

Background slides & video at
www.podometic.in/aamt-talk

How India's ZERO concept
never made it to the West

Background slides & video at
www.podometric.in/aamt-talk

Why primary teachers should
switch from arithmoi to arithmos

Background slides & video at
www.podometic.in/aamt-talk

How to reveal 2 – 5
to seven year-olds

A cosmic background image featuring a deep blue and black space filled with numerous small, bright white stars and larger, glowing nebulae in shades of blue and purple. The overall effect is a vast, deep-sea-like celestial environment.

Everyone knew...

The universe was
expanding

Yet gravity slowed this
expansion

Eventually the universe
would contract under the
force of gravity

And the universe would
end in a 'big crunch'

A photograph of Earth from space, showing the horizon and a bright blue glow. The text is overlaid on the image.

Yet three astronomers
had a problem.

Their data said the
expansion of the universe
was speeding up!

This went against everything known

So, Dr. Adam Riess wrote

“Approach these results not with your heart or head but with your eyes, We are observers after all!”

By believing their eyes...



Adam Riess



Saul Perlmutter



Brian Schmidt

Nobel Prizes for the discovery of the accelerating expansion of the Universe through observations of distant supernovae



Adam Riess

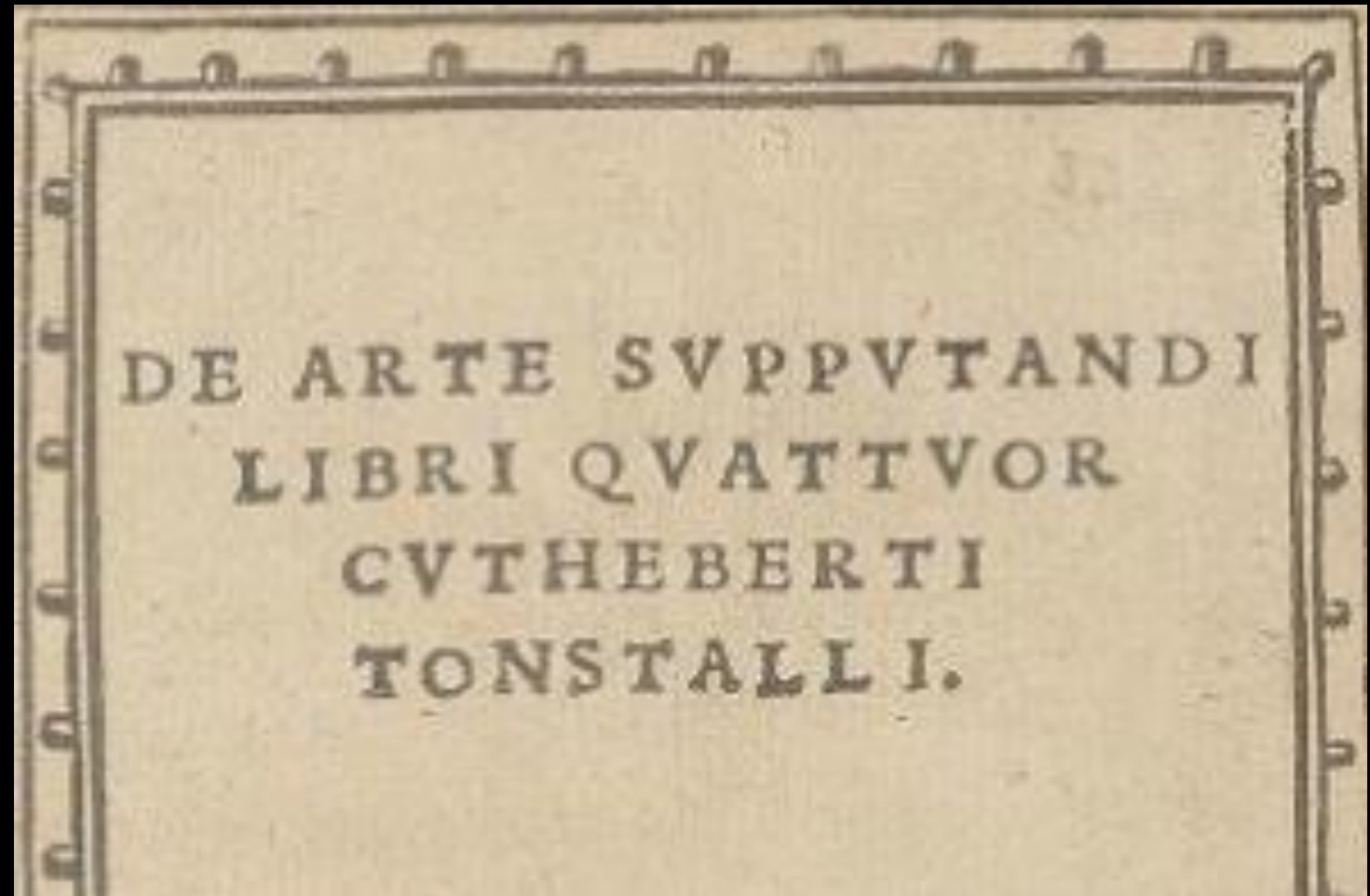


Saul Perlmutter



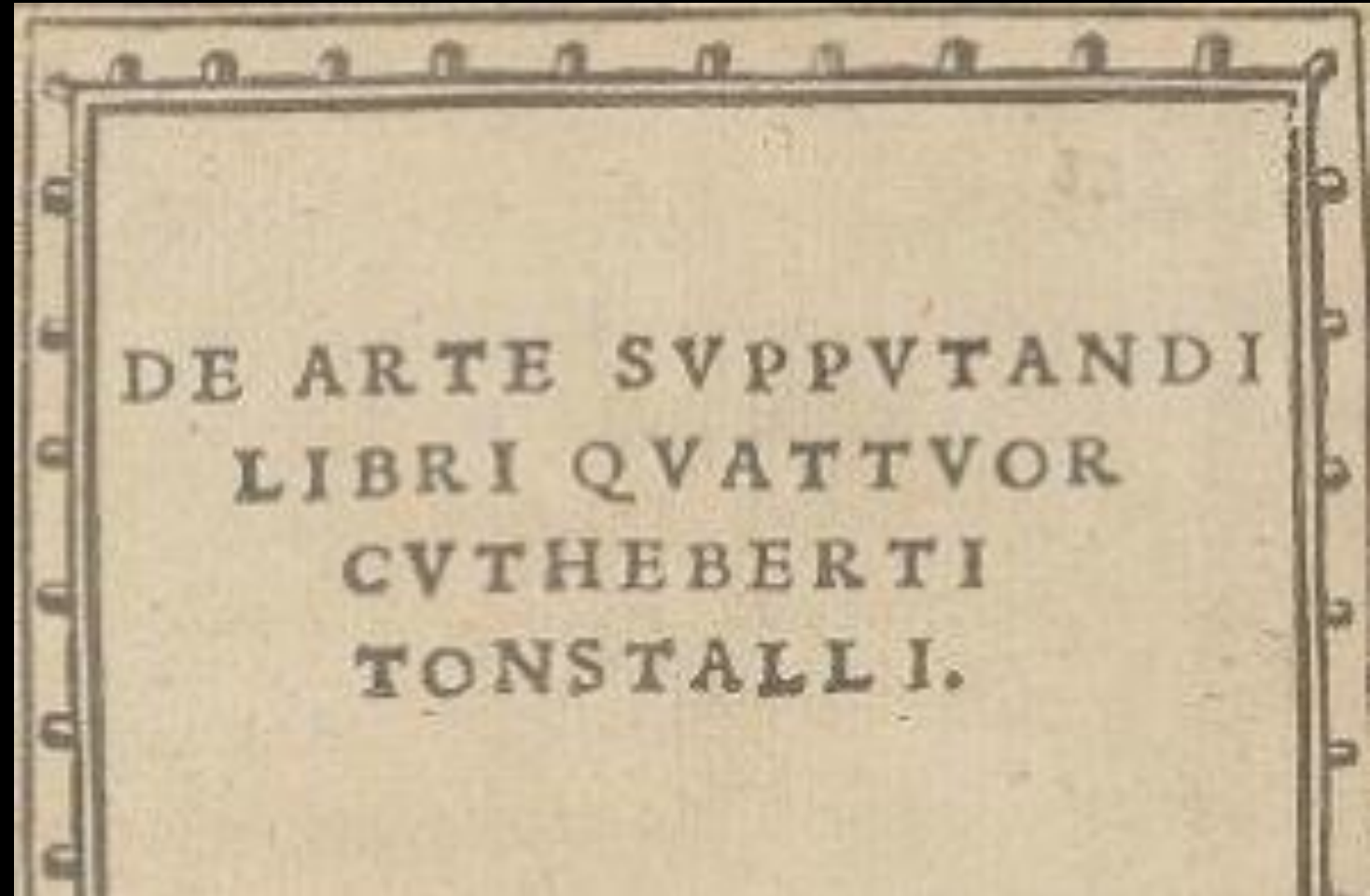
Brian Schmidt

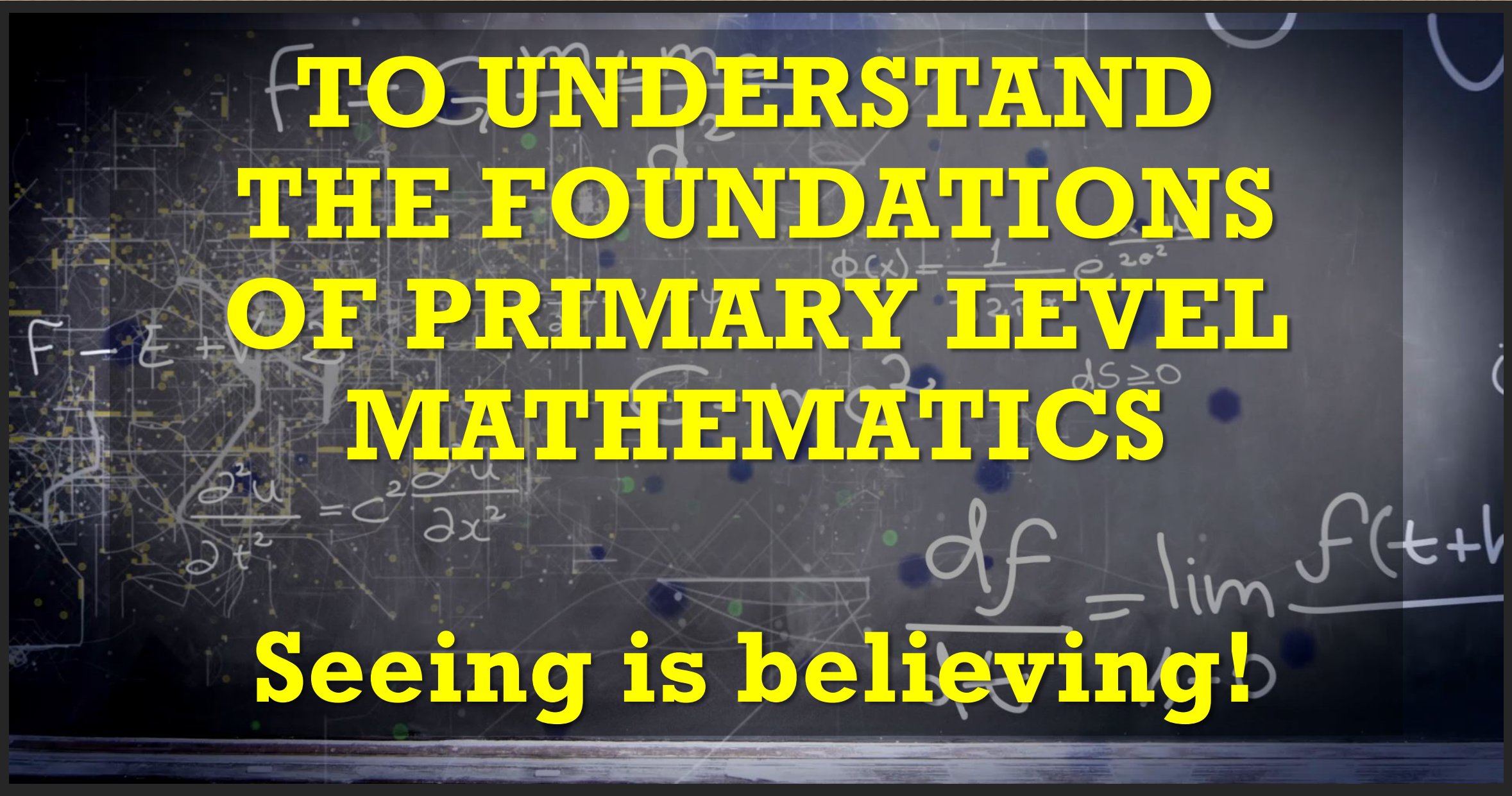
The Art of Calculation in Four Books. Cuthbert Tonstall 1522



The Art of Calculation in Four Books. Cuthbert Tonstall 1522

Elementary math
pedagogies have
been
DISCONNECTED
from science
since 1522





TO UNDERSTAND THE FOUNDATIONS OF PRIMARY LEVEL MATHEMATICS

Seeing is believing!

I've been rebuilding
elementary maths
foundations from
ZERO since 1983.



Maths? It's all in the
mind, says Jonathan

1988



It's all in the mind, he says.
After a four second calculation he came up with the correct day.

Jonathon will be holding two classes at the Park Orchards Community Centre.

"I hope to change the way the Western world teaches maths," Jonathon said.

"I've learnt to tap the workings of the brain."

Jonathon's interest in brain powers began when he completed a speed reading class.

Using his speed reading ability, he read and absorbed numerous books on the imagination and the thing that drives it — the brain.

