

# *“Gunter Skalen in der Praxis”*

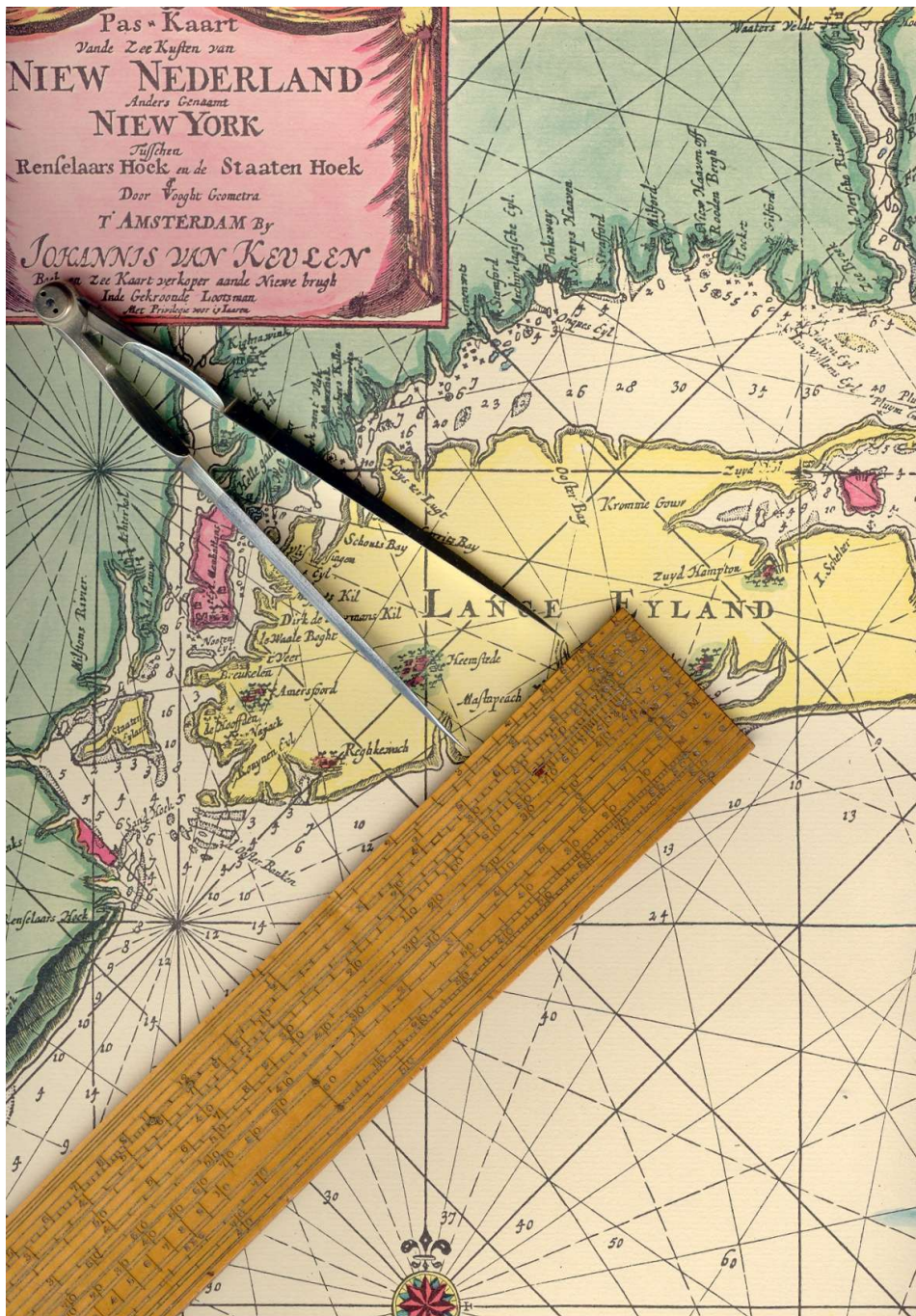
## Gunter Scales in Operation

IM2006 Conference, Greifswald, 28 - 30 September, 2006

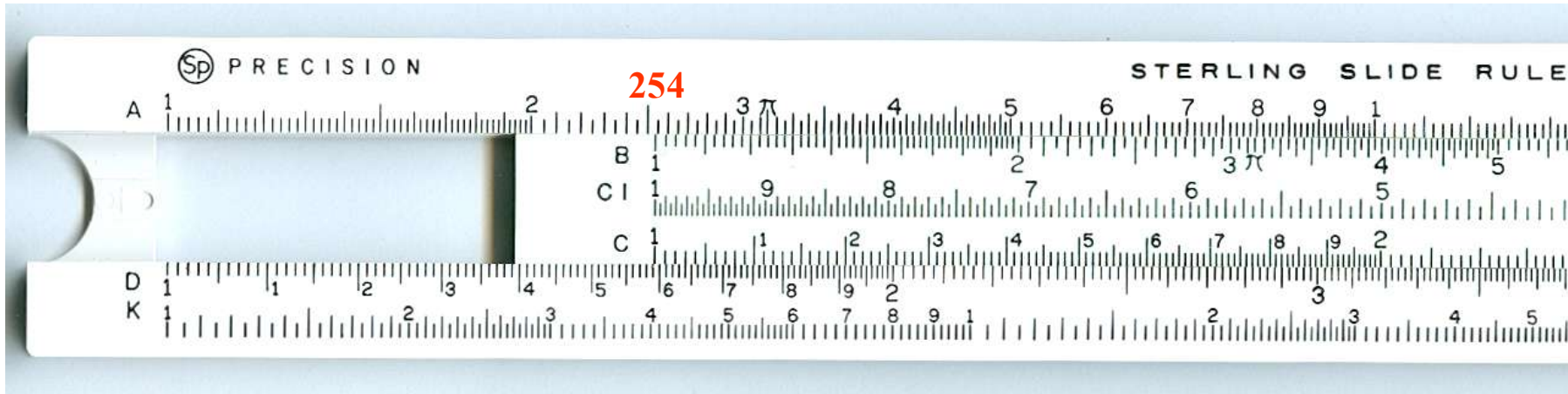
Otto E. van Poelje

([ovpoelje@rekenlinialen.org](mailto:ovpoelje@rekenlinialen.org))



