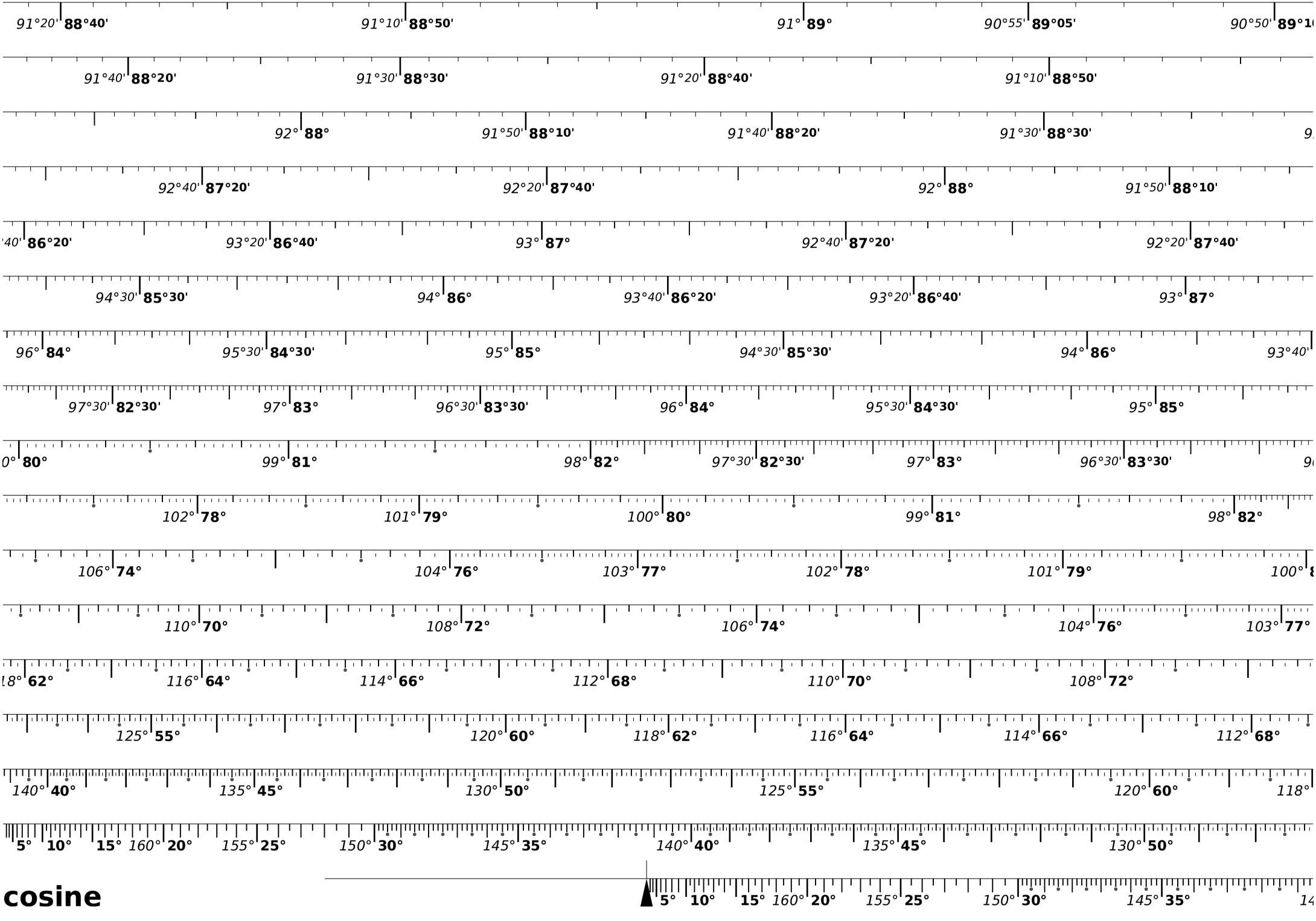

91°20' 88°40'
91°10' 88°50'
91° 89°
90°55' 89°05'
91°40' 88°20'
91°30' 88°30'
91°20' 88°40'
91°10' 88°50'
92° 88°
91°50' 88°10'
91°40' 88°20'
91°30' 88°30'
92°40' 87°20'
92°20' 87°40'
92° 88°
91°50' 88°10'
86°20'
93°20' 86°40'
93° 87°
92°40' 87°20'
92°20' 87°40'
94°30' 85°30'
94° 86°
93°40' 86°20'
93°20' 86°40'
93° 87°
96° 84°
95°30' 84°30'
95° 85°
94°30' 85°30'
94° 86°
97°30' 82°30'
97° 83°
96°30' 83°30'
96° 84°
95°30' 84°30'
95° 85°
80°
99° 81°
98° 82°
97°30' 82°30'
97° 83°
96°30' 83°30'
102° 78°
101° 79°
100° 80°
99° 81°
98° 82°
106° 74°
104° 76°
103° 77°
102° 78°
101° 79°
110° 70°
108° 72°
106° 74°
104° 76°
103° 77°
62°
116° 64°
114° 66°
112° 68°
110° 70°
108° 72°
125° 55°
120° 60°
118° 62°
116° 64°
114° 66°
112° 68°
140° 40°
135° 45°
130° 50°
125° 55°
120° 60°
5° 10° 15° 160° 20° 155° 25° 150° 30° 145° 35° 140° 40° 135° 45° 130° 50°
cosine
5° 10° 15° 160° 20° 155° 25° 150° 30° 145° 35°

If $LHA>180°$:
$HA = 360° - LHA$, East
otherwise
$HA = LHA$, West

$coLat = 90° - Lat$

$$\cot W = \cot Dec * \cos HA$$

under **Dec** set **index**
over **HA** read **W**

$W > 90°$ if $HA > 90°$

$$\boldsymbol{Y = coLat \pm W}$$

Add if *Dec* and *Lat* are of the same name, subtract if they are contrary.

If $Y > 180°$ let $Y = -(Y - 180°)$

$$\cot Az = \frac{\cot HA}{\cos W} * \cos Y$$

under **HA** set **W**
over **Y** read **Az**

$Az > 90°$ if $|Y| > 90°$

Name for *Az* is contrary to *Lat* (depressed pole)*, rotation as *HA*.

S *Az* E	$Zn = 180° - Az$
S *Az* W	$Zn = 180° + Az$
N *Az* E	$Zn = Az$
N *Az* W	$Zn = 360° - Az$

*Invert the name if $Y < 0$ AND *Dec* and *Lat* are of the same name! If *Dec* and *Lat* are named contrary then the name for *Az* is always the depressed pole regardles of the sign of *Y*.