Eventually Jonathon discovered a revolutionary method of teaching maths to children.

The second course will run on Fridays, March 4 and 11 at 1 to 3 pm.

This is *Fantastic Maths*, which Jonathon says can enable you to become a calculating whiz kid by learning how to mentally check the answer to any sum you do.

These classes will be run on Tuesdays, February 23, March 1 and March 8. Grades five and six at 3.45 to 4.30 pm and grades seven and eight 4.45 to 5.30 pm.

How **Science** Simplifies and Supercharges Primary Level **Mathematics** Learning and Teaching



Science

has units of quantity so let

Mathematics

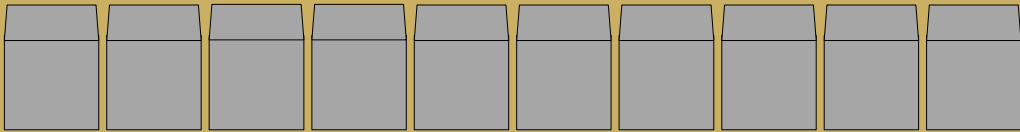
also have units of quantity

**In Our Closed System
We Began With Zero Cubes
on Ocean Level Zero**

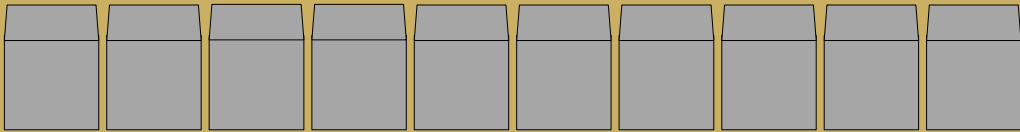
THE EQUAL & OPPOSITE QUANTITIES SUM TO ZERO

Either 1m^3 liquid OR 1m^3 solid
can be considered a primary
unit of count or measure

Then we Added Solid Cubes to Ocean Level Zero

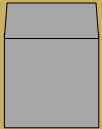


Did the Ocean Rise or Fall?



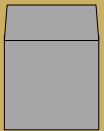
Neither!

Because Every Action has an Equal and Opposite Reaction



Neither!

Because Every Action has an Equal and Opposite Reaction

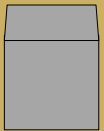


Here we added a solid cube



Neither!

Because Every Action has an Equal and Opposite Reaction



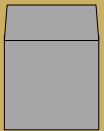
Here we added a solid cube



Here we subtracted a solid cube

Neither!

Because Every Action has an Equal and Opposite Reaction

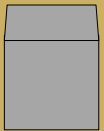


Here we subtracted a liquid cube



Neither!

Because Every Action has an Equal and Opposite Reaction



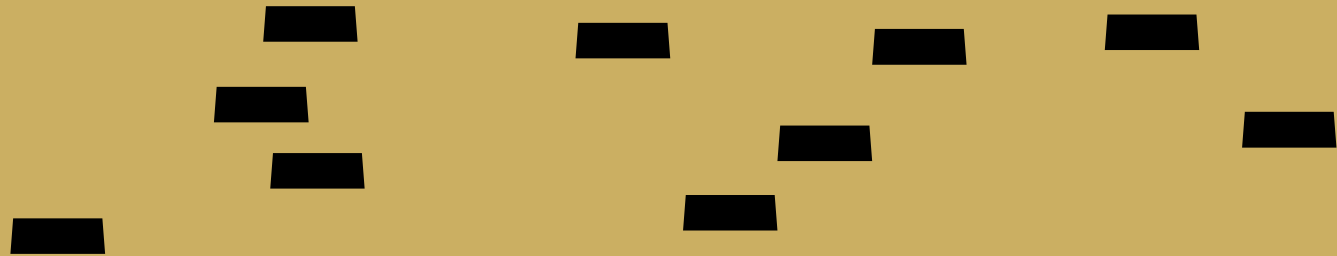
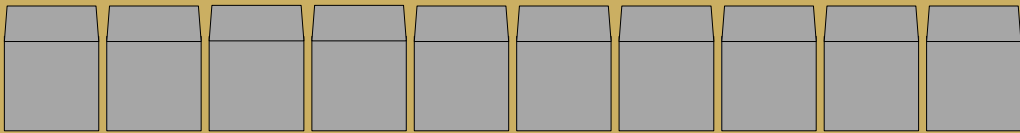
Here we subtracted a liquid cube



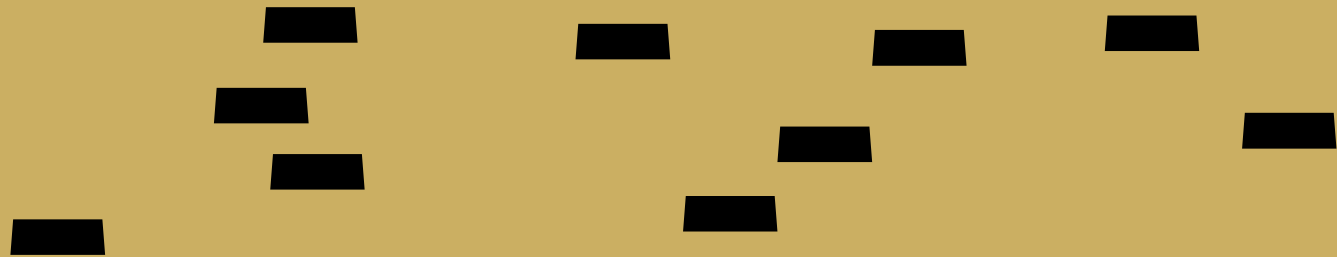
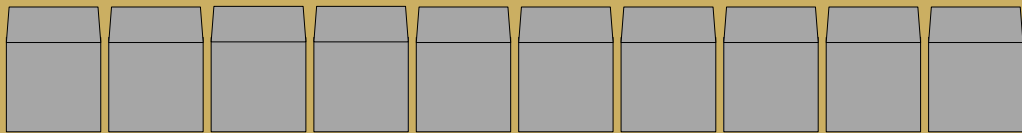
Here we added a liquid cube

NEWTON'S THIRD LAW

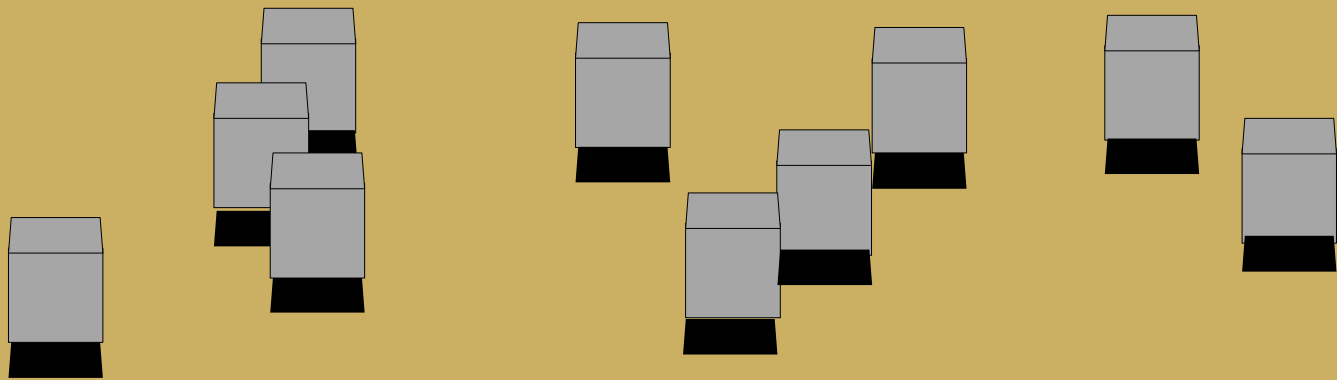
**Every ~~action~~ operation has an
equal and opposite ~~reaction~~
operation**



