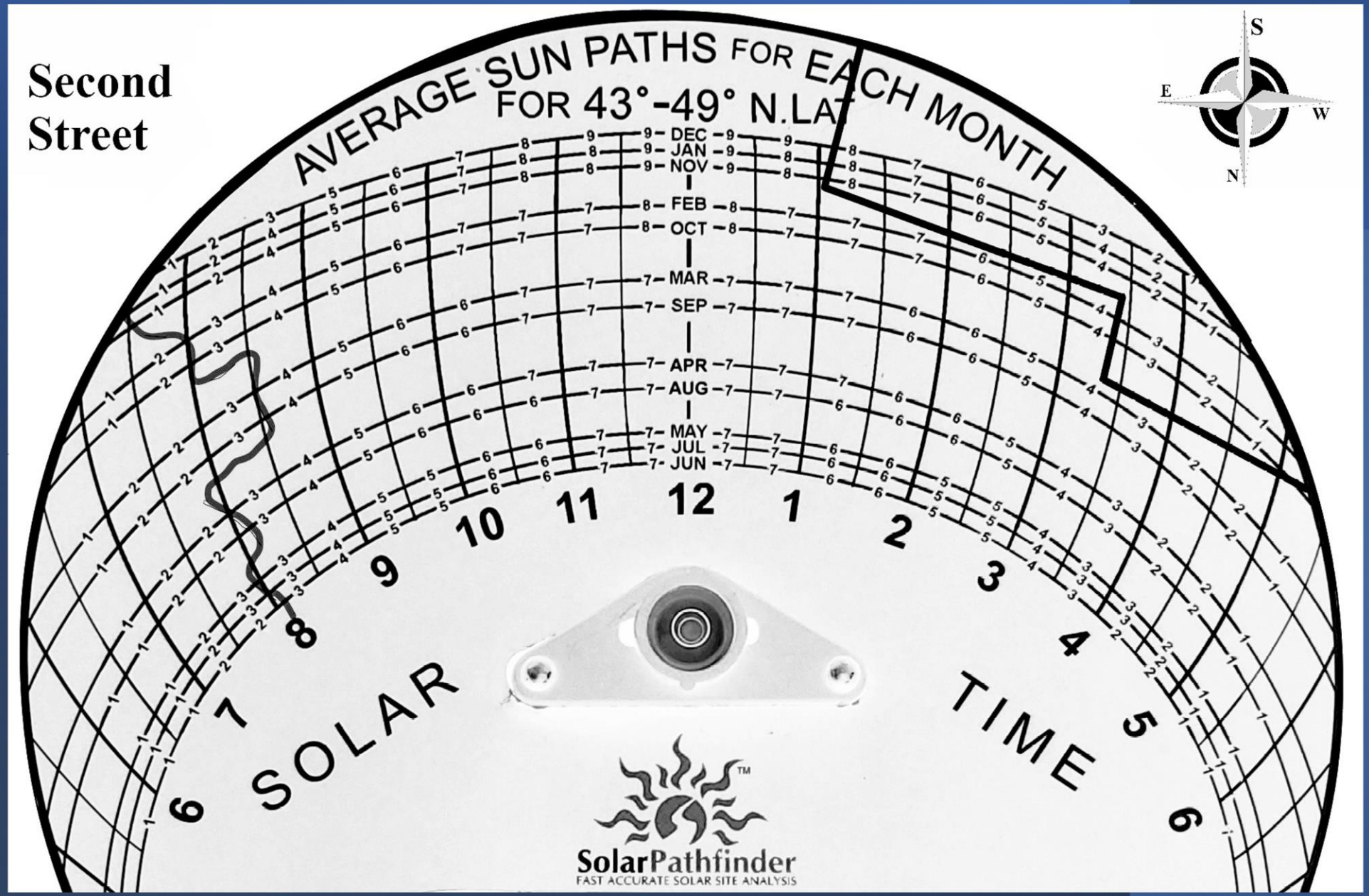
(**1005** / 1200) X 100 =

84%

84%

Percentage of sunlight available for the year at this location.

Second Street



Sunpath Diagram for **Second** Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	19	=	19
2	X	19	=	38
3	X	7	=	21
4	X	2	=	8
5	X	3	=	15
6	X	3	=	18
7	X	3	=	21
8	X	3	=	24
9	X		=	
				164
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

