WKU SCHOOL OF ENGINEERING & APPLIED SCIENCES

Advances in Arithmetic: Introducing the Errorless Calculator

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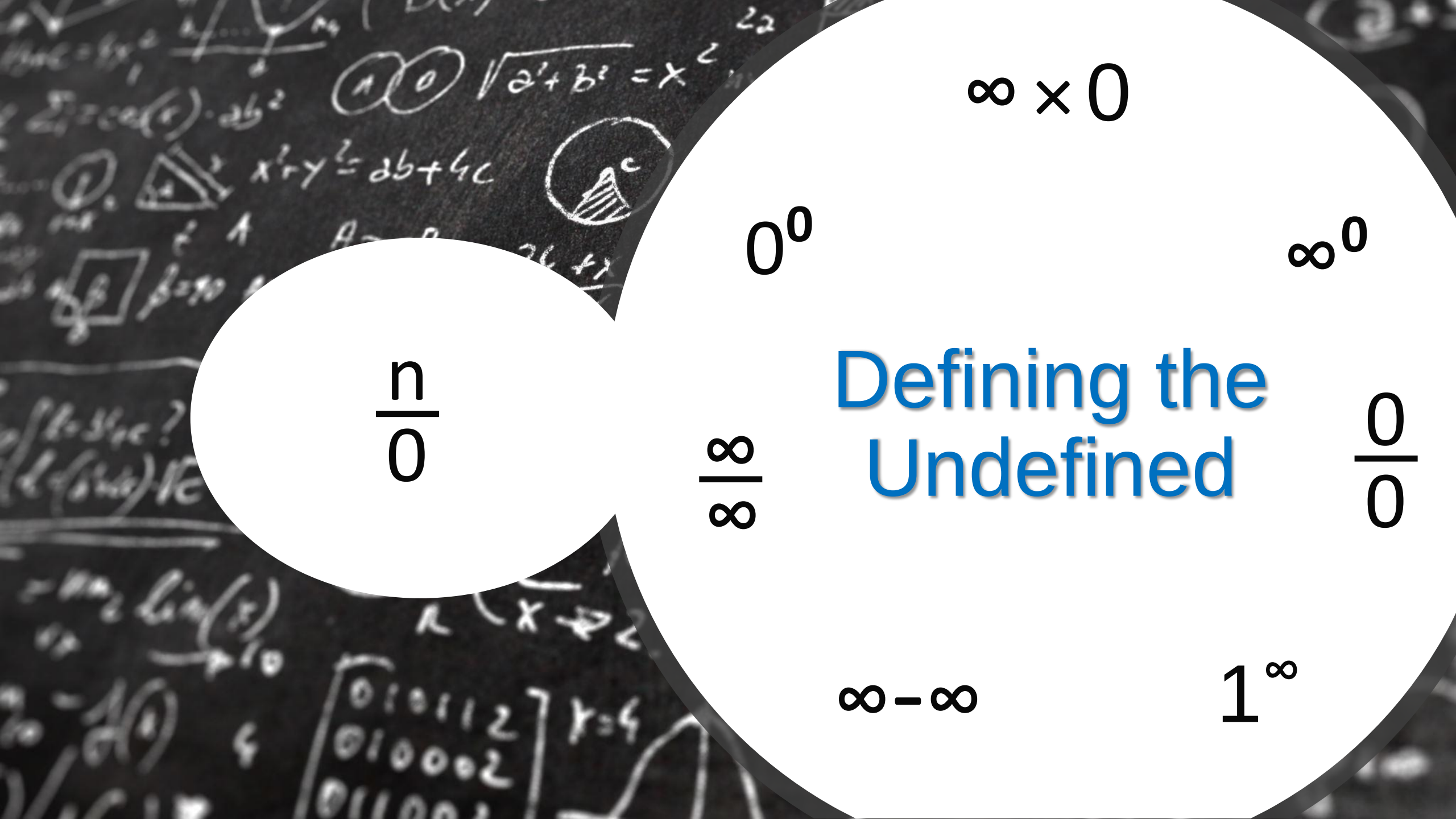
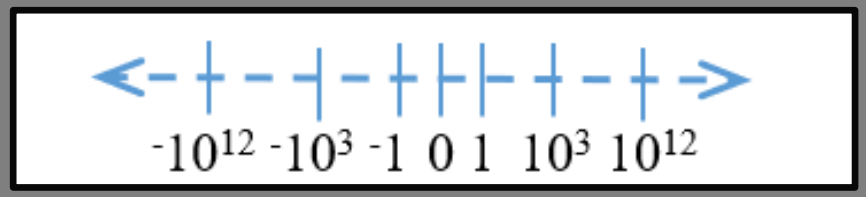

$\frac{n}{0}$
$\infty \times 0$
0^0
∞^0
Defining the Undefined
$\frac{\infty}{\infty}$
$\frac{0}{0}$
$\infty - \infty$
1^∞

What are Omnifinites?