ZERO HAS BEEN SYMMETRICALLY SPLIT INTO EQUAL & OPPOSITE QUANTITIES



THE EQUAL & OPPOSITE QUANTITIES SUM TO ZERO



**THE
EQUAL & OPPOSITE
QUANTITIES
SUM TO ZERO**

THE EQUAL & OPPOSITE QUANTITIES SUM TO ZERO

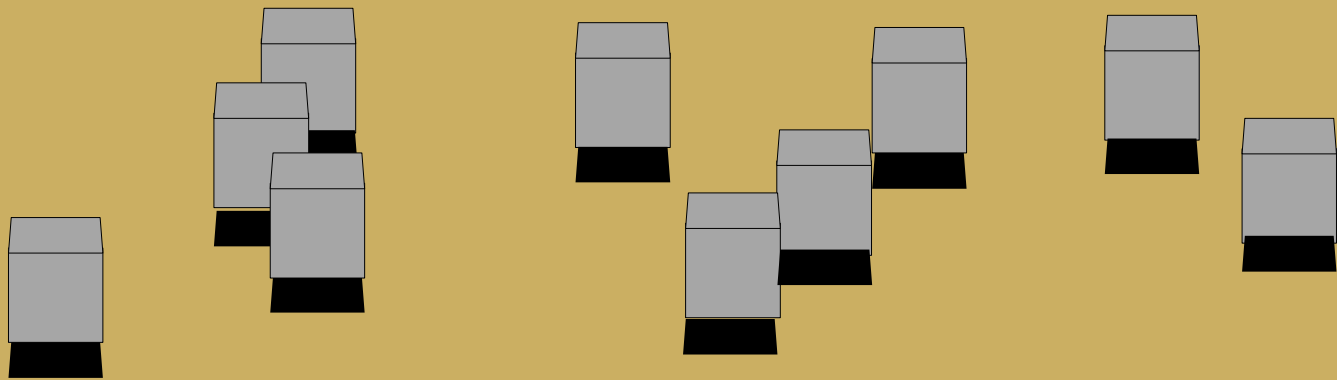
If liquid is 'positive' then solid is 'negative' as they cancel each other out in our closed system.

THE EQUAL & OPPOSITE QUANTITIES SUM TO ZERO

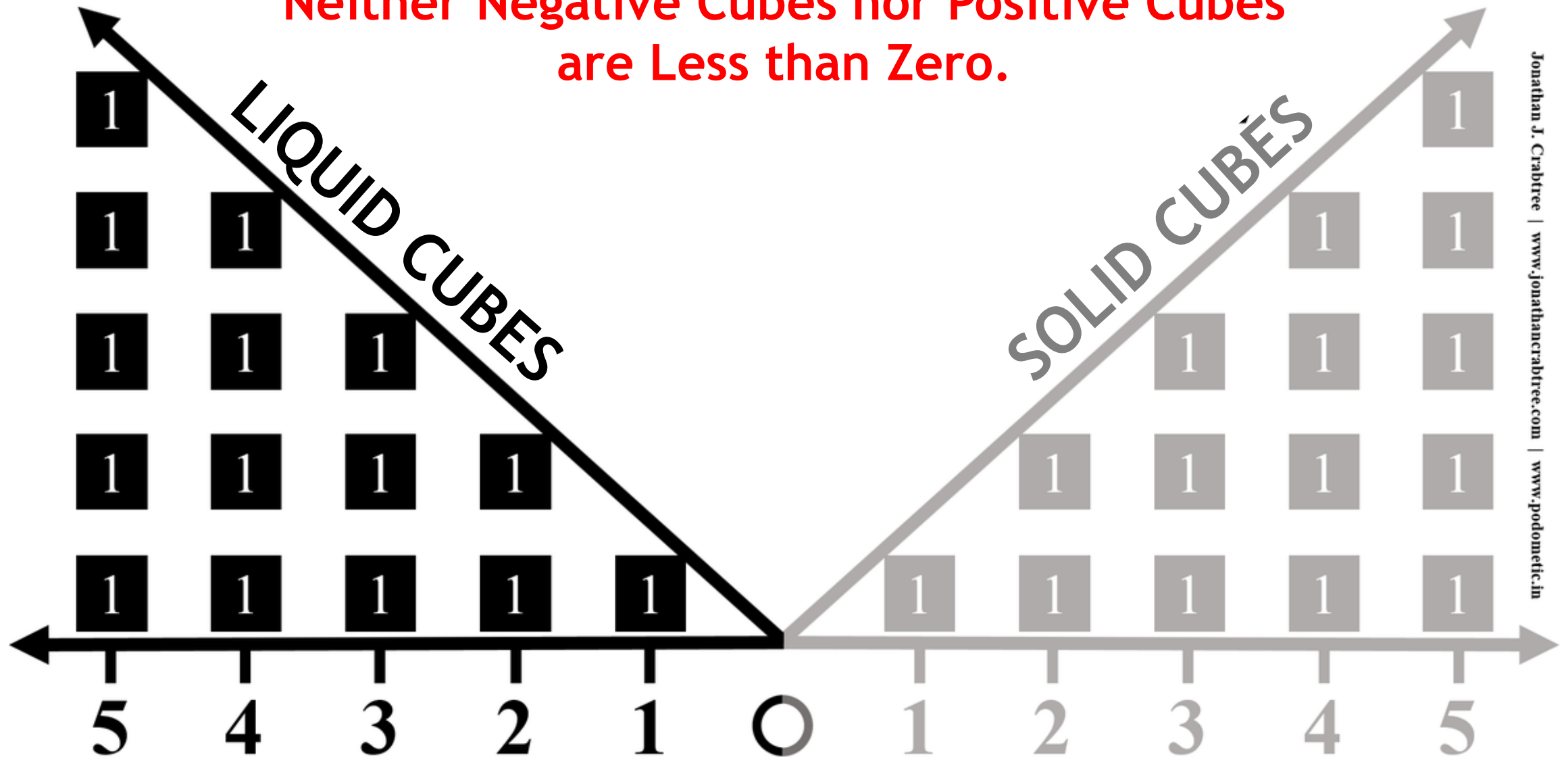
Vice-versa,
if liquid is 'negative'
then solid is 'positive'.