1200

- 164

=**1036**

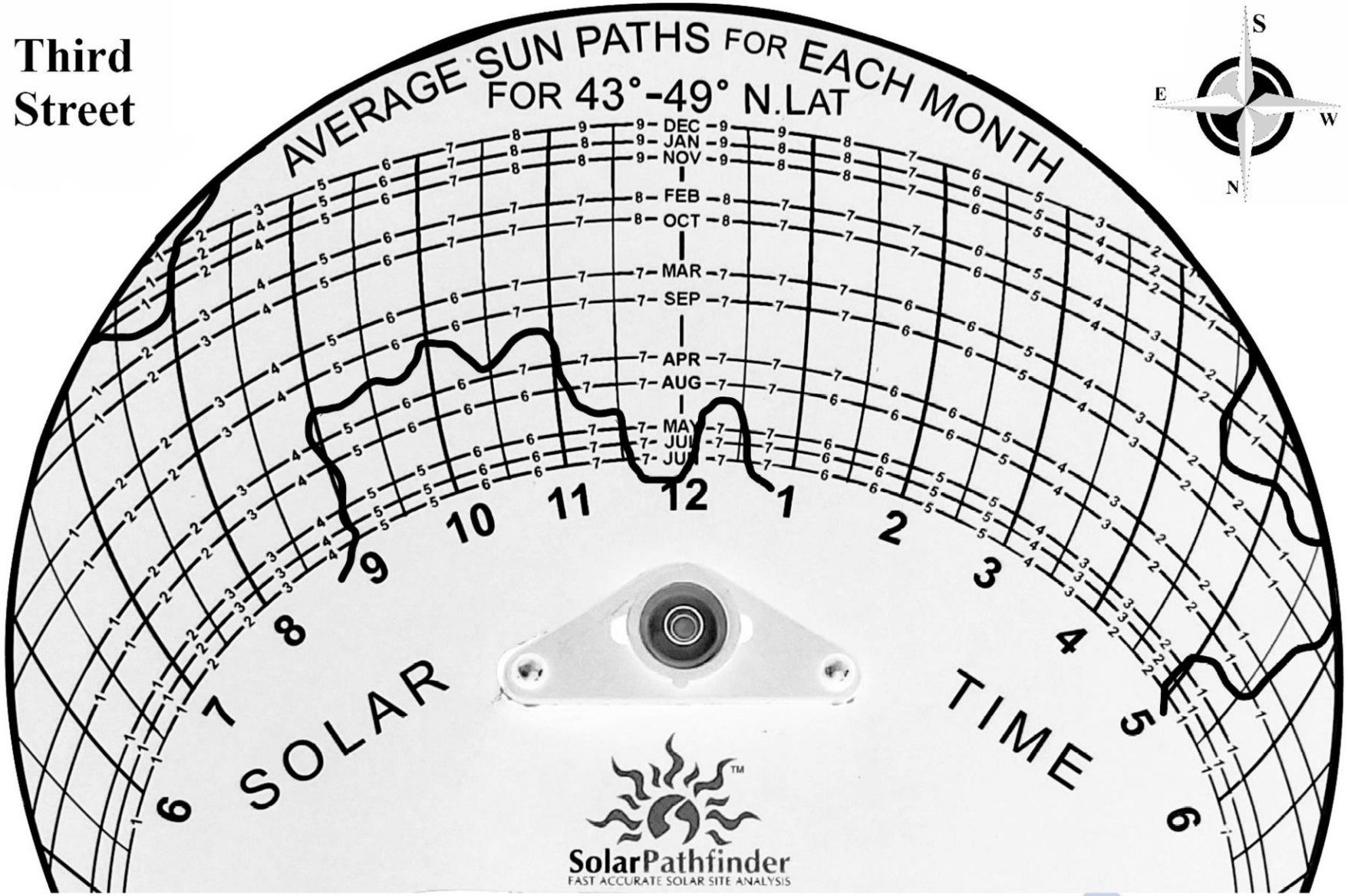
(**1036** / 1200) X 100 =

86%

86%

Percentage of sunlight available for the year at this location.

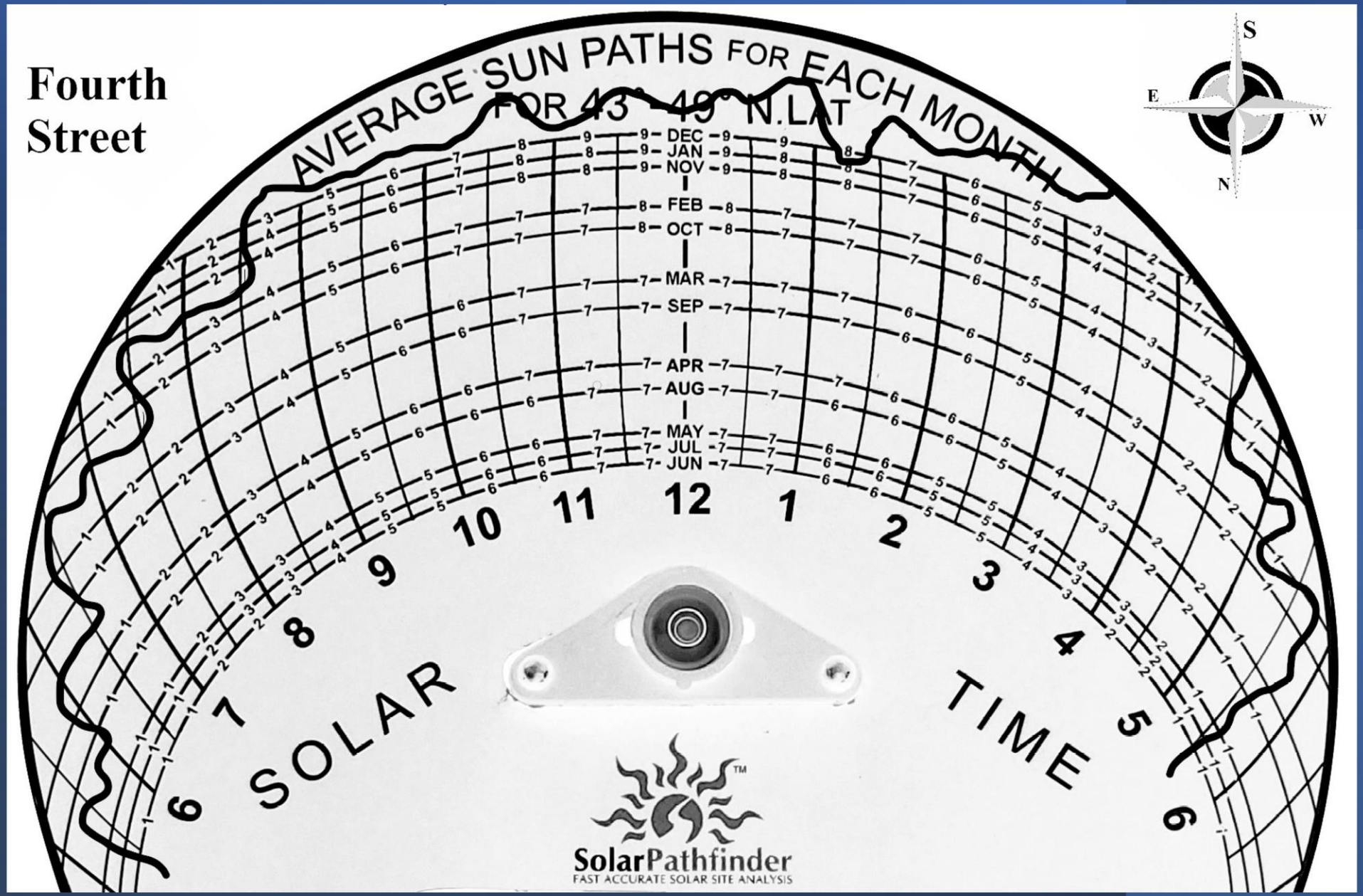
Third Street



Sunpath Diagram for **Third** Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram			Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..
1	X	13	=	13	
2	X		=		1200
3	X		=		- 168
4	X		=		=**1032**
5	X	8	=	40	
6	X	11	=	66	(**1032** / 1200) X 100 =
7	X	7	=	49	**86%**
8	X		=		
9	X		=		
				168	**86%**
				Sum total of sunpath diagram shaded numbers	**Percentage of sunlight available for the year at this location.**