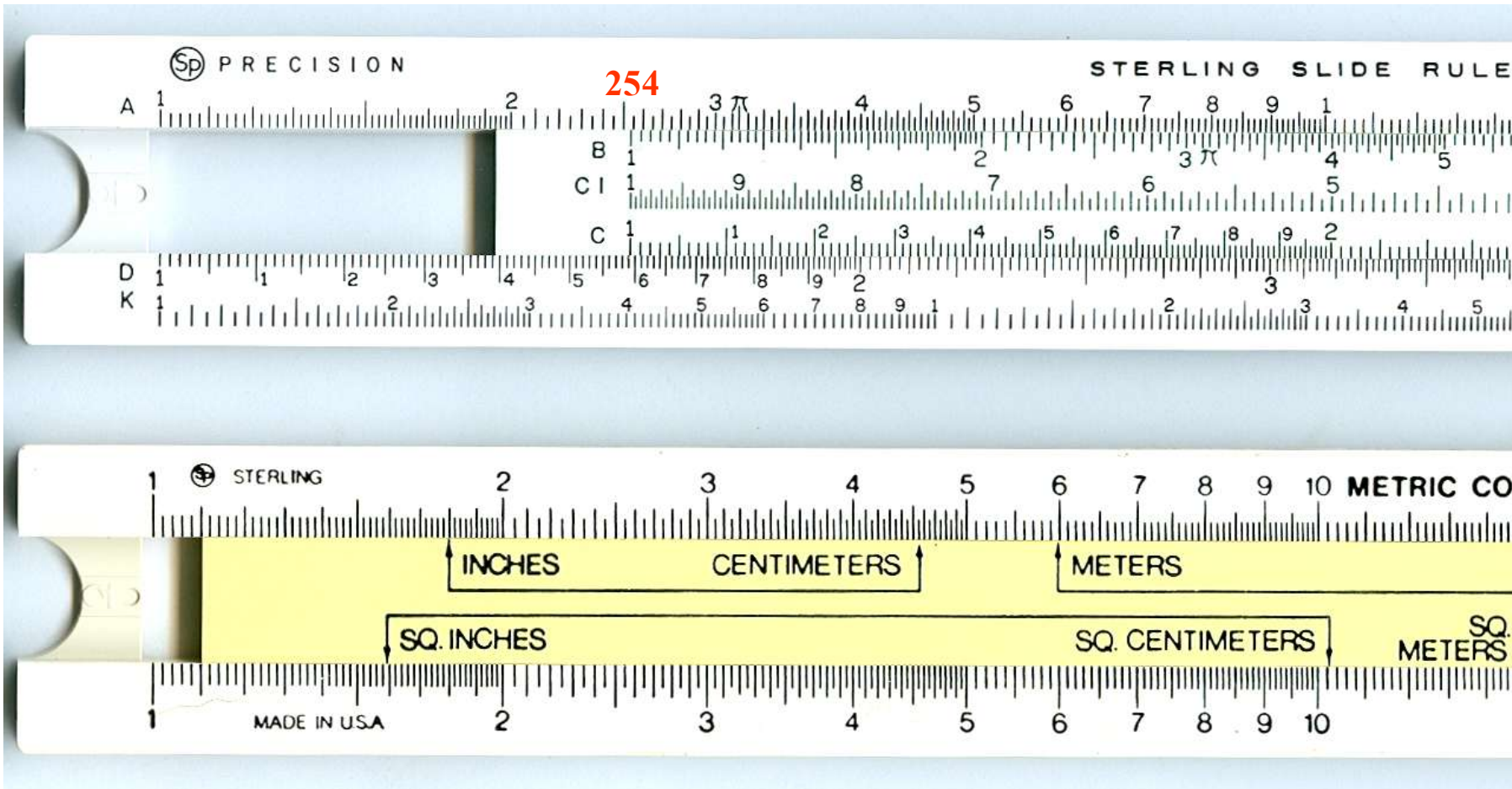


- # Historical Navigation Tools:
4. Map
  5. Pair of Dividers
  6. ... a Gunter Rule



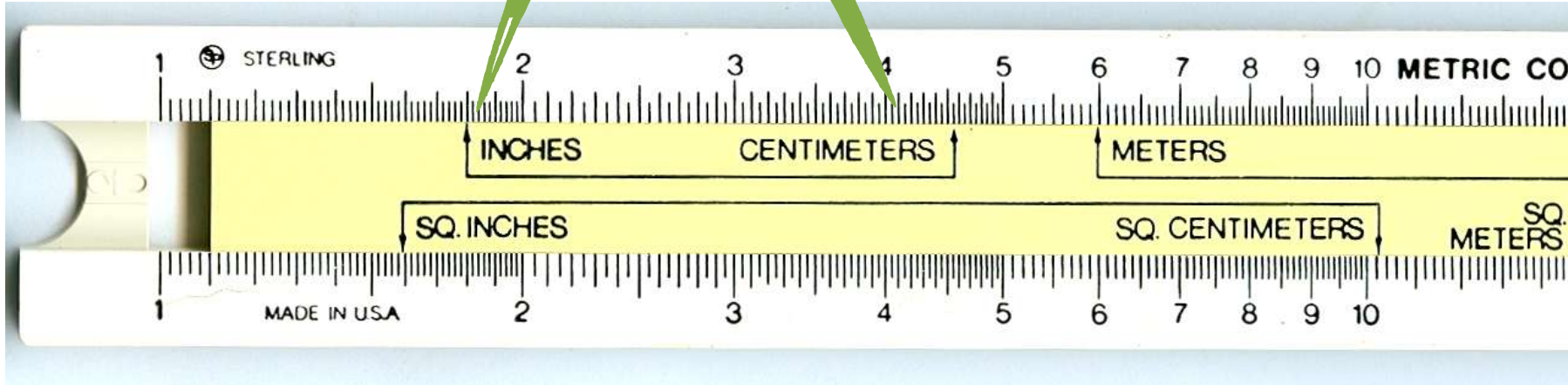
## Comparison Slide Rule and Gunter Scale

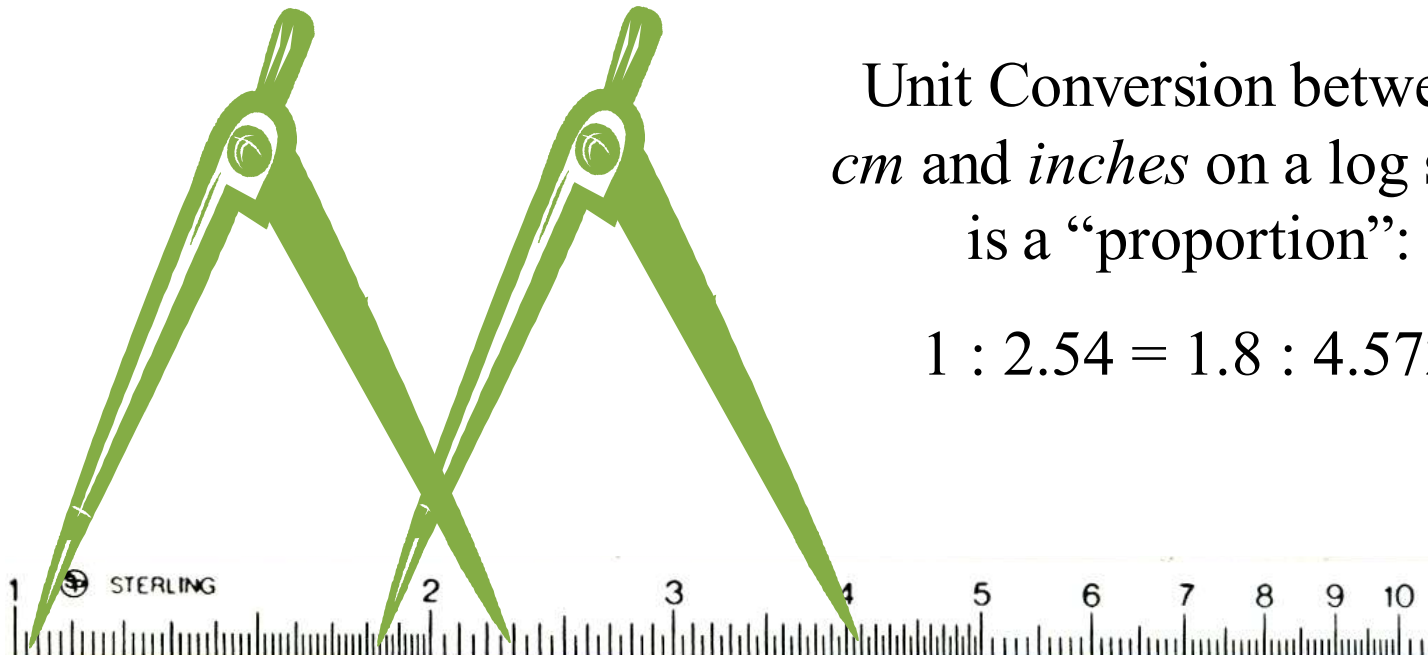
Unit Conversion between  
*cm* on A- and *inches* on B-scale  
of a generic slide rule