THE EQUAL & OPPOSITE QUANTITIES SUM TO ZERO

Let **SOLID CUBES** be positive and
LIQUID CUBES
be negative.

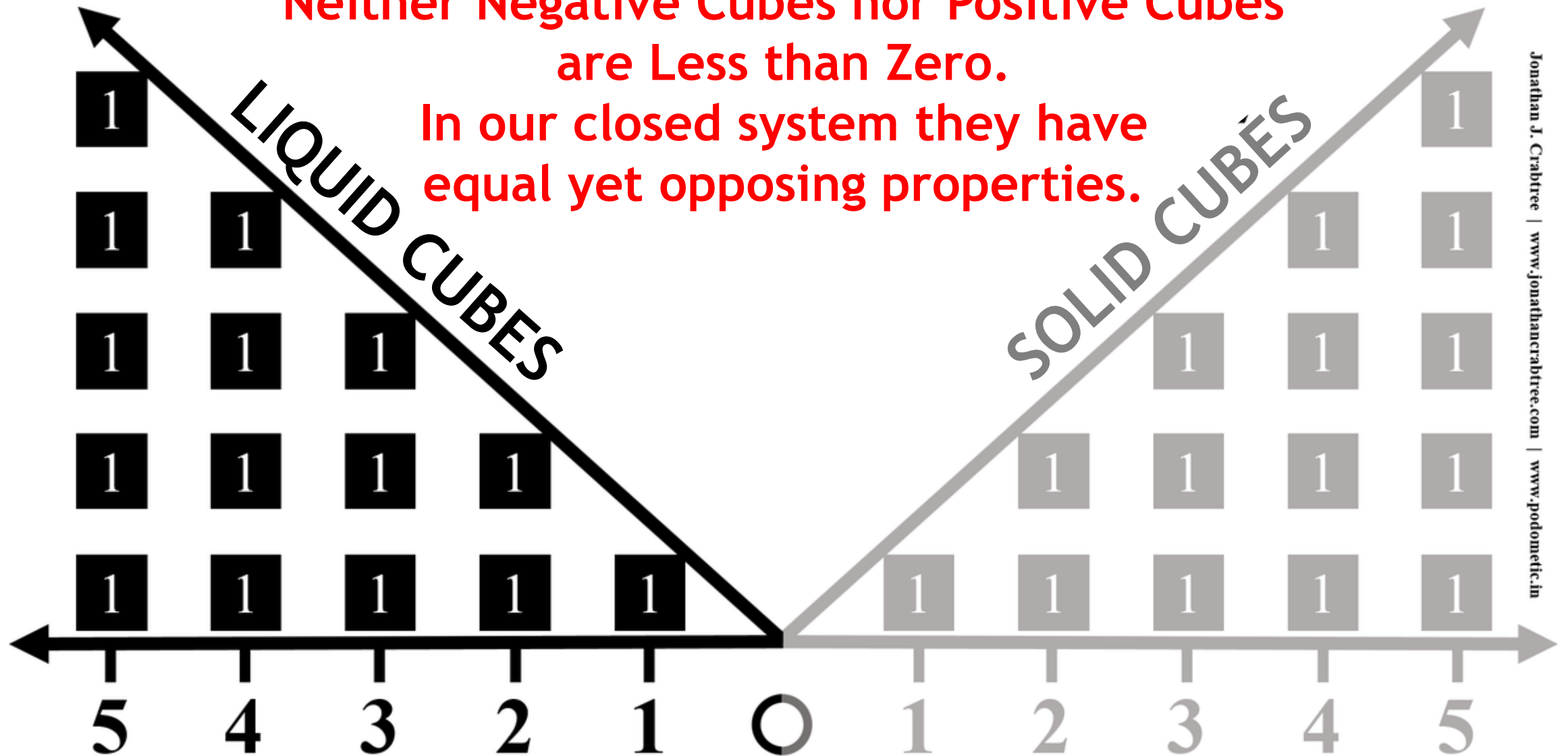


Neither Negative Cubes nor Positive Cubes
are Less than Zero.



Neither Negative Cubes nor Positive Cubes
are Less than Zero.

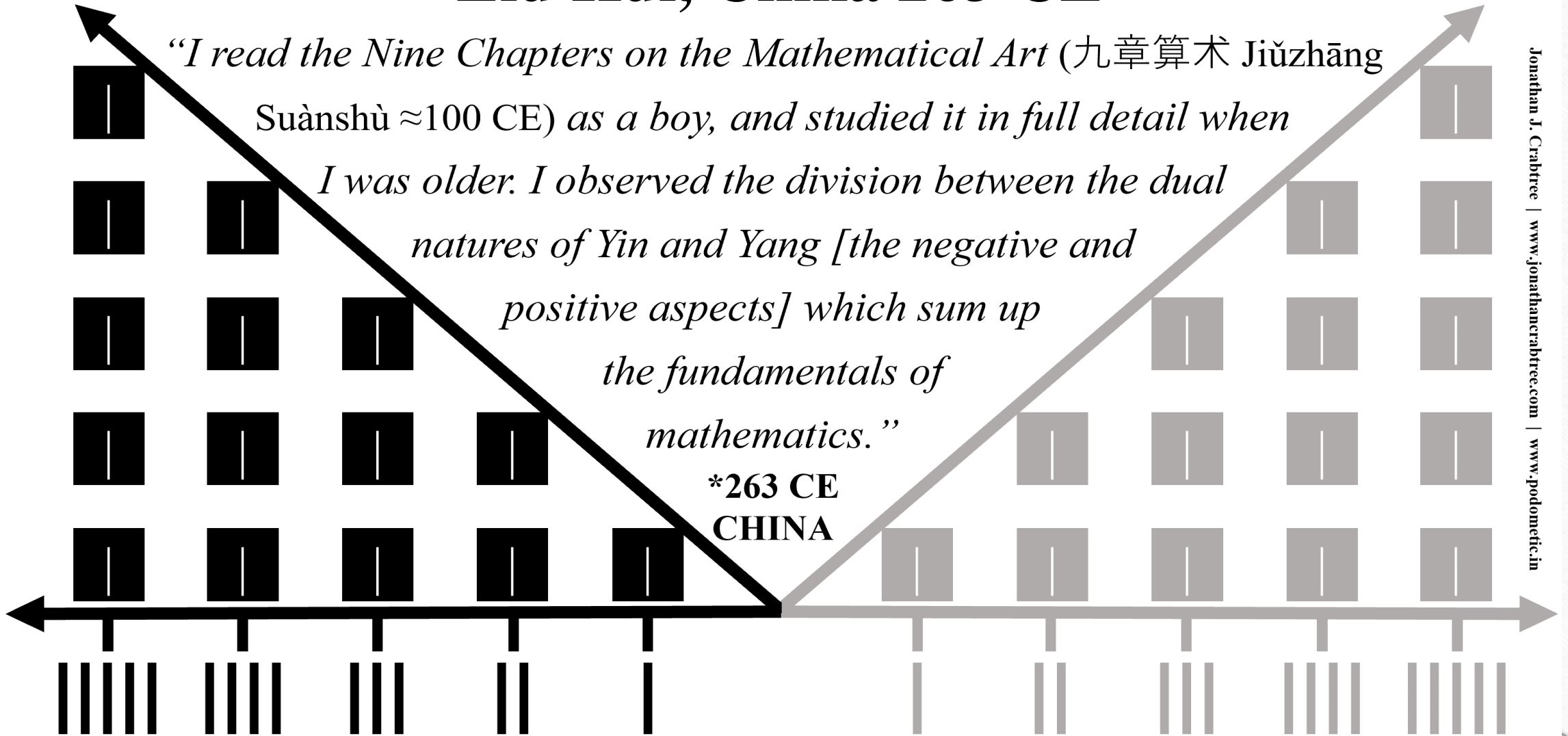
In our closed system they have
equal yet opposing properties.