Fourth Street



Sunpath Diagram for **Fourth** Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	13	=	13
2	X	3	=	6
3	X		=	
4	X		=	
5	X		=	
6	X		=	
7	X		=	
8	X	1	=	8
9	X		=	
				27
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

1200

- 27

=**1173**

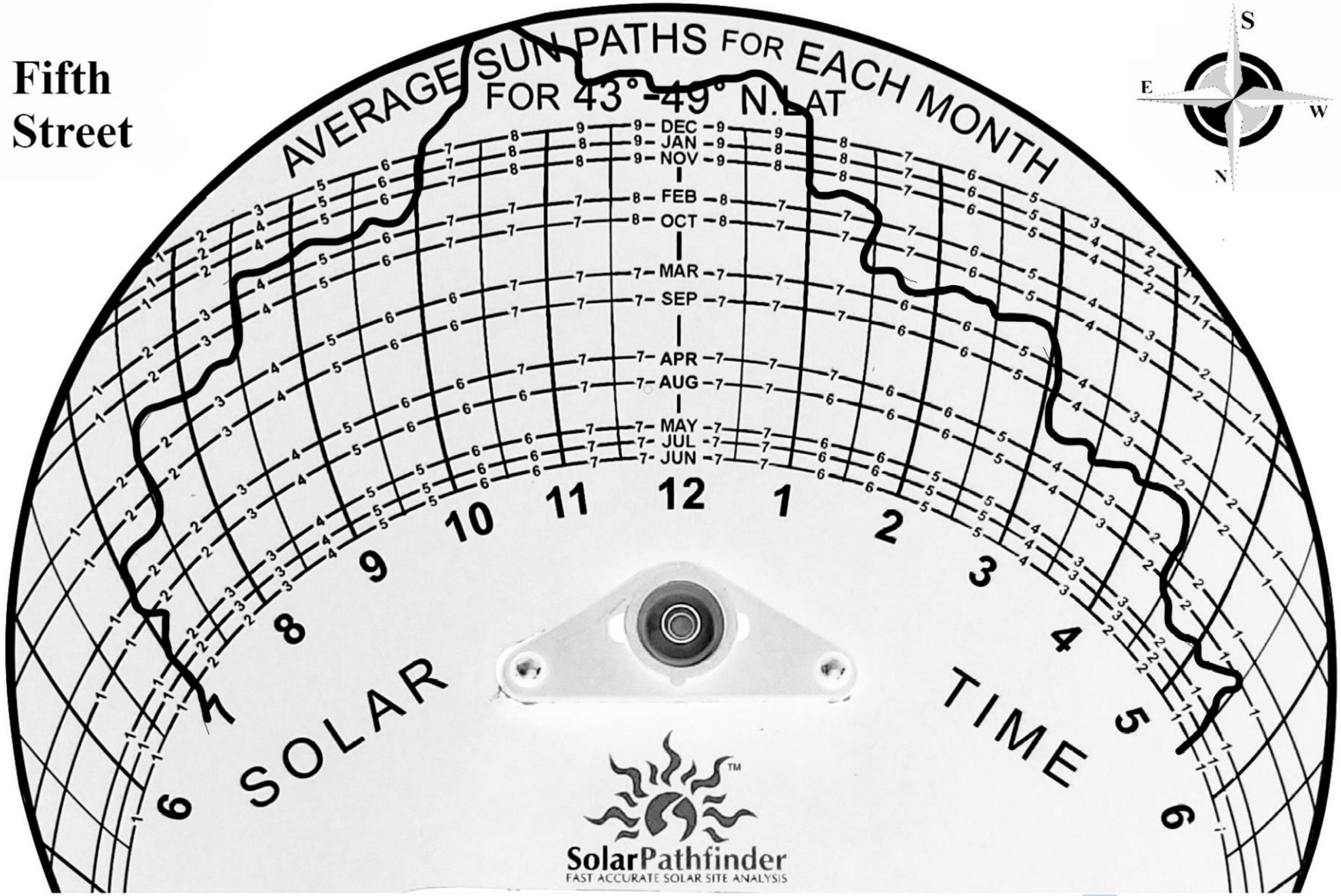
(**1173** / 1200) X 100 =

98%

98%

Percentage of sunlight available for the year at this location.

Fifth Street



Sunpath Diagram for **Fifth** Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	31	=	31
2	X	18	=	36
3	X	8	=	24
4	X	8	=	32
5	X	8	=	40
6	X	8	=	48
7	X	5	=	35
8	X	3	=	24
9	X		=	
				270
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