$$\cot Hc = \frac{\cot Y}{\cos Az}$$

under **Y** set **Az**
at **index** read **Hc**

$Hc < 0°$ if $Y < 0°$

For great circle calculation:
$zd = 90° - Hc$

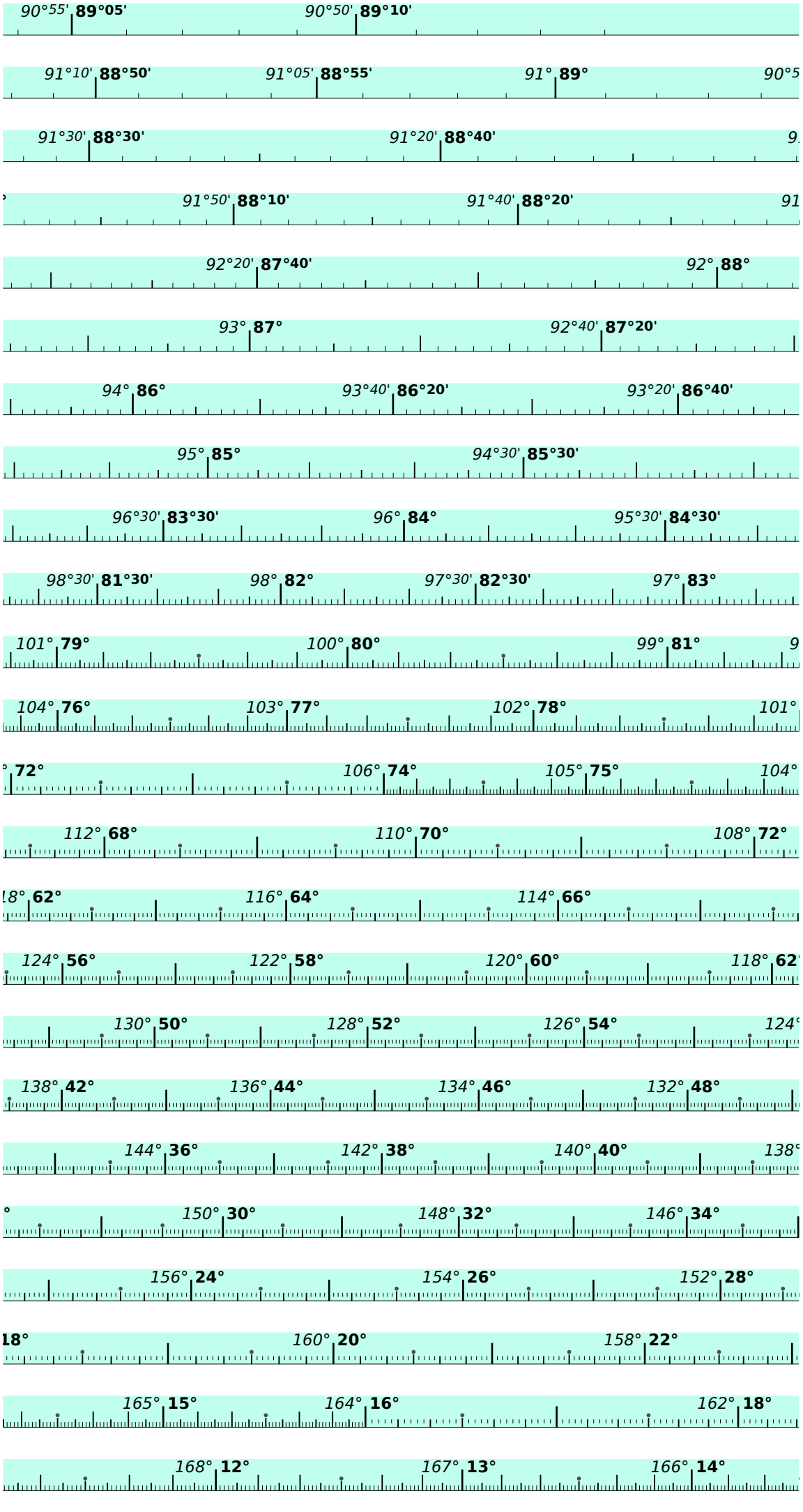
Special cases:

If *Az* is in the range [85°..95°] *Hc* looses its accuracy. Calculate *Hc* by interchanging *Dec* and *Lat*.

If *HA* is is in the range [89°..91°], choose different assumed *Lon*.

If $|Y|$ is in the range [89°..91°], choose different assumed *Lat*.

If *Dec* is less than 0°20' calculate *Az* assuming *W=Dec*, then calculate *Hc* by interchanging *Dec* and *Lat*.



cotangent

If $LHA>180°$:
$HA = 360° - LHA$, East
otherwise
$HA = LHA$, West

$coLat = 90° - Lat$

$$\cot W = \cot Dec * \cos HA$$

under **Dec** set **index**
over **HA** read **W**

$W > 90°$ if $HA > 90°$

$$\boldsymbol{Y = coLat \pm W}$$

Add if *Dec* and *Lat* are of the same name,
subtract if they are contrary.

If $Y > 180°$ let $Y = -(Y - 180°)$

$$\cot Az = \frac{\cot HA}{\cos W} * \cos Y$$

under **HA** set **W**
over **Y** read **Az**

$Az > 90°$ if $|Y| > 90°$

Name for *Az* is contrary to *Lat* (depressed pole)*, rotation as *HA*.

S *Az* E	$Zn = 180° - Az$
S *Az* W	$Zn = 180° + Az$
N *Az* E	$Zn = Az$
N *Az* W	$Zn = 360° - Az$

*Invert the name if $Y < 0$ AND *Dec* and *Lat* are of the same name! If *Dec* and *Lat* are named contrary then the name for *Az* is always the depressed pole regardles of the sign of *Y*.

$$\cot Hc = \frac{\cot Y}{\cos Az}$$

under **Y** set **Az**
at **index** read **Hc**

$Hc < 0°$ if $Y < 0°$

For great circle calculation:
$zd = 90° - Hc$

Special cases:

If *Az* is in the range [85°..95°] *Hc* looses its accuracy. Calculate *Hc* by interchanging *Dec* and *Lat*.