Liu Hui, China 263 CE

"I read the Nine Chapters on the Mathematical Art (九章算术 Jiǔzhāng Suànshù \approx 100 CE) as a boy, and studied it in full detail when I was older. I observed the division between the dual natures of Yin and Yang [the negative and positive aspects] which sum up the fundamentals of mathematics."

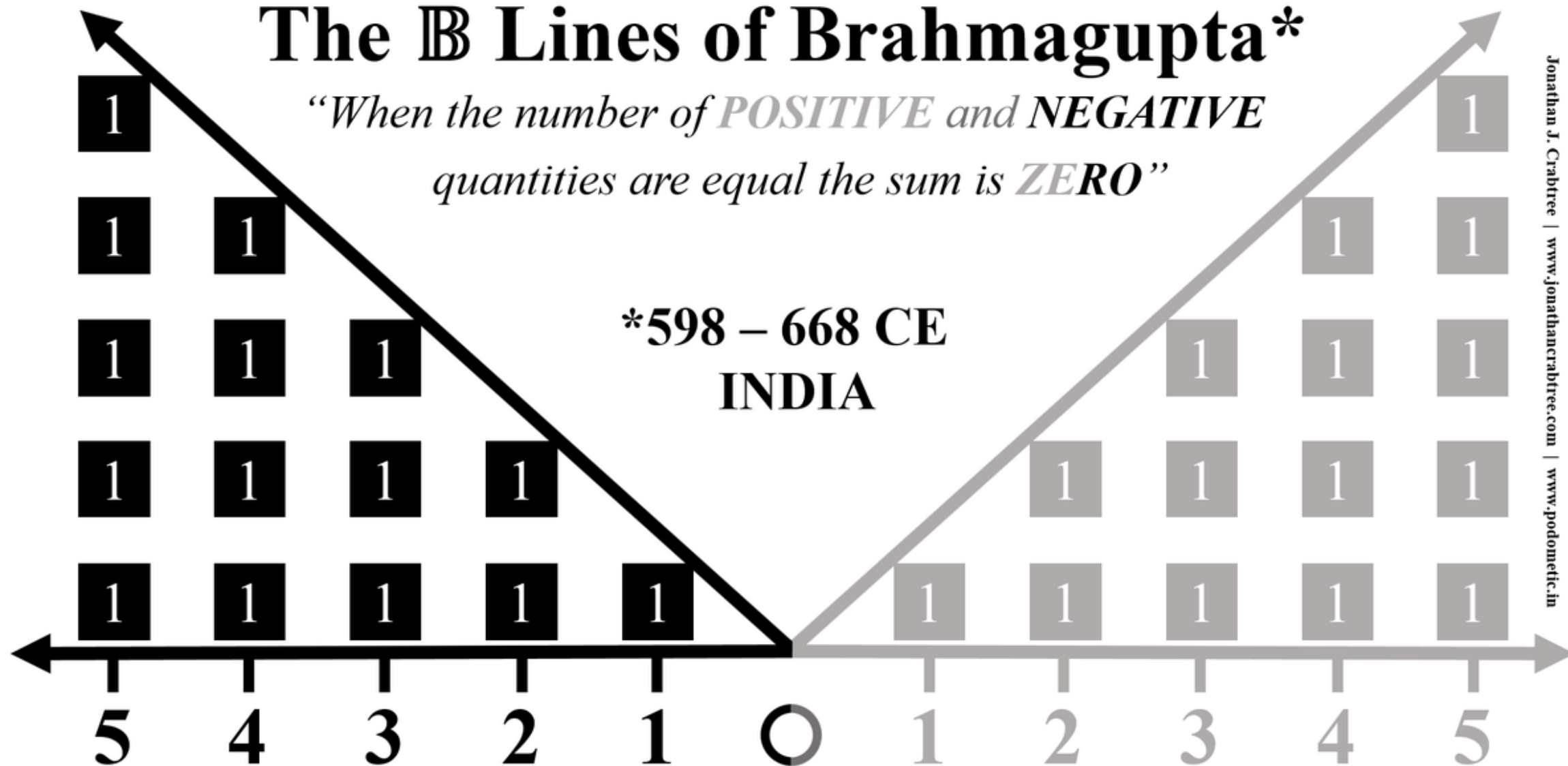
***263 CE
CHINA**

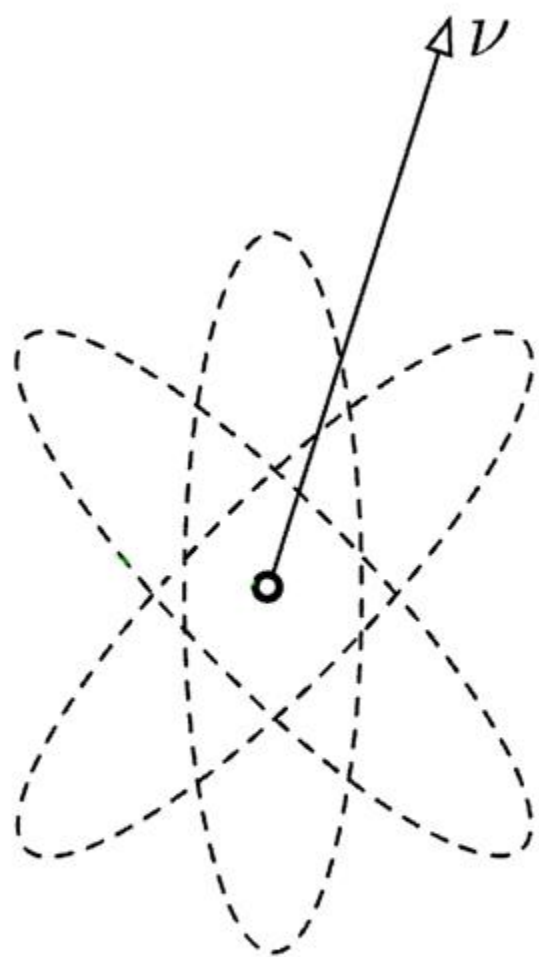


The \mathbb{B} Lines of Brahmagupta*

*“When the number of **POSITIVE** and **NEGATIVE** quantities are equal the sum is **ZERO**”*

***598 – 668 CE
INDIA**





e^+ positron

e^- electron

ν neutrino

γ quantum/photon
(511 keV)

1 NEGATIVE
ELECTRON

+

1 POSITIVE
POSITRON

=

ZERO!