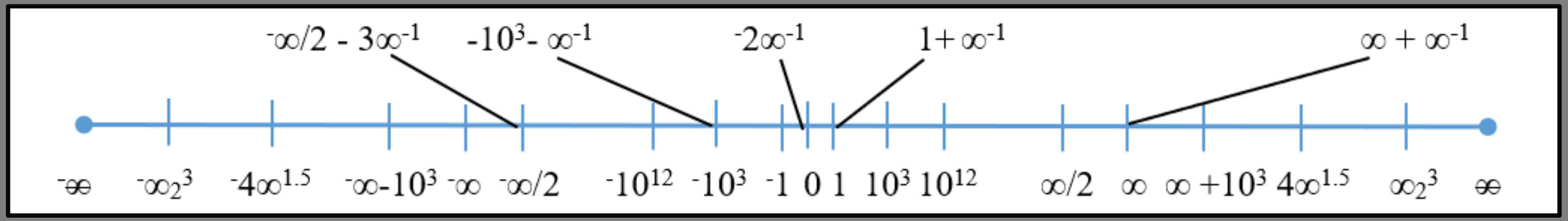
Answer: ALL NUMBERS

- Finites: Reals 1, 2, -3, π, ...
- Nonfinites
  - Infinites:
    ∞, $-\infty$, 2∞ , ∞^3, ...
  - Infinitesimals:
    ∞^{-1}, $-\infty^{-1}$, $5\infty^{-2}$, ∞^{-7}, ...

Number Lines: Reals vs. Omnifinites



Reals: Open System



Omnifinites: Closed System

Special Numbers

0

Zero

Smallest magnitude of all numbers.

± Absolute Infinity

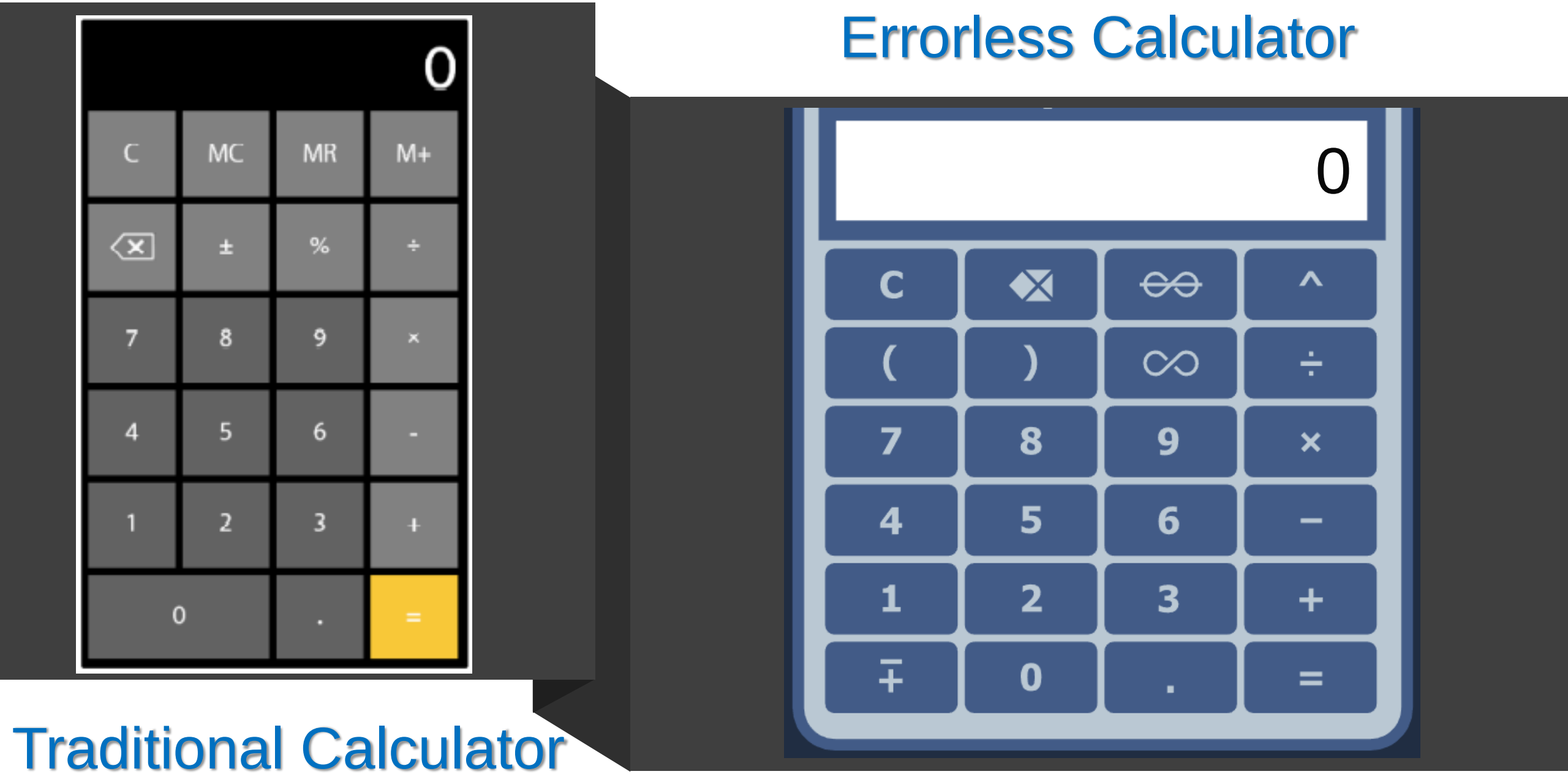
Largest positive and most negative of all numbers.