Unit Conversion between  
*cm* and *inches* on A scale  
of a conversion slide rule

Unit Conversion between *cm* and *inches* on A scale is a “proportion”



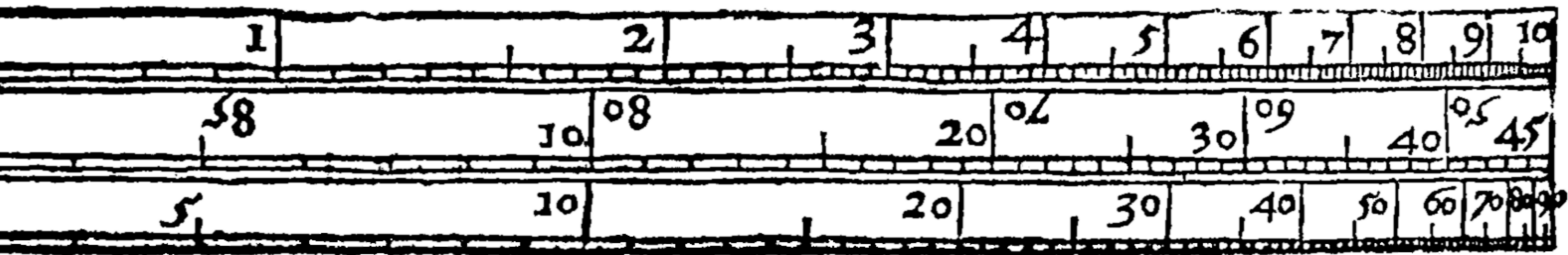
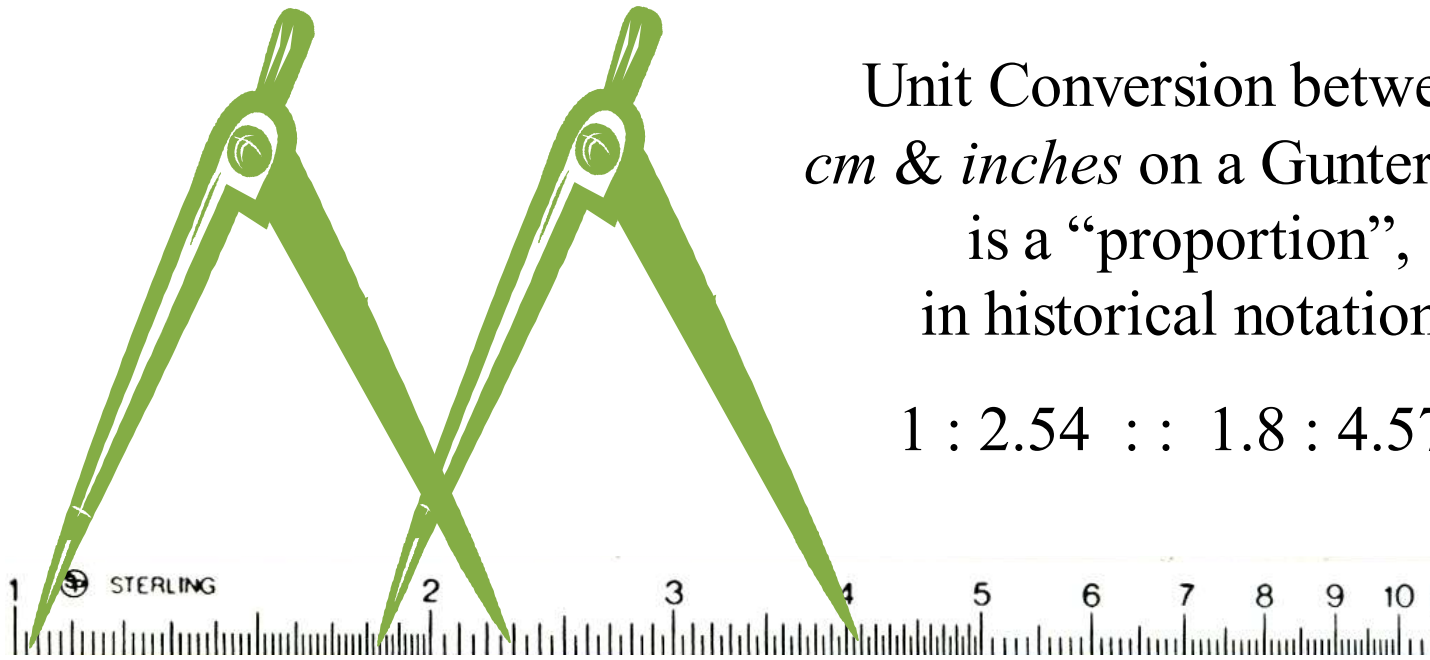


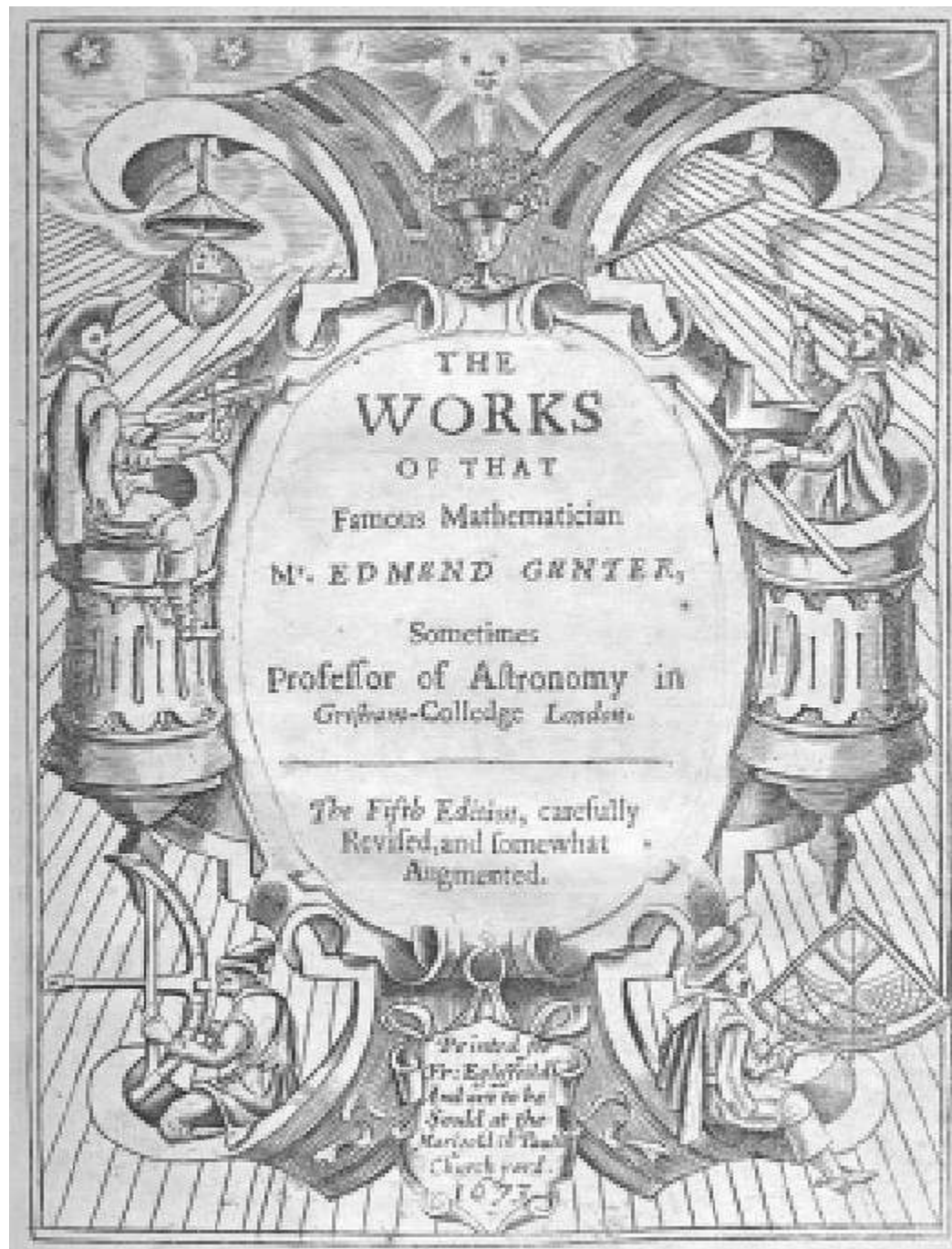
Unit Conversion between  
*cm* and *inches* on a log scale  
is a “proportion”:

$$1 : 2.54 = 1.8 : 4.572$$

Unit Conversion between  
*cm* & *inches* on a Gunter scale  
is a “proportion”,  
in historical notation:

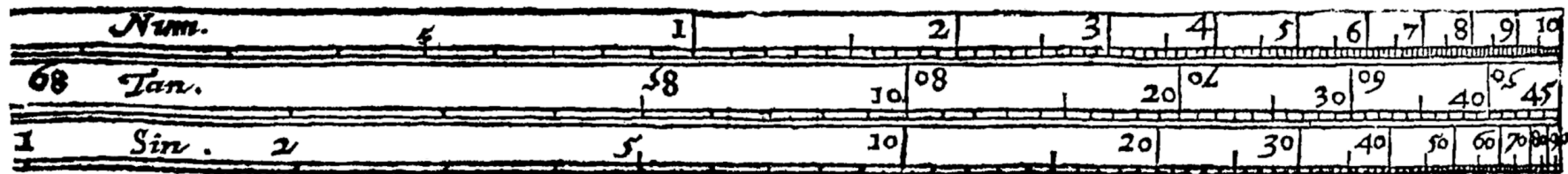
$$1 : 2.54 :: 1.8 : 4.572$$





# Edmund Gunter's Book on the Sector and the Logarithms





Original Drawing of Gunter Scales, 1624



Front of a Gunter Rule

24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

LEA RUM CHOC SIN TAN PETRA POLTRY

110

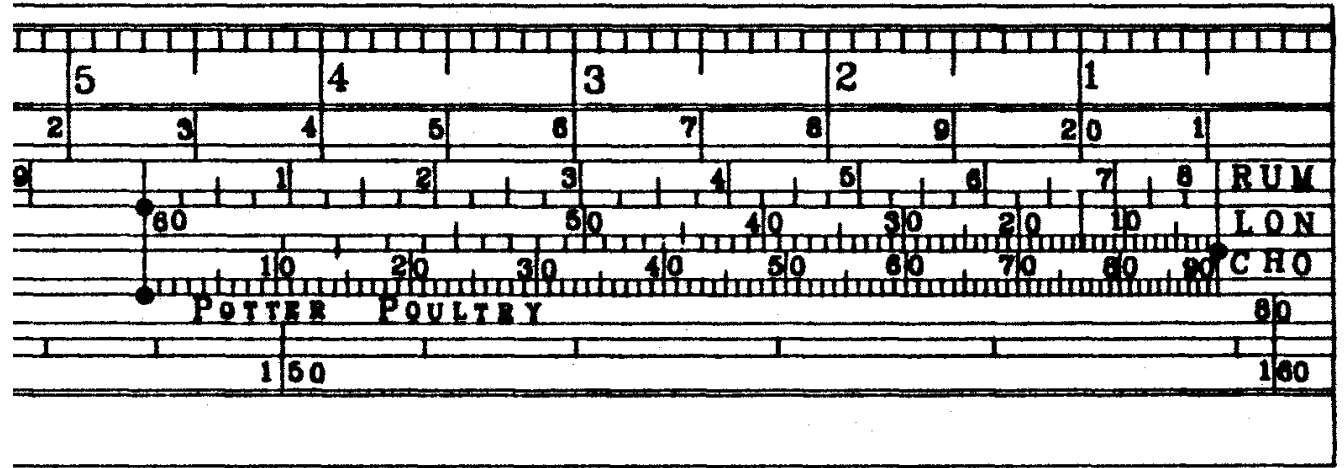
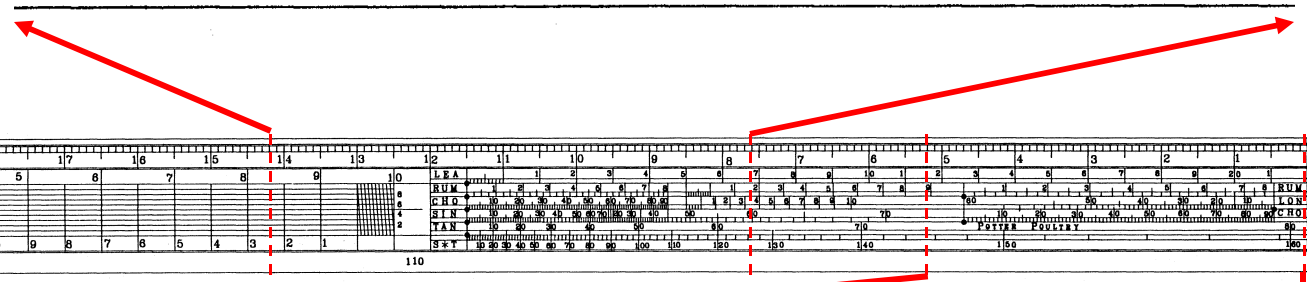
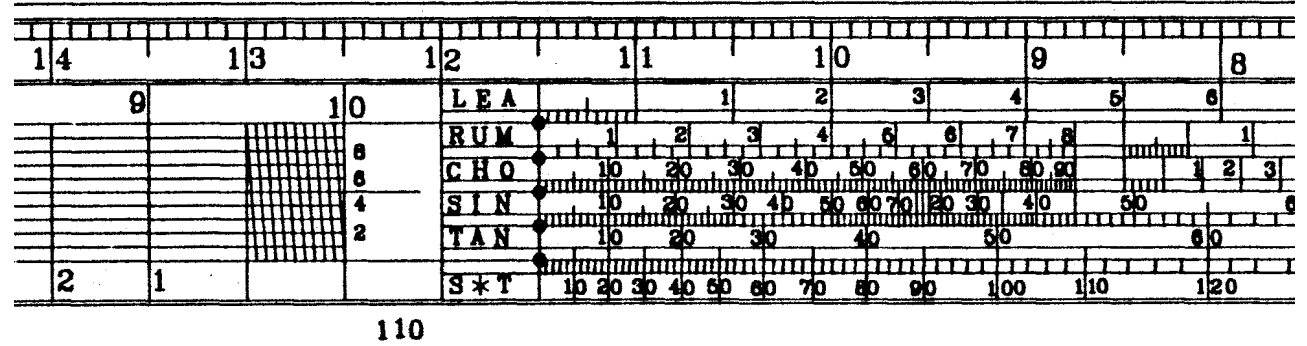
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