BY JENS MAUS ([HTTP://JENS-MAUS.DE/](http://jens-maus.de/)) - OWN
WORK - PART OF PHD THESIS [HTTP://NBN-
RESOLVING.DE/URN:NBN:DE:BSZ:14-QUCOSA-23509](http://nbn-resolving.de/urn:nbn:de:bsz:14-qucosa-23509),
PUBLIC DOMAIN,
[HTTPS://COMMONS.WIKIMEDIA.ORG/W/INDEX.PHP?
CURID=379922](https://commons.wikimedia.org/w/index.php?curid=379922)

**“ SEEING SYMMETRY AND DISCERNING
WHEN IT BREAKS, IS A KEY
FOR UNDERSTANDING BOTH
MATHEMATICS & PHYSICS. ”**

BIG BANG!



BIG BANG!

Planet
Nega-
tron

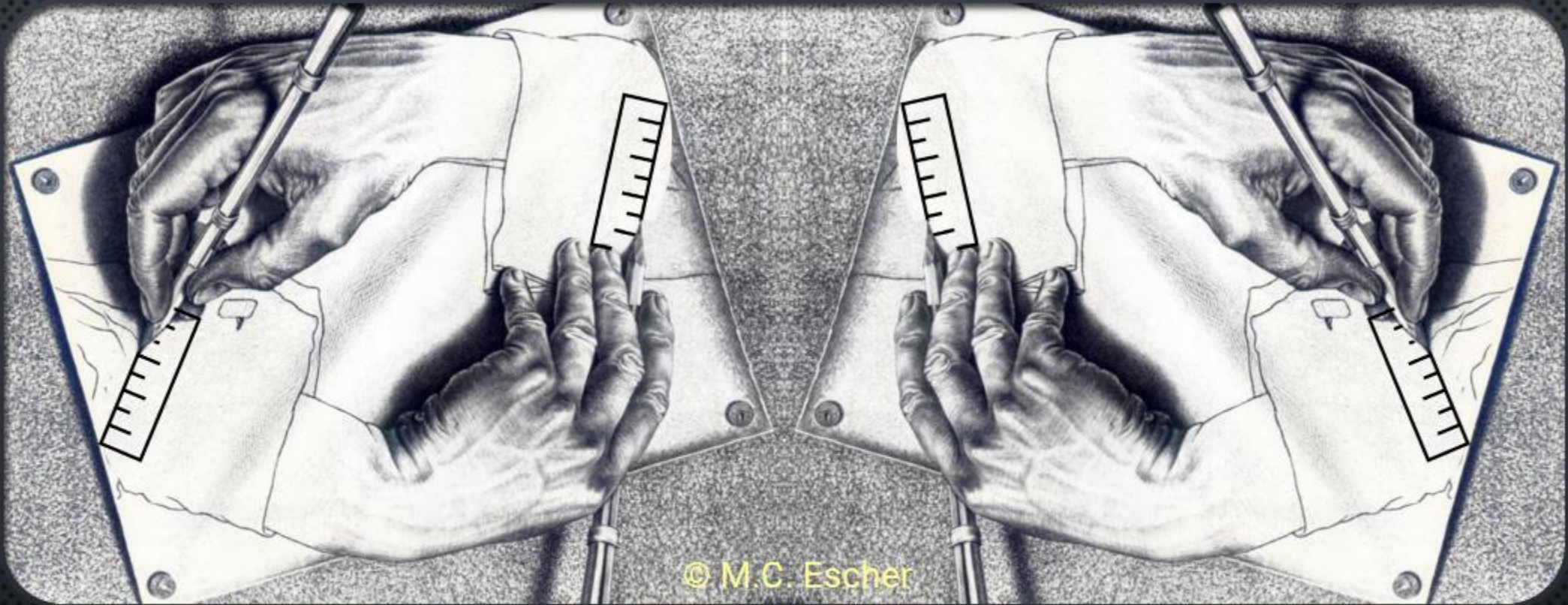
Planet
Posi-
tron

ZERO GRAVITY

Wherever opposing quantities or forces
or directions are equal you will find **ZERO**.