1200

- 270

=**930**

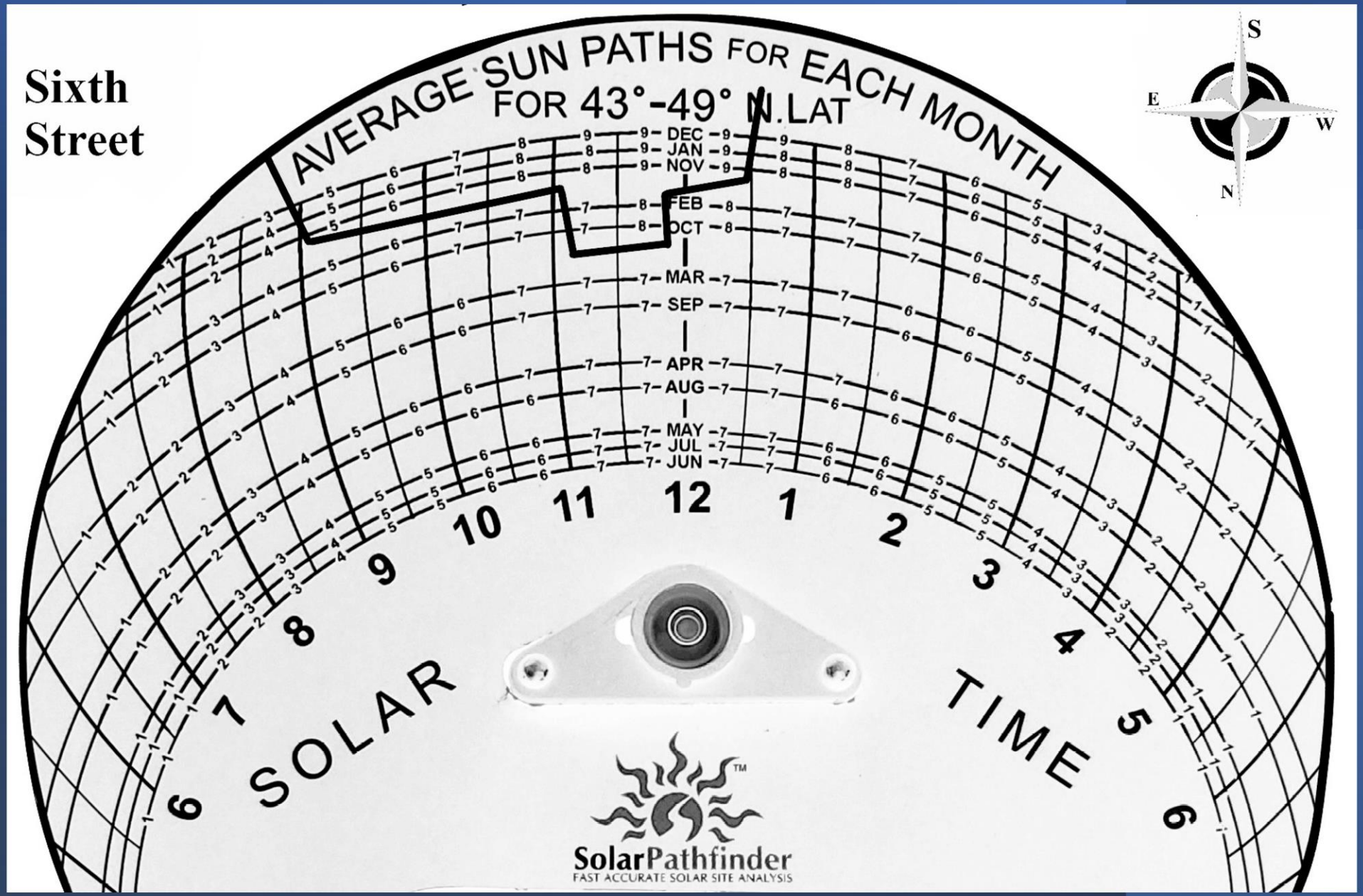
(**930** / 1200) X 100 =

78%

78%

Percentage of sunlight available for the year at this location.

Sixth Street



Sunpath Diagram for **Sixth** Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X		=	
2	X		=	
3	X		=	
4	X		=	
5	X	3	=	15
6	X	3	=	18
7	X	5	=	35
8	X	7	=	56
9	X	7	=	63
				187
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

1200

- 187

=**1013**

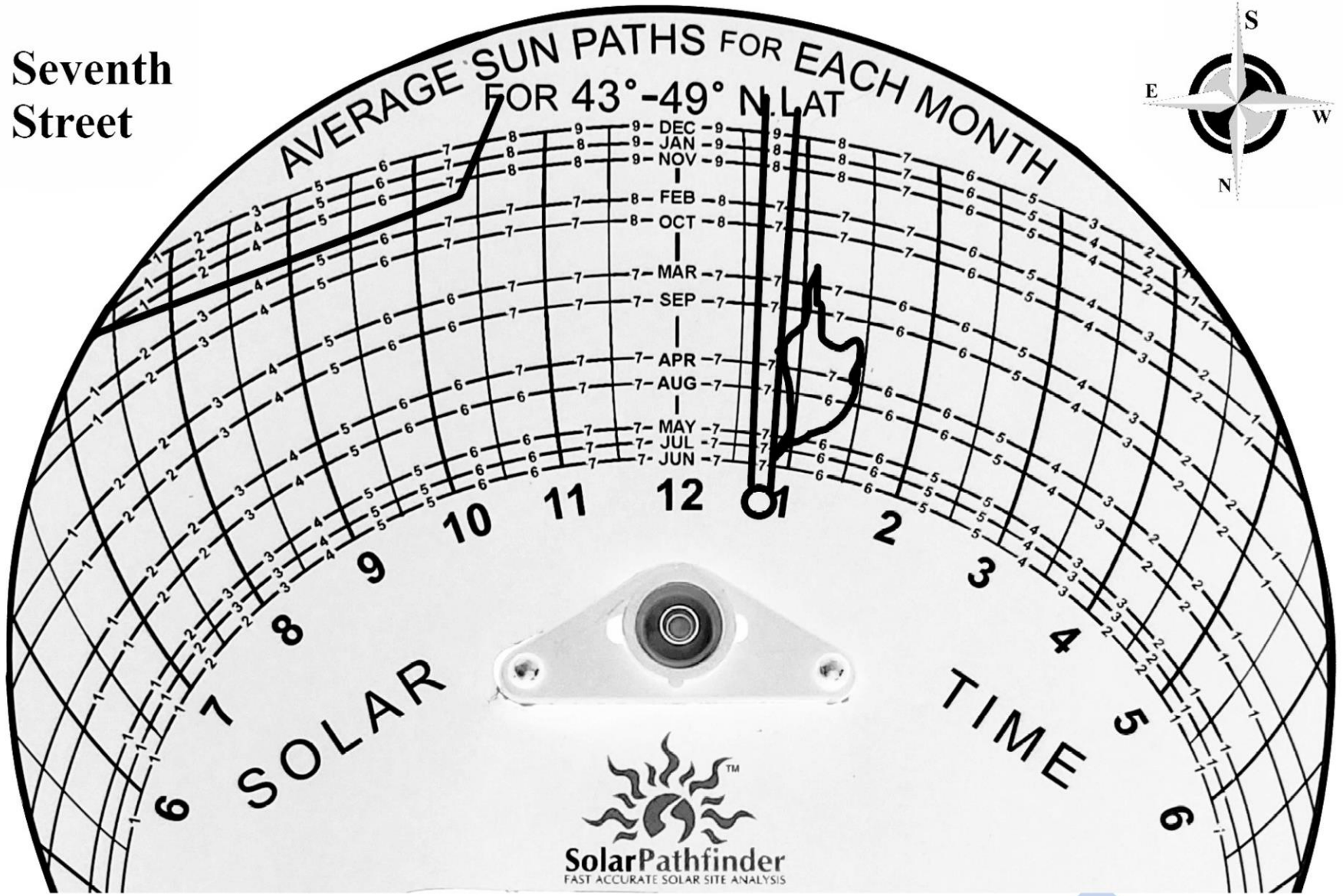
(**1013** / 1200) X 100 =

84%

84%

Percentage of sunlight available for the year at this location.