LEA RUM CHOC SIN TAN PETRA POLTRY

110

## 2-foot *Standard Gunter Rule*

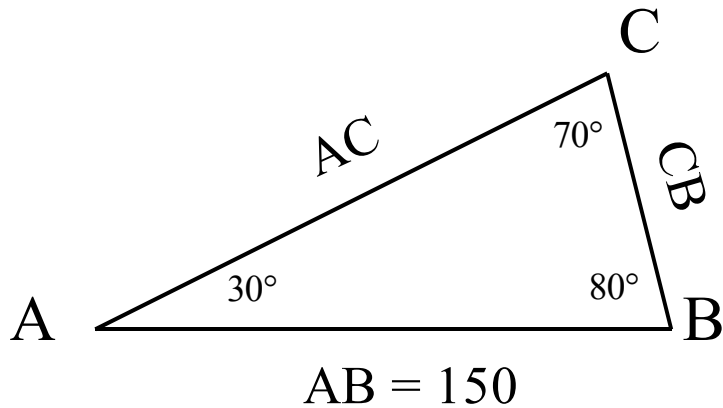
Front Side





# Dead Reckoning - Example 1:

## Calculation of side BC in the Course Triangle



e.g.:

AB = Steered Course

AC = True Course

BC = Drift by Current/Wind

$$\frac{AB}{\sin(C)} = \frac{BC}{\sin(A)} \quad (1)$$

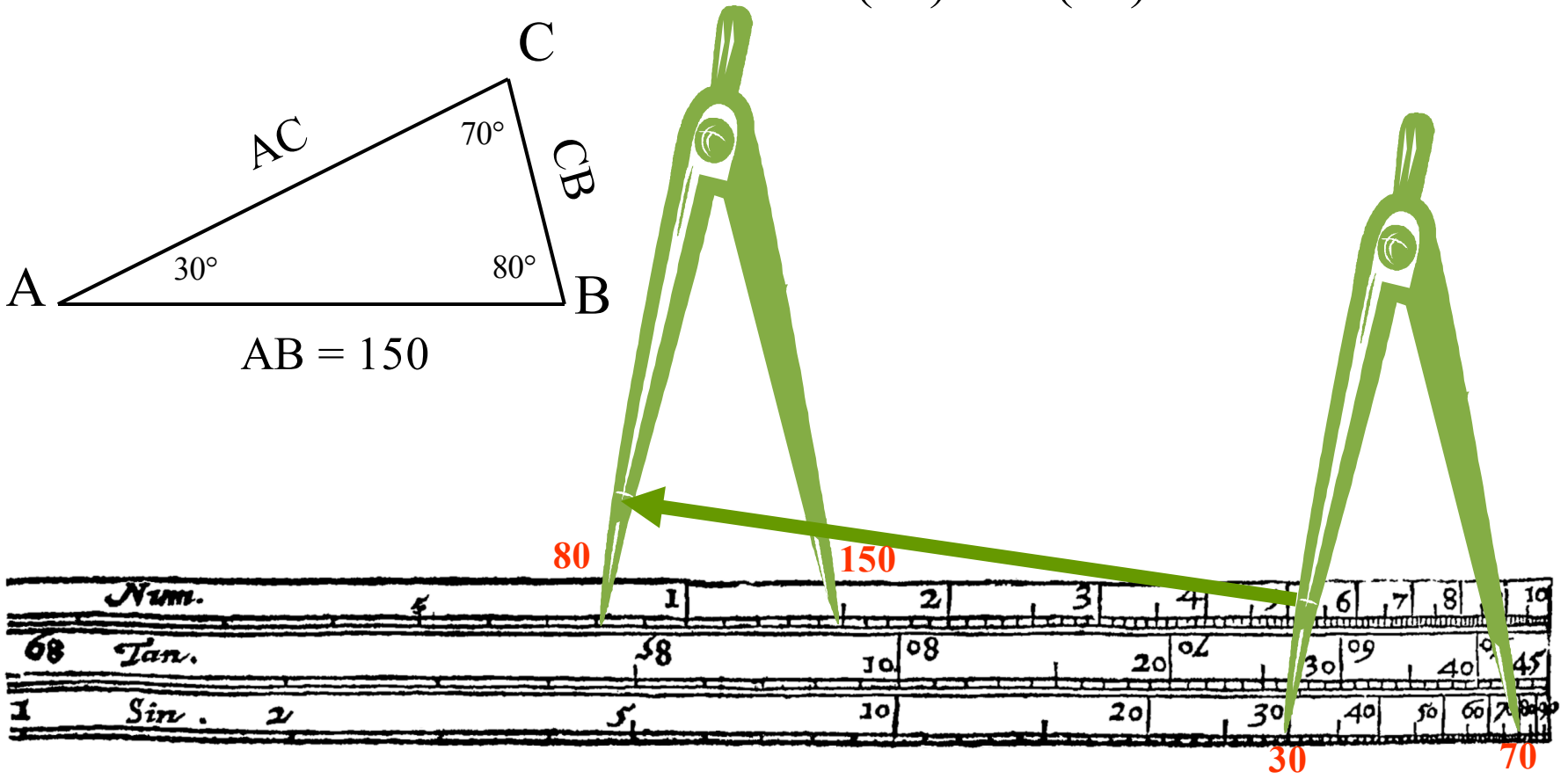
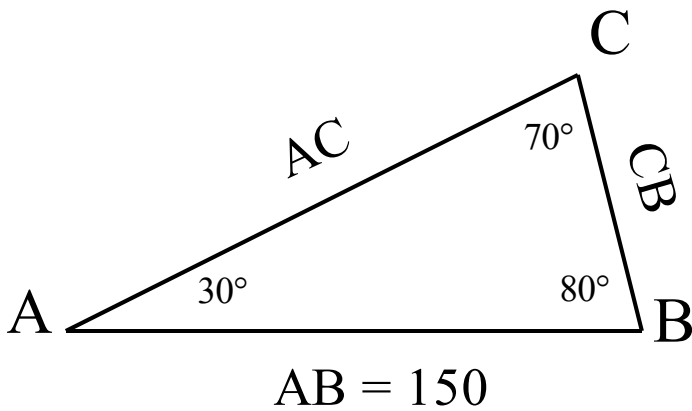
$$\frac{150}{\sin(70)} = \frac{BC}{\sin(30)} \quad (2)$$

