Slide Rules

Undergraduate Colloquium

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Department of Mathematics

University of Utah

Peter Alfeld

pa@math.utah.edu

Online Resources

- **The pdf of this talk:**

  http://www.math.utah.edu/˜pa/sliderules/SR.pdf

- **PA slide rule home page:**

  www.math.utah.edu/˜pa/sliderules

- **Slide Rule Explorer home page:**

  http://www.math.utah.edu/˜pa/sliderules/SRE.html

- **The Oughtred Society:**

  http://www.oughtred.org/

- **Digital Slide Rule:**

  http://www.animatedsoftware.com/elearning/DigitalSlideRule/DigitalSlideRule.swf

- Explain how to multiply and divide.

- This works because the C and D scales are logarithmic and

$$\log(xy) = \log(x) + \log(y)$$

- Are there any other (differentiable) functions satisfying

$$f(xy) = f(x) + f(y)?$$

No!

- recap of multiplication:

1. Locate x on Scale **D** on the body.

2. Align the index of scale **C** on the slide with x.

3. Move the hairline over y on scale **C** on the slide.

4. Read the product xy under the hairline on Scale **D** on the body.

- What if we use scales other than **C** and **D**?

- Then we evaluate a different expression!

- What Scales?

No.	Scale	Expression
1	**CD**	x
2	**CDI**	$1/x$
3	**CDF**	πx
4	**CDIF**	$1/(\pi x)$
5	**AB**	x^2
6	**W**	$\sqrt{x}$
7	**ABI**	$1/x^2$
8	**K**	x^3
9	**KI**	$1/x^3$
10	**LL**	e^x
11	**L**	$\log_{10}(x)$
12	**S**	$\arcsin(x)$
13	**T**	$\arctan(x)$
14	**P**	$\sqrt{1-x^2}$
15	**H**	$\sqrt{1+x^2}$
16	**SH**	$\sinh(x)$
17	**CH**	$\cosh(x)$
18	**TH**	$\tanh(x)$

For example, to compute

$$\sqrt{\frac{\pi^2 x^2 - y}{\pi^2 x^2}}$$

proceed as follows:

1. Find x on scale **A** on the body.
2. Align x with the index of scale **CIF** on the slide.
3. Move the hairline over y on scale **CIF** on the slide.
4. Read the value of

$$\sqrt{\frac{\pi^2 x^2 - y}{\pi^2 x^2}}$$

under the hairline on scale **P** on the body.

More Procedures

- Table Lookup, 1 variable. Align all scales of the slide rule, look up x on scale 1, and the result on scale 2.

- Multiplication, 2 variables, as described above.

- Division. Look up x on scale 1 on the body, align with y y on scale 2 on the slide, move to the index of scale 2, and see the result on scale 3 on the body.

- The fourth procedure is similar to Multiplication and Division except that instead of the index on scale 2 you use a number on a fourth scale. Thus you choose x on scale 1 on the body, align y on scale 2 on the slide, move to z on scale 3 on the slide, and read the result aligned with z on scale 4 on the body.

- Suppose you have a hypothetical slide rule that has all 18 scales on the body and on the slide.

- Many expressions can be evaluated in different ways. For example, there are 42 different ways to compute xy and 96 different ways to compute xyz.

- How many mathematically distinct expressions can you evaluate with these procedures on your hypothetical slide rule?

- The answer:

Variables	Expressions
1	280
2	$8,540$
3	$95,144$

- For details see

http://www.math.utah.edu/˜pa/sliderules/SRE.html

Thank You