Seventh Street



Sunpath Diagram for **Seventh** Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	3	=	3
2	X	3	=	6
3	X	1	=	3
4	X	2	=	8
5	X	3	=	15
6	X	4	=	24
7	X	13	=	91
8	X	2	=	16
9	X	1	=	9
				175
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

1200

<u>- 175</u>

=**1025**

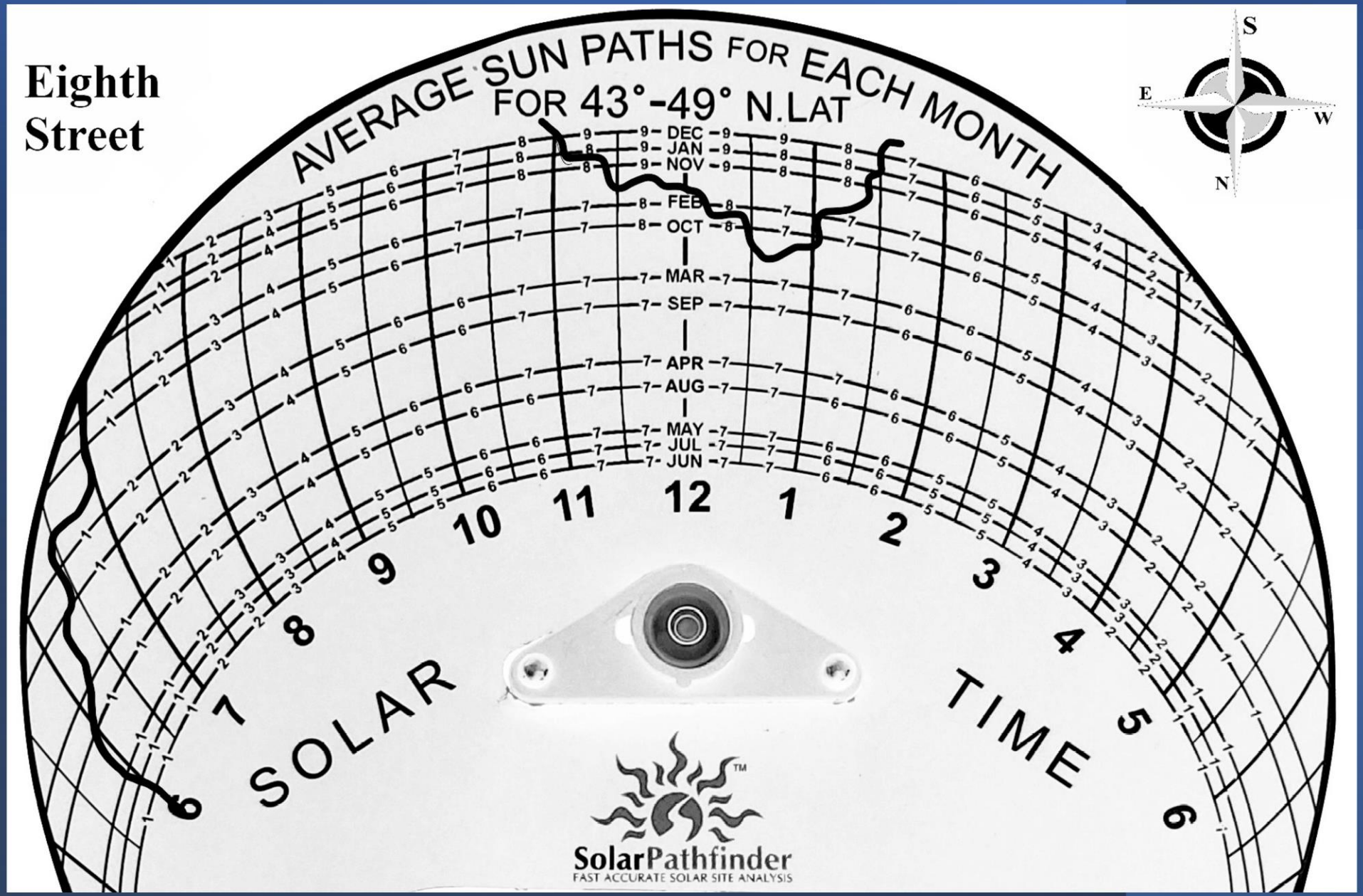
(**1025** / 1200) X 100 =

85%

85%

Percentage of sunlight available for the year at this location.

Eighth Street



Sunpath Diagram for **Eighth** Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	1	=	1
2	X		=	
3	X		=	
4	X		=	
5	X		=	
6	X		=	
7	X	2	=	14
8	X	7	=	56
9	X	8	=	72
				143
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

