

## Expressions you can evaluate on a slide rule!

Consider general scales **U** (body), **V** (slide), **Z** (body)

### Multiplication procedure:

- Select  $u$  on **U**, align with index on **V**.
- Find  $v$  on **V**, align with result  $z$  on **Z**.
- If **U** = **Z** = **D** and **V** = **C** then  $z = uv$ .
- What if **U**, **V**, and **Z** are different?

### Division Procedure:

- Select  $u$  on **U**, align with  $v$  on **V**.
- Align the index of **V** with result  $z$  on **Z**.
- If **U** = **Z** = **D** and **V** = **C** then  $z = \frac{u}{v}$ .
- What if **U**, **V**, and **Z** are different?

Suppose we have the following scales.  $x$  is the corresponding value on the **C** or **D** scale.

**C** and **D**:  $x$

**CI** and **DI**:  $1/x$

**CF** and **DF**:  $\pi x$

**CIF** and **DIF**:  $1/(\pi x)$

**A** and **B**:  $x^2$

**R**:  $\sqrt{x}$

**K**:  $x^3$

**E**:  $e^x$

**L**:  $\log_{10} x$

**S**:  $\arcsin x$

**T**:  $\arctan x$

**P**:  $\sqrt{1 - x^2}$

**H**:  $\sqrt{1 + x^2}$

- **This display** shows all **3,540** distinct expressions that can be so evaluated on a **hypothetical slide rule** that has all 13 scales on both the slide and the body.
- **Caveats apply!** The numbers involved may have to be in certain ranges, and you may have to be judicious about which relevant variant of a scale you use to read your result.
- **Look up** the reference number of an expression in the accompanying book to find the scales needed to evaluate it.
- **Log** means the base 10 logarithm, and **Exp** the base 10 exponential.
- **Angles** are measured in **degrees!** Yikes!
- The expressions are **computer generated** and can often be simplified.
- Replacing the index of **V** in the multiplication procedure with a number  $w$  on a scale **W** (on the slide) gives **24,314** distinct expressions in three variables.
- The corresponding (never printed) book would have 2,143 pages.
- **Exercise:** Why not do the same thing in the division procedure?
- See [www.math.utah.edu/~pa/sliderules](http://www.math.utah.edu/~pa/sliderules)
- or email [pa@math.utah.edu](mailto:pa@math.utah.edu)
- for more information.