$$\frac{150}{\sin(70)} = \frac{BC}{\sin(30)} \quad (3)$$

$$\sin(70) \quad 150$$

# Dead Reckoning - Example 1: Calculation of side BC in the Course Triangle

$$\sin(30) : \sin(70) :: BC : 150$$

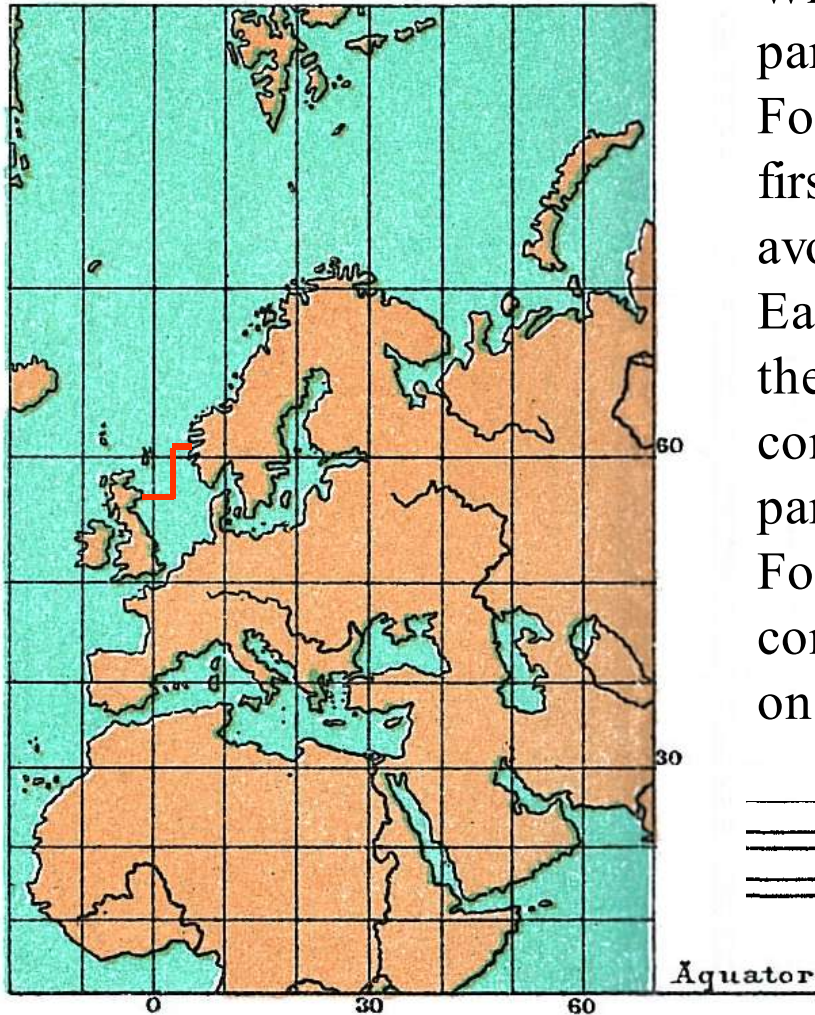


## Parallel Sailing - Example 2:

Calculation of miles in 1 degree longitude (LON) at given latitude

(CHO)

Mercator Map

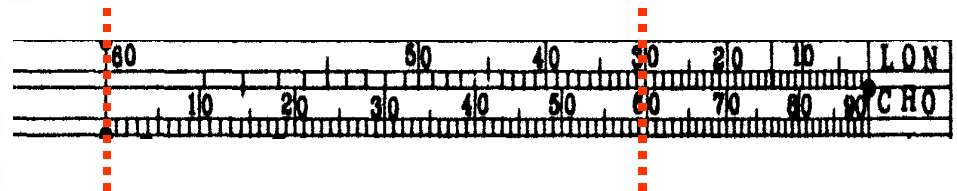


When no reliable longitude was available, parallel sailing was a safer way.

For example, from Aberdeen to Bergen: first East, then North, then East, so avoiding the Shetlands.

Easting distance depends on latitude: at the Equator (CHO=0) one degree contains 60 miles (LON), but at 60° N the parallel contains about 30 miles.

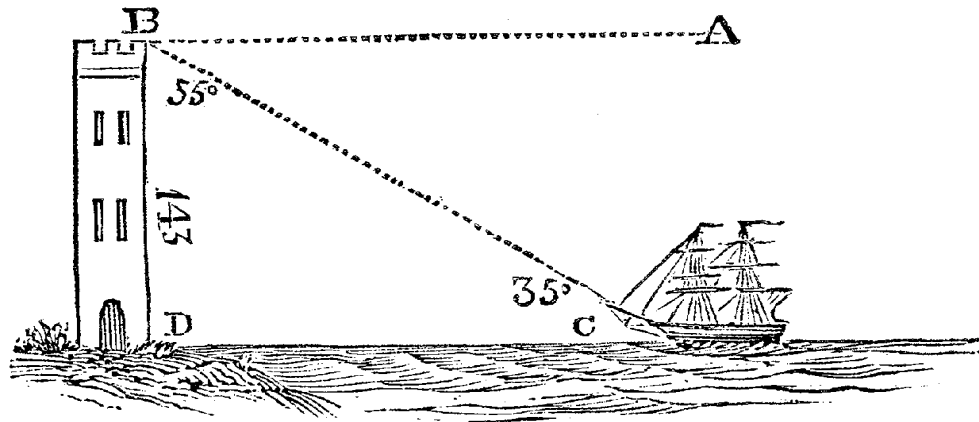
For this calculation, the Gunter rule contained the LON-CHO pair of scales on the front.





### Coastal Navigation - Example 3:

Given a measured  $35^\circ$  elevation of a tower of known height  $BD = 143$ ,  
determine the ship's distance  $DC$  to shore:  $\tan(35^\circ) = \mathbf{BD} : \mathbf{DC}$   
or  $\mathbf{\tan. 35^\circ : 1 :: BD : DC}$



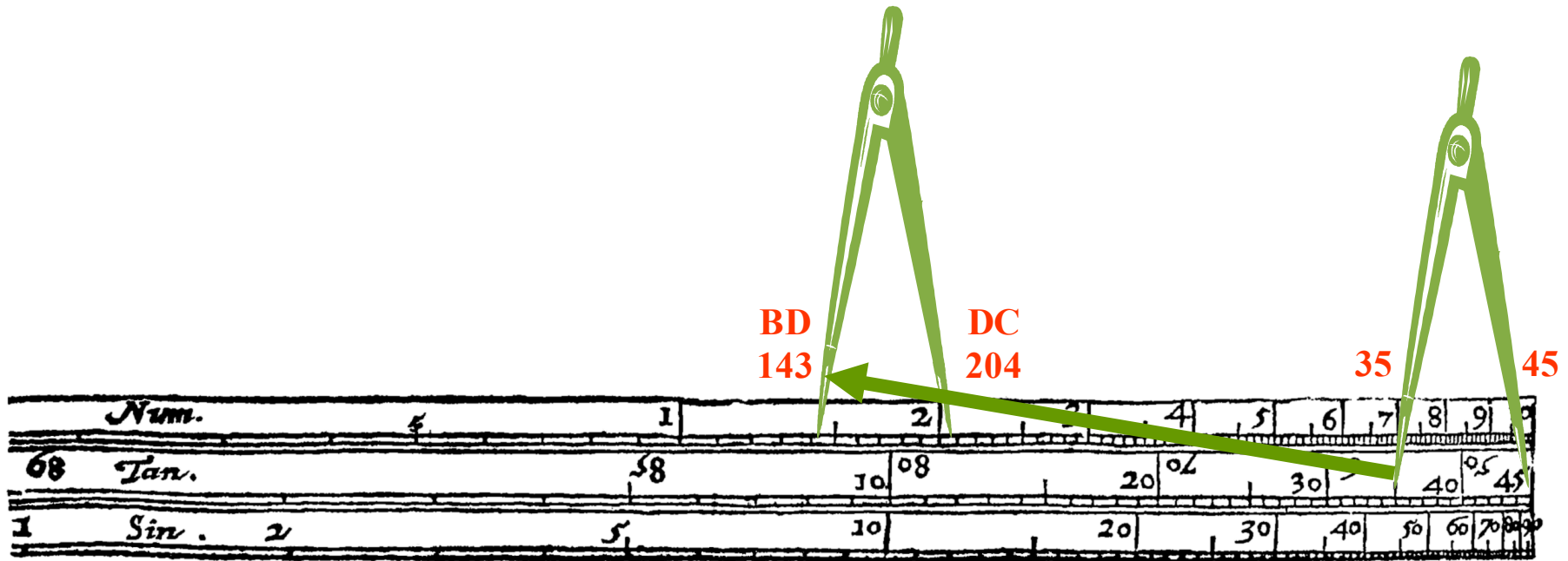
The angle of depression of the vessel is  $ABC$ , and consequently is equal to the angle of elevation of the tower,  $BCD$ . Hence, making  $BD$  radius;

$$\text{Rad.} : \text{tang. } 35^\circ :: \mathbf{BD} : \mathbf{DC}.$$

Stretch the compasses on the line  $T$ , from 45 to 55; this will reach from 143 to 204 on the line  $N$ .