1200

- 143

=**1057**

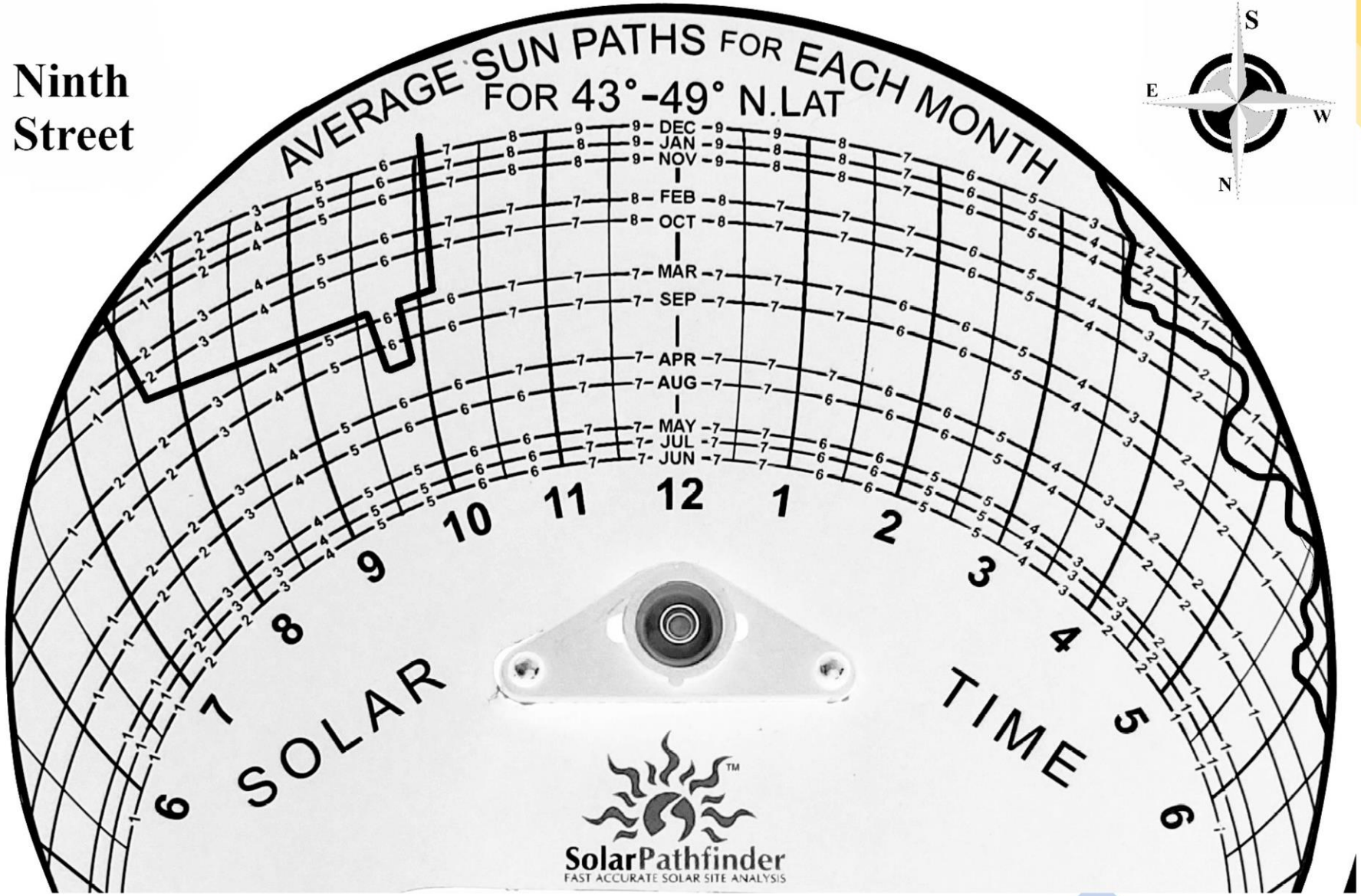
(**1057** / 1200) X 100 =

88%

88%

Percentage of sunlight available for the year at this location.

Ninth Street



Sunpath Diagram for **Ninth** Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	8	=	8
2	X	8	=	16
3	X	3	=	9
4	X	4	=	16
5	X	5	=	25
6	X	7	=	42
7	X		=	
8	X		=	
9	X		=	
				116
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

1200

- 116

=**1084**

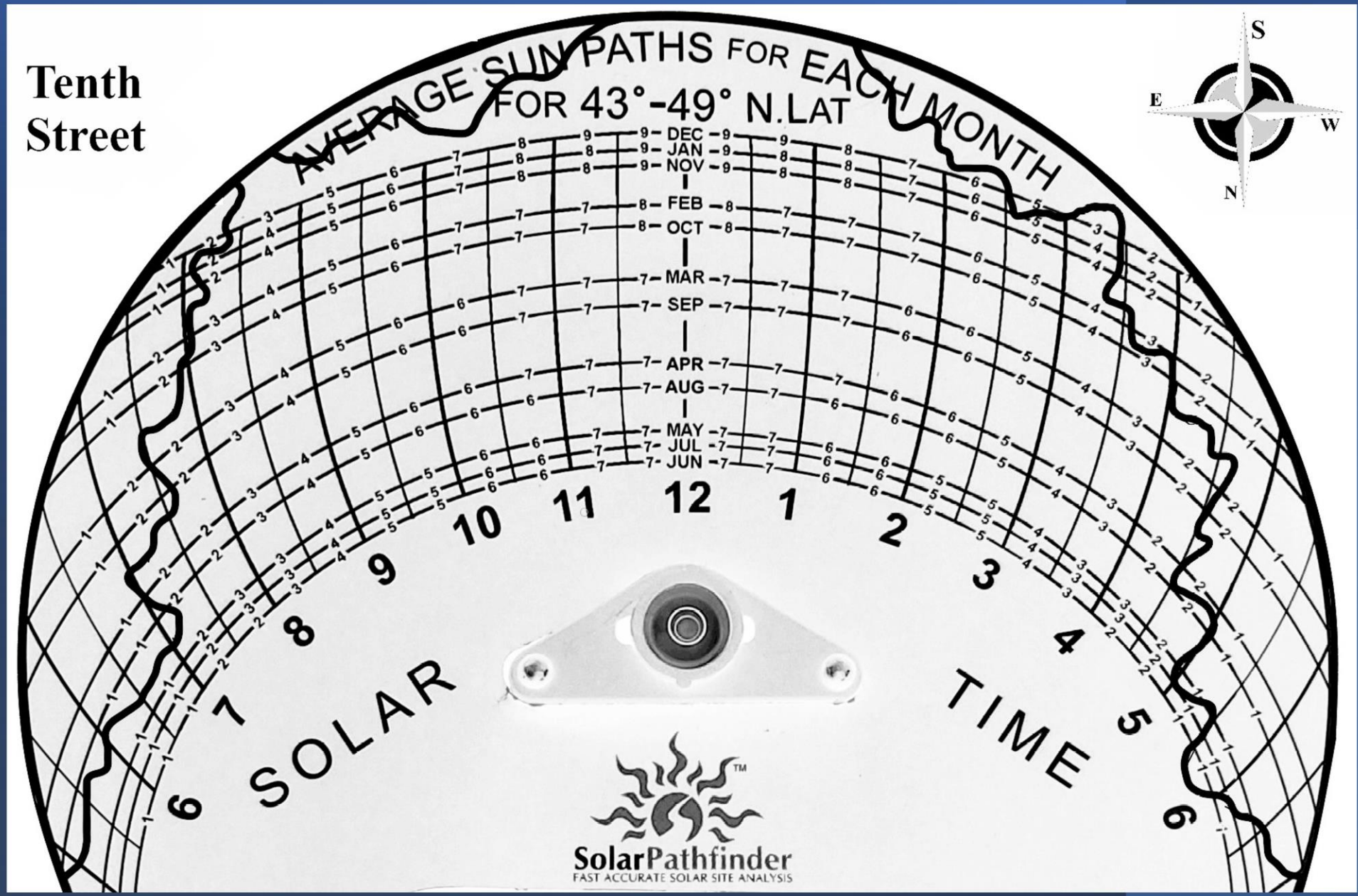
(**1084** / 1200) X 100 =

90%

90%

Percentage of sunlight available for the year at this location.