Comparison of Differing Infinities

Absolute Infinity	Traditional Infinity	Omnifinite Infinity
$\infty + \infty = \infty$	$\infty + \infty = \infty$	$\infty + \infty = 2\infty$
$-\infty + -\infty = -\infty$	$-\infty + -\infty = -\infty$	$-\infty + -\infty = -2\infty$
$\infty - \infty = 0$	$\infty - \infty = \text{NA}$	$\infty - \infty = 0$
$-\infty - -\infty = 0$	$-\infty - -\infty = \text{NA}$	$-\infty - -\infty = 0$

Comparison of Differing Infinities

Absolute Infinity	Traditional Infinity	Omnifinite Infinity
$\infty \times \infty = \infty$	$\infty \times \infty = \infty$	$\infty \times \infty = \infty^2$
$-\infty \times -\infty = \infty$	$-\infty \times -\infty = \infty$	$-\infty \times -\infty = \infty^2$
$\infty \div \infty = 1$	$\infty \div \infty = NA$	$\infty \div \infty = 1$
$-\infty \div -\infty = 1$	$-\infty \div -\infty = NA$	$-\infty \div -\infty = 1$


Errorless Calculator
0
C
MC
MR
M+
±
%
÷
7
8
9
×
4
5
6
-
1
2
3
+
0
.
=
0
C
^
(
)
÷
7
8
9
×
4
5
6
−
1
2
3
+
0
.
=
Traditional Calculator

Features of the Errorless Calculator

- Math errors do not occur
- Division by zero has a specified solution
- Indeterminant forms have specified solutions

Example: Inputs & Outputs

Input 1	Operation	Input 2	Equals	Output
2.14	+	7.6	=	9.74
5∞	+	14.1∞	=	19.1∞
3.4	+	2∞	=	2∞ + 3.4
9∞	+	∞∞	=	∞∞

Input 1	Operation	Input 2	Equals	Output
2.14	−	7.6	=	-5.46
5∞	−	14.1∞	=	-9.1∞
3.4	−	2∞	=	-2∞ + 3.4
9∞	−	∞∞	=	-∞∞ + 9∞

Example: Inputs & Outputs

Input 1	Operation	Input 2	Equals	Output
2.14	×	7.6	=	16.264
5∞	×	14.1∞	=	$70.5\infty^2$
3.4	×	2∞	=	6.8∞
9∞	×	∞∞	=	∞∞

Input 1	Operation	Input 2	Equals	Output
2.14	÷	7.6	=	0.28157894736842
5∞	÷	14.1∞	=	0.35460992907801
3.4	÷	2∞	=	$1.7\infty^{-1}$
9∞	÷	∞∞	=	0

Example: Inputs & Outputs

Input 1	Operation	Input 2	Equals	Output
2.14	^	7.6	=	324.447683302052
5∞	^	14.1∞	=	$7{,}169{,}305{,}073^{\infty}\infty^{14.1\infty}$
3.4	^	2∞	=	11.56^{∞}
9∞	^	∞∞	=	∞∞

Inputs with Mixed Operations	Equals	Output
7 ÷ 2.5 + 3 × 4∞	=	12∞ + 2.8
(2 + ∞) × 3.2	=	3.2∞ + 6.4
(4.1 + 1.5∞)^2	=	$1.21\infty^2 + 8.8\infty + 16$
3 ^ 2 × 4 ÷ ∞ + 6	=	$6 + 36\infty^{-1}$

Final Thoughts

Scientific Infinity Calculator


Questions?