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## Financial Arithmetic - Example 4:

Given a sum of 2500 gold pieces, loaned at a yearly interest of 20%, determine the compound debt accrued over 4 years:

$$\text{total debt} = 2500 \times (1 + 0.20)^4$$

The image shows a historical-style slide rule with two rows of numbers and various markings. The top row is labeled "Num." and has numbers 1 through 10. The bottom row is labeled "Sin." and has numbers 1 through 10. There are also markings for "68 Jan." and "1.2" in red. The slide rule is used for calculations, and the numbers are arranged in a way that suggests a specific calculation, likely related to the compound interest problem above.

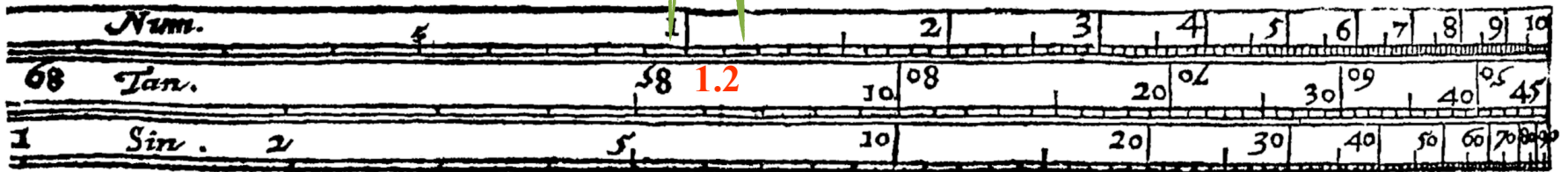
Row	Label	1	2	3	4	5	6	7	8	9	10
Top	Num.	1	2	3	4	5	6	7	8	9	10
Bottom	Sin.	1	2	3	4	5	6	7	8	9	10

Additional markings on the slide rule include "68 Jan." on the left side, "1.2" in red in the middle, and "10 08 20 02 30 09 40 05 45" along the bottom edge.

## Financial Arithmetic - Example 4:

Given a sum of 2500 gold pieces, loaned at a yearly interest of 20%,  
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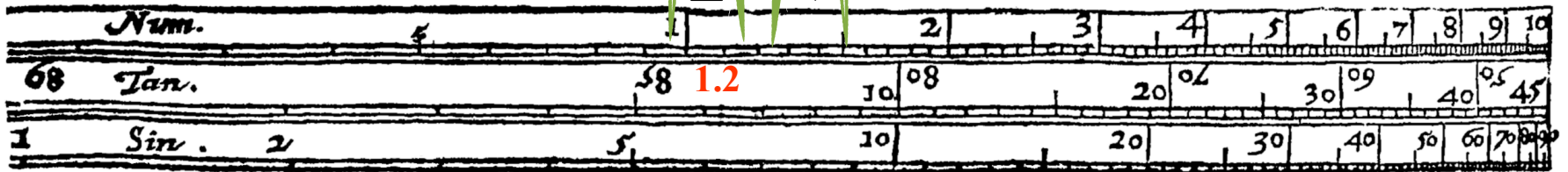
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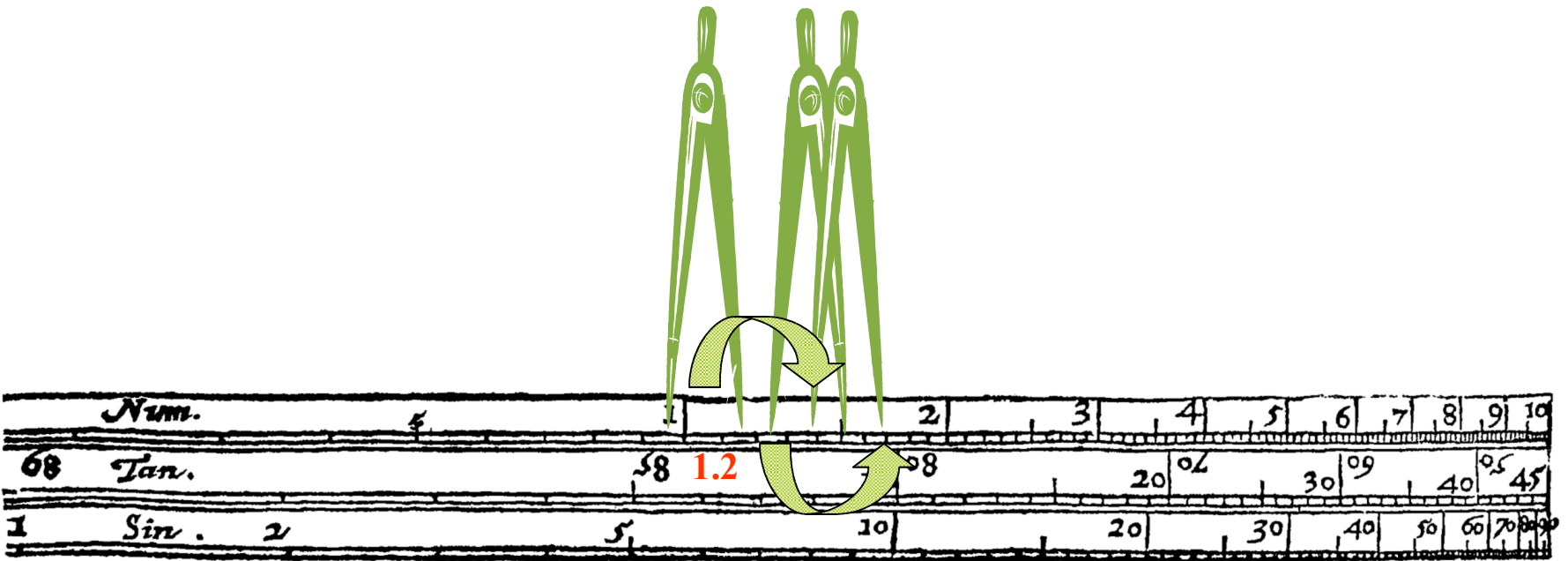
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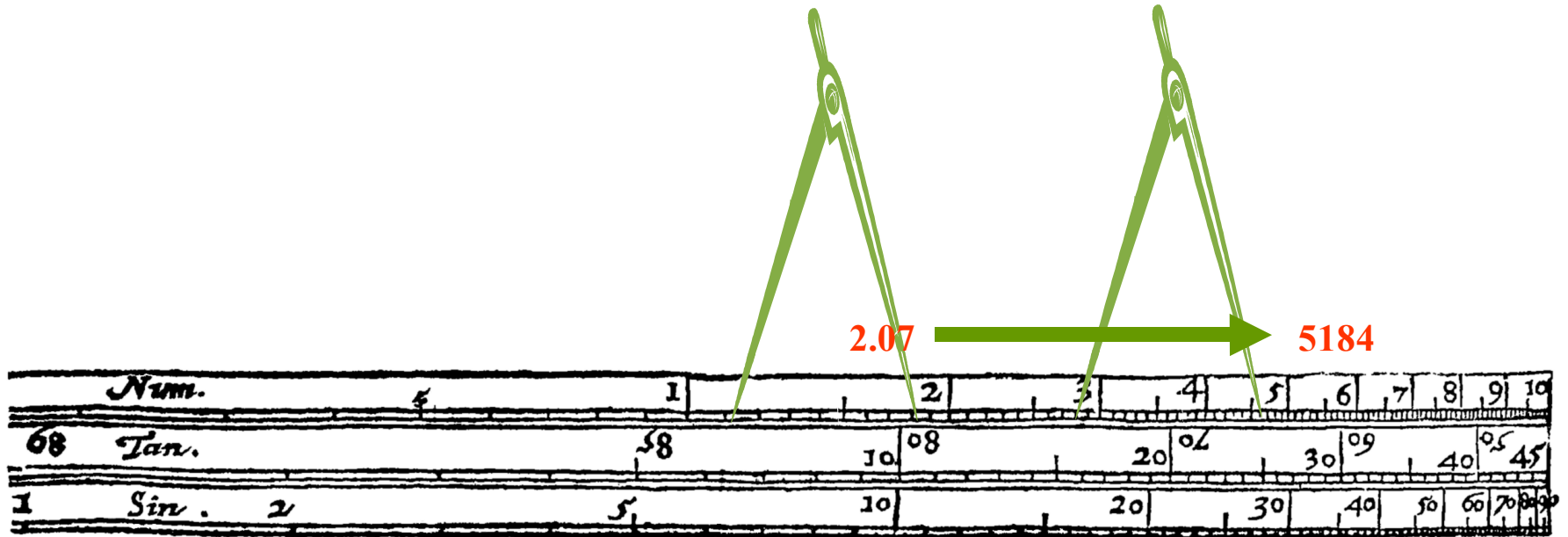