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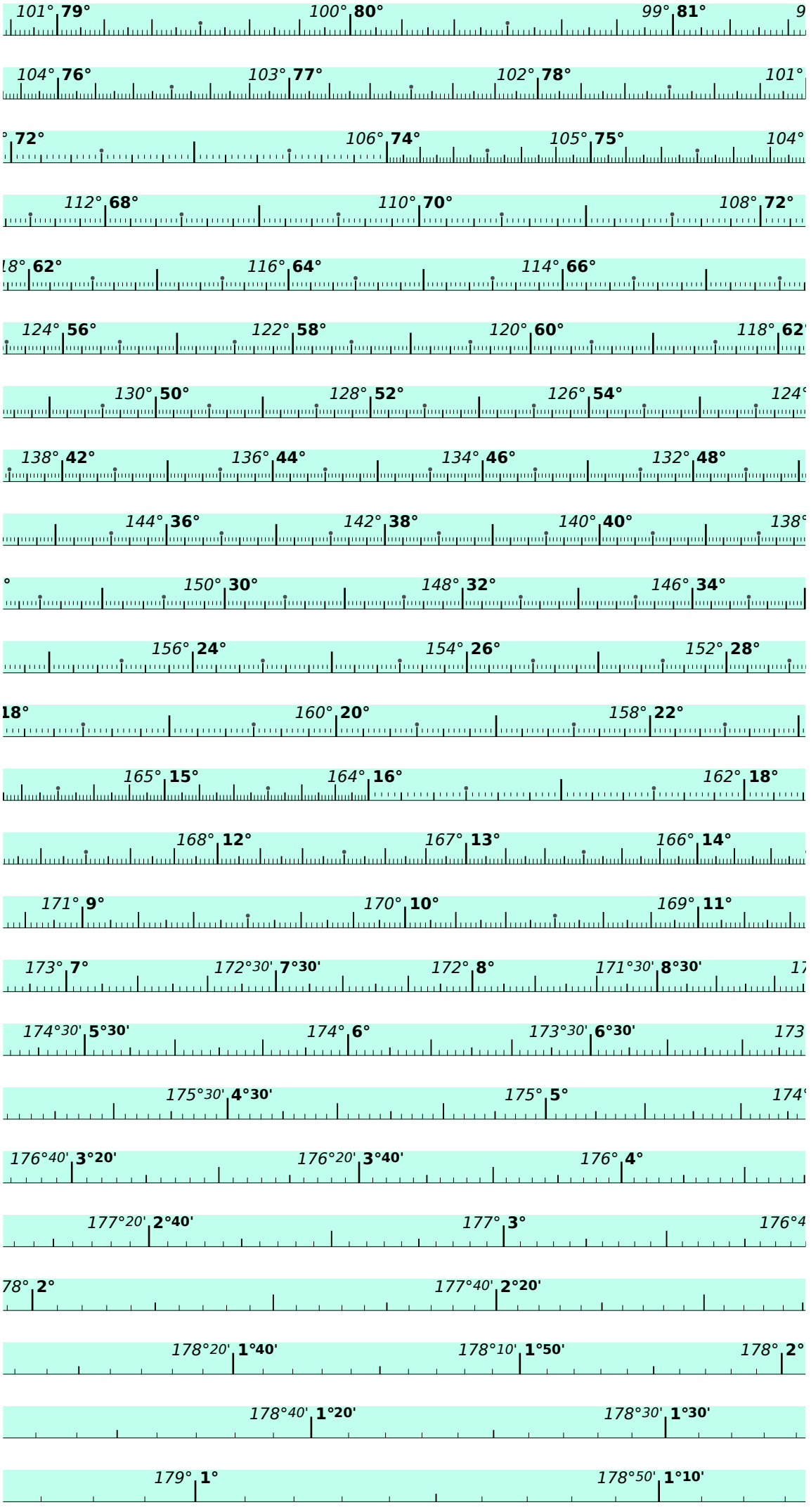

cotangent

If $LHA>180°$:
$HA = 360° - LHA$, East
otherwise
$HA = LHA$, West

$coLat = 90° - Lat$

$$\cot W = \cot Dec * \cos HA$$

under **Dec** set **index**
over **HA** read **W**

$W > 90°$ if $HA > 90°$

$$\boldsymbol{Y = coLat \pm W}$$

Add if *Dec* and *Lat* are of the same name,
subtract if they are contrary.

If $Y > 180°$ let $Y = -(Y - 180°)$

$$\cot Az = \frac{\cot HA}{\cos W} * \cos Y$$

under **HA** set **W**
over **Y** read **Az**

$Az > 90°$ if $|Y| > 90°$

Name for *Az* is contrary to *Lat* (depressed pole)*, rotation as *HA*.