Tenth Street



Sunpath Diagram for **Tenth** Street

Percentage of sunlight available number from sunpath diagram		Number of these numbers located in shade from the sunpath diagram		
1	X	24	=	24
2	X	13	=	26
3	X	1	=	3
4	X	1	=	5
5	X		=	
6	X		=	
7	X		=	
8	X		=	
9	X		=	
				58
				Sum total of sunpath diagram shaded numbers

Calculate the percentage of sunlight available for the year at this location in the space below. Show your math work in detail..

1200

- 58

=**1142**

(**1142** / 1200) X 100 =

96%

96%

Percentage of sunlight available for the year at this location.

5-1. The people who own the residence where your tracing was made need a loan to cover most of the purchase and installation costs for the solar PV system they want to install. Imagine you are a bank loan officer. Do you believe the percentage of sunlight available for the year at this location is enough for you to approve the loan? Answer yes or no, then provide your reasoning.

*

Part 6:
Show What You Know

Part 6: Show What You Know

6-1. Demonstrate what you've learned in this lesson in answering the following question. How does the Solar Pathfinder enable most people (buyers, installers, bankers) to make good, site-specific decisions about where to locate a solar PV system?

*

Part 6: Show What You Know

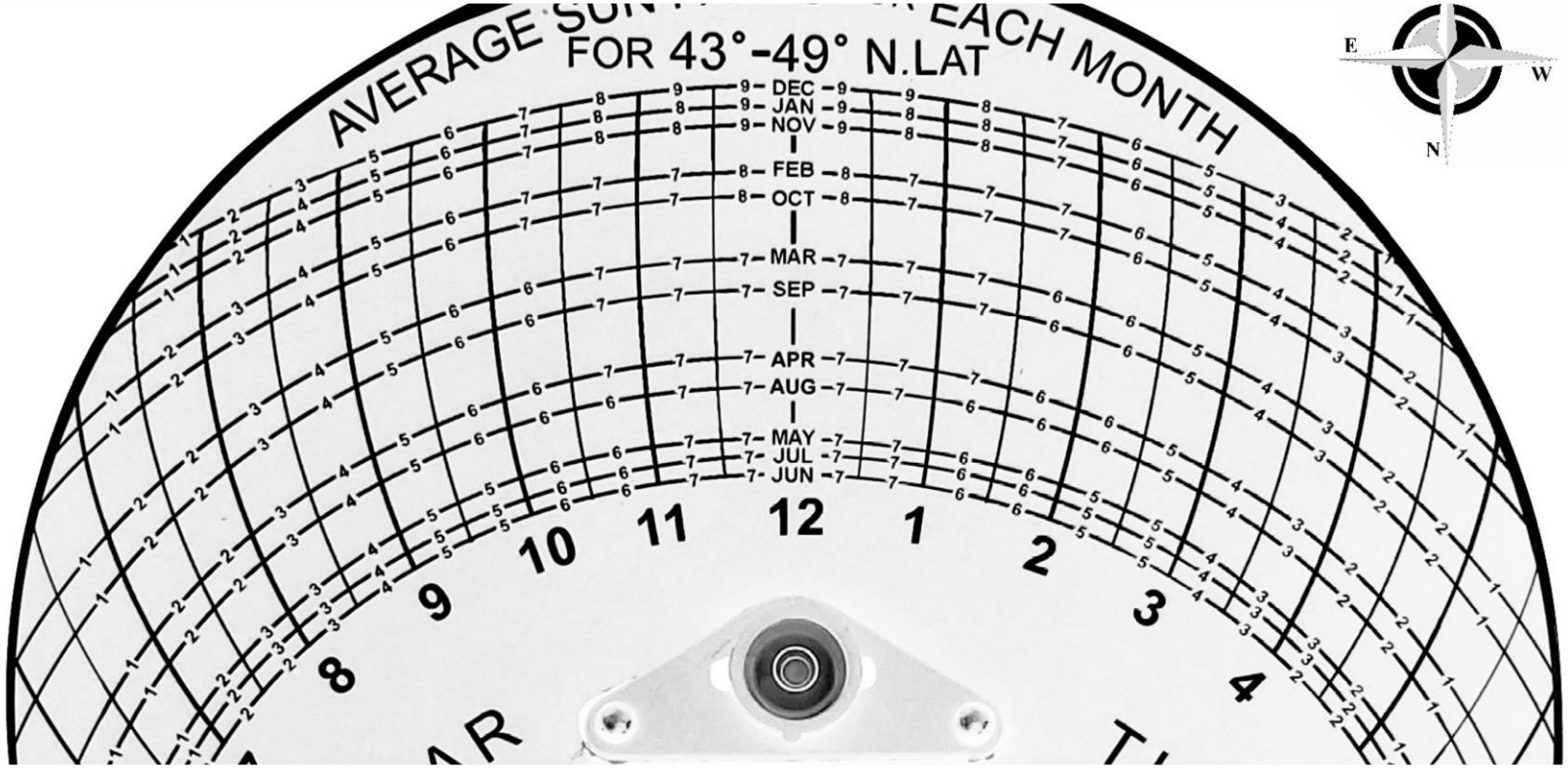
6-2. The Solar Pathfinder provides data on the percentage of sunlight available for the year at a given site. Develop a paragraph that describes at least three additional factors that often make a difference in determining whether or not a solar PV system makes sense for most people to install.