## Financial Arithmetic - Example 4:

Given a sum of 2500 gold pieces, loaned at a yearly interest of 20%, determine the compound debt accrued over 4 years:

$$\begin{aligned}\text{total debt} &= 2500 \times (1 + 0.20)^4 \\ &= 5184\end{aligned}$$

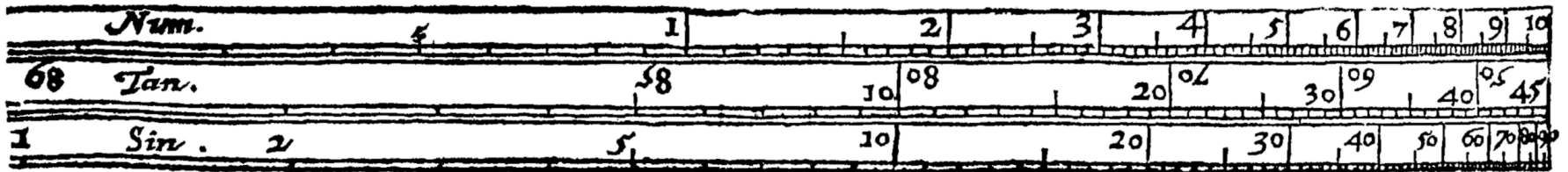




# Non-integer Exponentiation - Example 5:

Determine 3 times 1.2 to the power 2.5

$$3 \times (1.2)^{2.5} =$$



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Determine 3 times 1.2 to the power 2.5

$$3 \times (1.2)^{2.5} =$$



Num.	1	2	3	4	5	6	7	8	9	10
68 Jan.	58	10 <sup>08</sup>	20 <sup>02</sup>	30 <sup>09</sup>	40 <sup>05</sup>	45				
1 Sin. 2	5	10	20	30	40	50	60	70	80	90

Non-integer  
Exponentiation -

Example 5:

Determine 3 times 1.2  
to the power 2.5

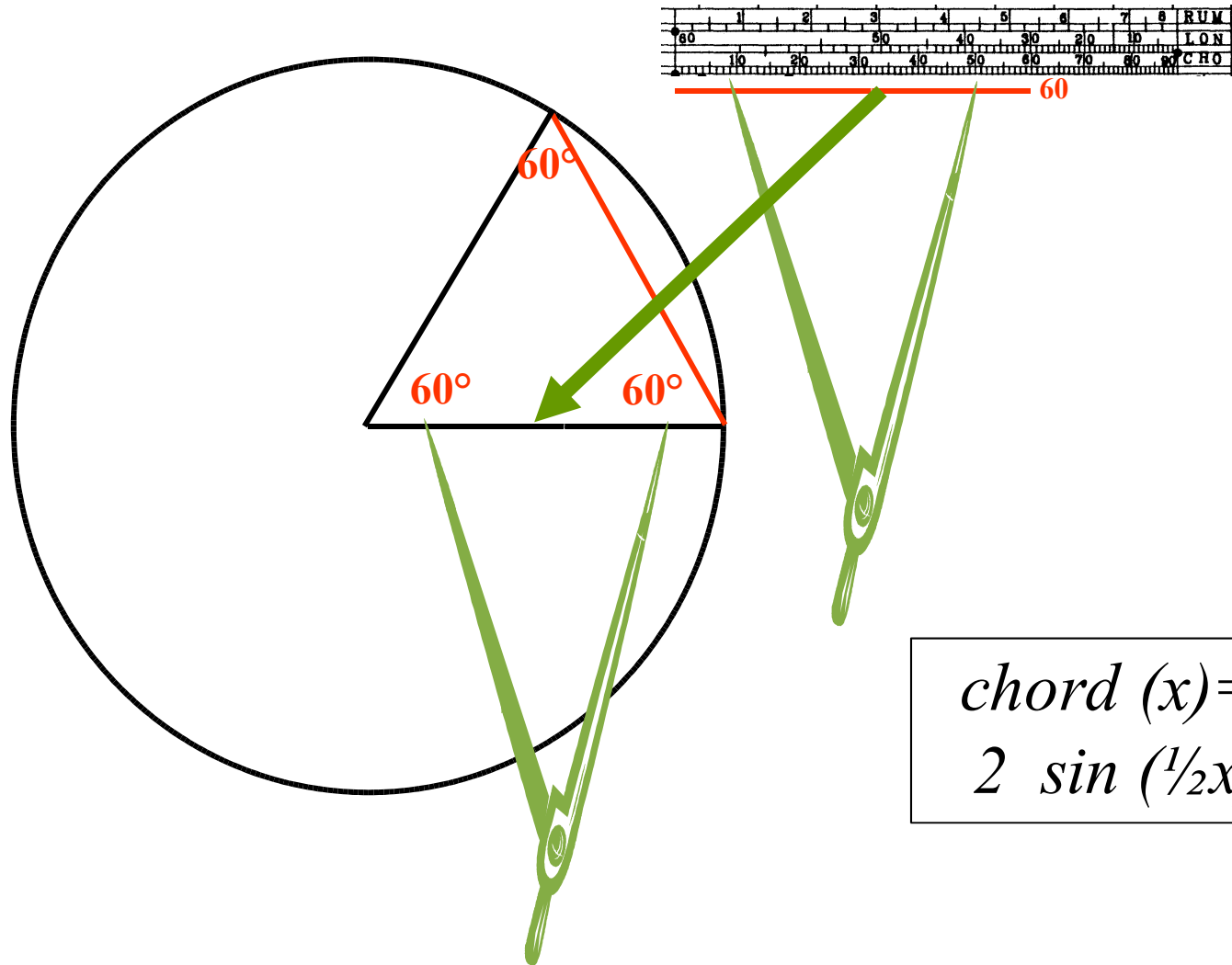
$$3 \times (1.2)^{2.5} = 4.732$$



<i>Num.</i>		1	1.2	2	3	4	5	6	7	8	9	10					
68	<i>Tan.</i>	58		10°08		20°02		30°09		40°05		45					
1	<i>Sin.</i>	2		5		10		20		30		40	50	60	70	80	90

# CHORDS - Example 6:

Use of the Chord Scale to Construct  
a Unit Circle around chord ( $60^\circ$ )



$$\text{chord } (x) = 2 \sin \left( \frac{1}{2}x \right)$$

# CHORDS - Example 6:

Use of the Chord Scale to Construct  
an Angle of  $30^\circ$