S *Az* E	$Zn = 180° - Az$
S *Az* W	$Zn = 180° + Az$
N *Az* E	$Zn = Az$
N *Az* W	$Zn = 360° - Az$

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$$\cot Hc = \frac{\cot Y}{\cos Az}$$

under **Y** set **Az**
at **index** read **Hc**

$Hc < 0°$ if $Y < 0°$

For great circle calculation:
$zd = 90° - Hc$

Special cases:

If *Az* is in the range [85°..95°] *Hc* looses its accuracy. Calculate *Hc* by interchanging *Dec* and *Lat*.

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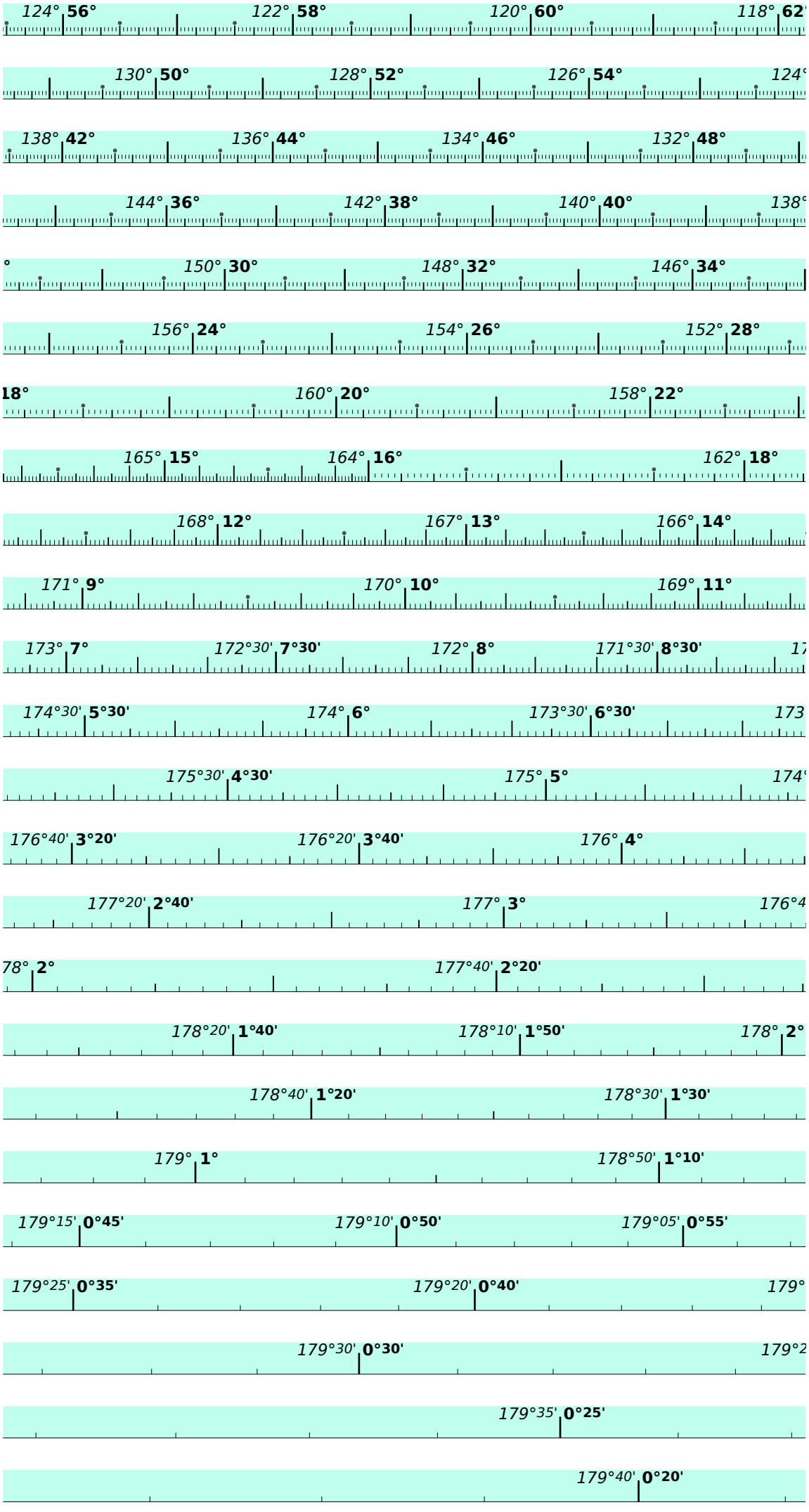

cotangent