*

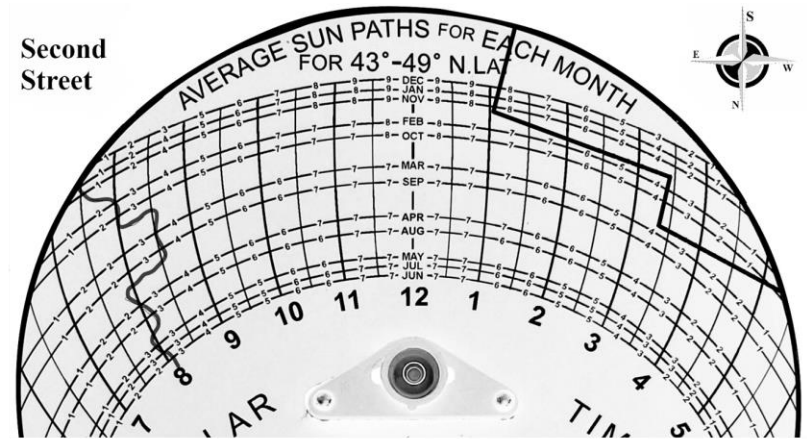
Part 6: Show What You Know

6-3. Describe the most important idea, concept, principle, or fact you learned while completing this this part of the lesson. Explain why it is important for you (and probably other people) to know and understand.

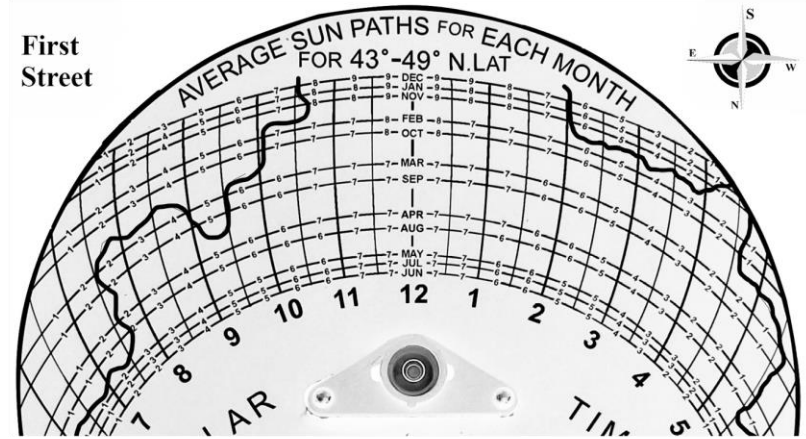
*



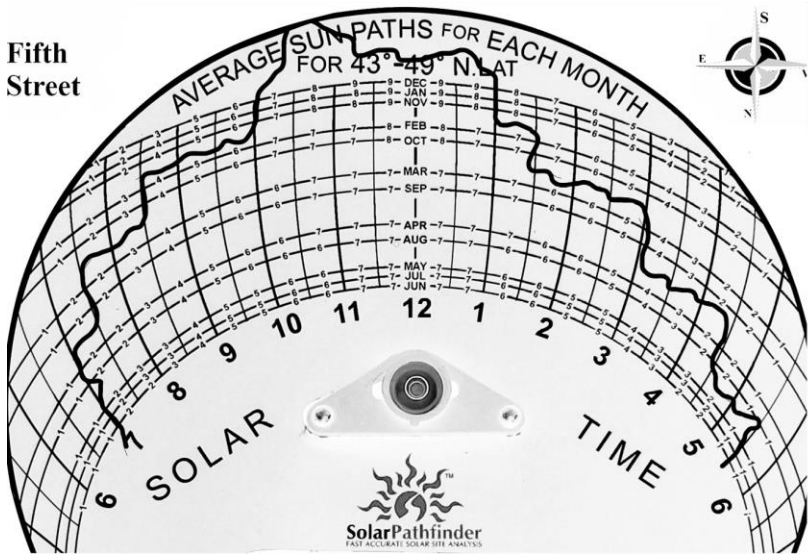
Second Street



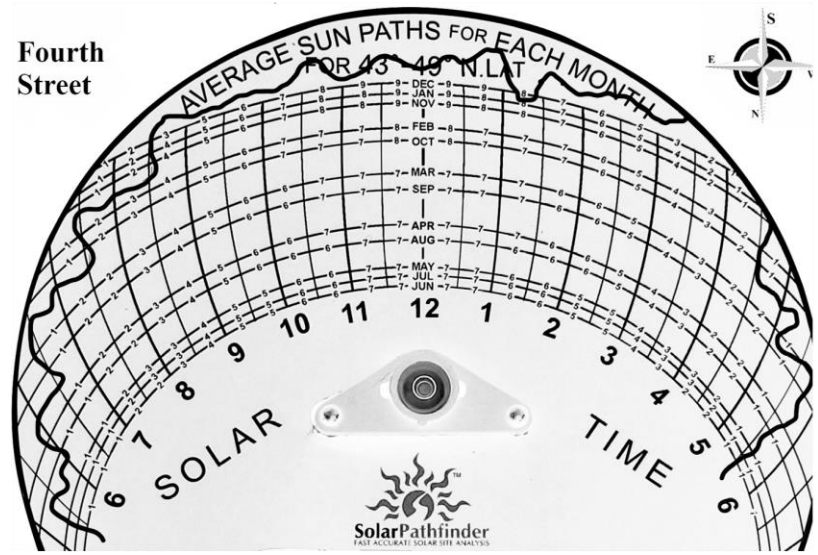
First Street



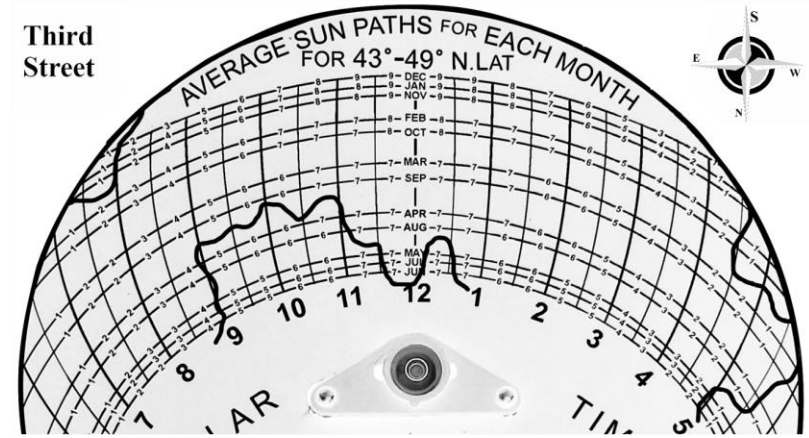
Fifth Street



Fourth Street



Third Street



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