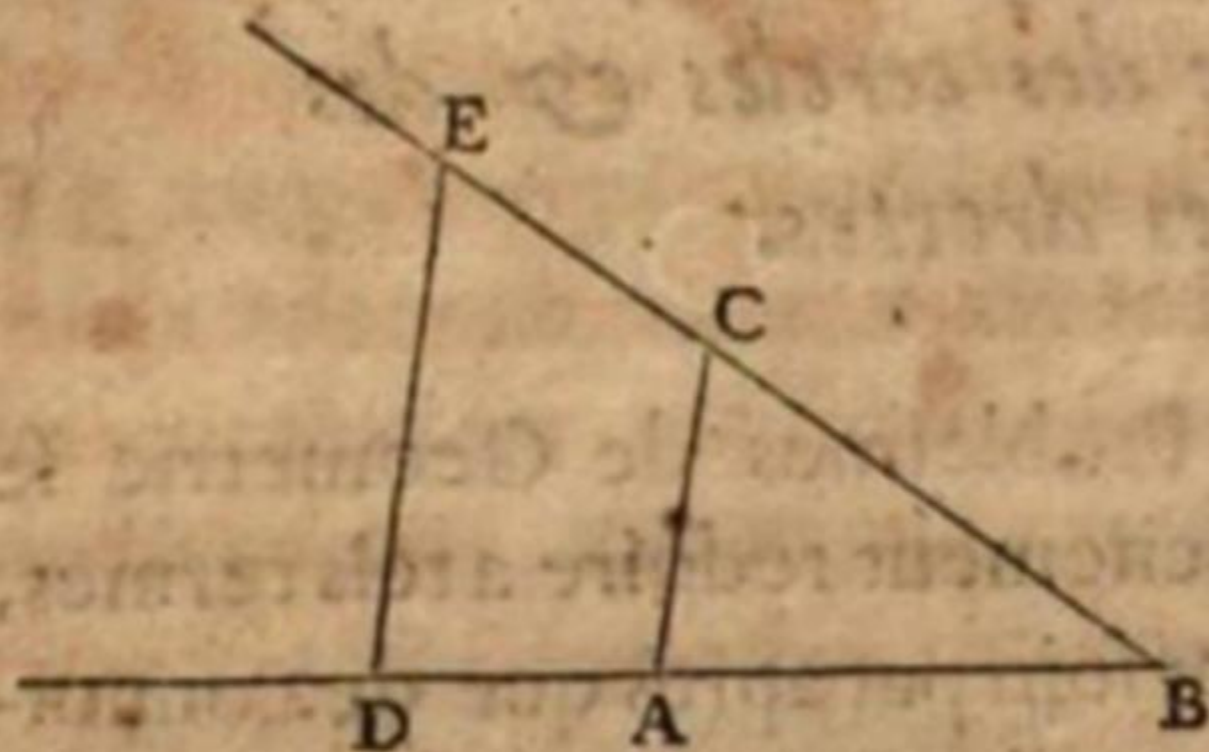
THE ZERO-POINT CHOICE



***FROM AN ARBITRARY POINT WHICH
DIRECTION DO WE GO?***

Applying Indian Logic to Descartes's Multiplication

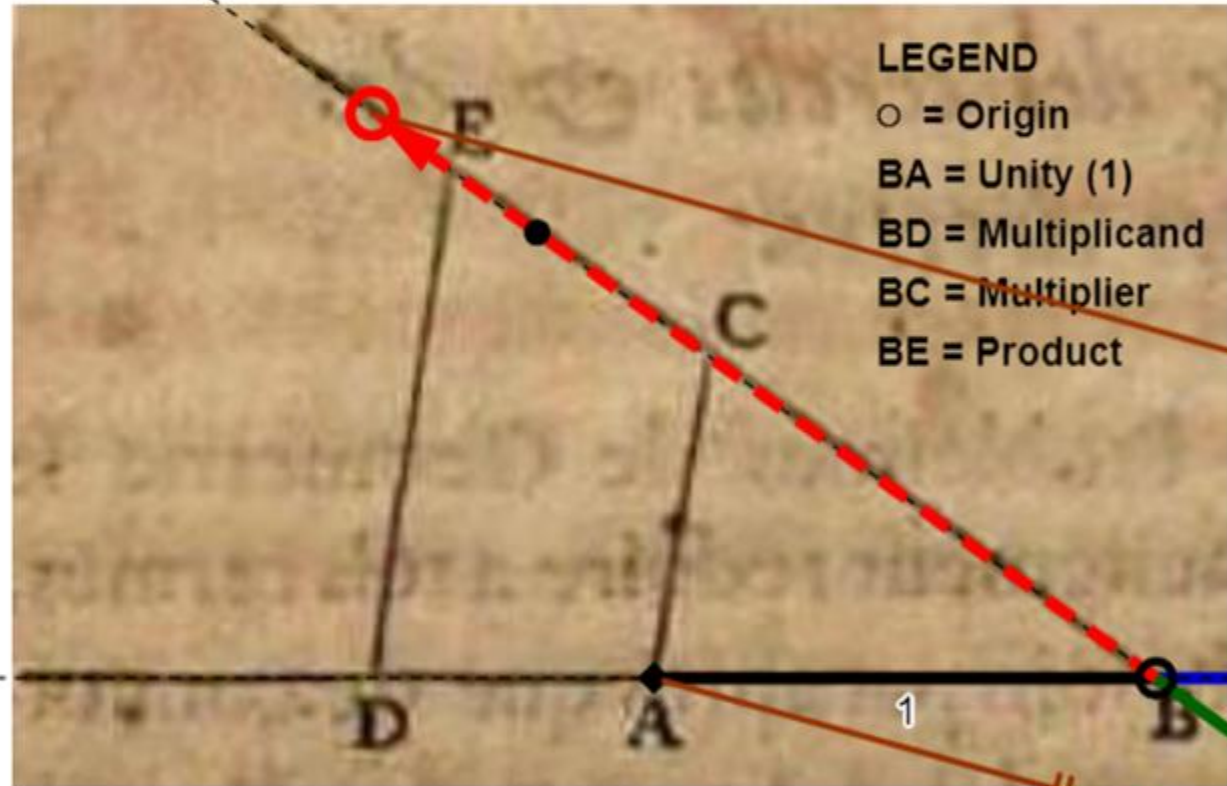
La Multi-
plication.



Soit par exemple
A B l'unité, & qu'il fail-
le multiplier B D par
B C, ie n'ay qu'a joindre
les points A & C, puis ti-
rer D E parallele a C A,
& B E est le produit de
cete Multiplication.

"For example, let AB be taken as unity, (1), and let it be required to multiply BD (the multiplicand) by BC (the multiplier), I have only to join the points A and C, and draw DE parallel to AC; and BE is the product of this Multiplication."

Indian Logic Meets Descartes' 1637 Multiplication Model.



“For example, let BA be taken as Unity, (1), and let it be required to multiply BD (the Multiplicand) by BC (the Multiplier), I have only to join the points A and C, and draw DE parallel to AC; and BE is the Product of this Multiplication.”

INSTRUCTIONS

Drag the Multiplicand (blue dot) and Multiplier (green dot) along the dashed lines or axes. Watch what happens to the red Product line when both the Multiplier and Multiplicand are negative (equal and opposite on the other side of the origin).

www.j.mp/AAMT-MULT

A Negative Multiplicand and a Negative Multiplier result in a Positive Product.

**Numbers count/measure
quantities and actions**

**Numbers count/measure
quantities and actions**

**Our universe is made of
matter and energy**

(masses and forces)

**The least quantity of matter
or energy you can have is zero.**

The least quantity of matter
or energy you can have is zero.

**Therefore, negative numbers
cannot represent quantities of
matter or energy less than zero.**

**You cannot have a negative
number of actions.**

**You cannot have a negative
number of actions.**

**The least number of actions
you can have is zero.**

**Integral multipliers cannot
be less than zero!**

**Integral multipliers cannot
be less than zero!**

Let Liquid Cubes or Holes be Negative...

$$-a \times +b =$$

$-a$ *added to*

zero b *times*

$-a \times +b =$
 $-a$ *added to*
zero *b times*

$-3 \times +2 =$
 -3 *added to*
zero *2 times*

$-a \times +b =$
 $-a$ *added to*
zero b *times*

$-3 \times +2 =$
 -3 *added to*
zero 2 *times*

$0 + -3 + -3$

$$-a \times +b =$$

$-a$ *added to*
zero b *times*

$$-3 \times +2 =$$

-3 *added to*
zero 2 *times*

$$0 + -3 + -3$$

Ocean Level **Zero** plus **6** holes
or **6** liquid cubes

$$-a \times -b =$$

$-a$ *subtracted from*
zero b *times*

$$-a \times -b =$$

$-a$ *subtracted from*
zero b *times*

$$-3 \times -2 =$$

-3 *subtracted from*
zero 2 *times*

$$-a \times -b =$$

$-a$ *subtracted from*
zero b *times*

$$-3 \times -2 =$$

-3 *subtracted from*
zero 2 *times*

$$0 - -3 - -3$$

$$-a \times -b =$$

$-a$ *subtracted from*
zero b *times*

$$-3 \times -2 =$$

-3 *subtracted from*
zero 2 *times*

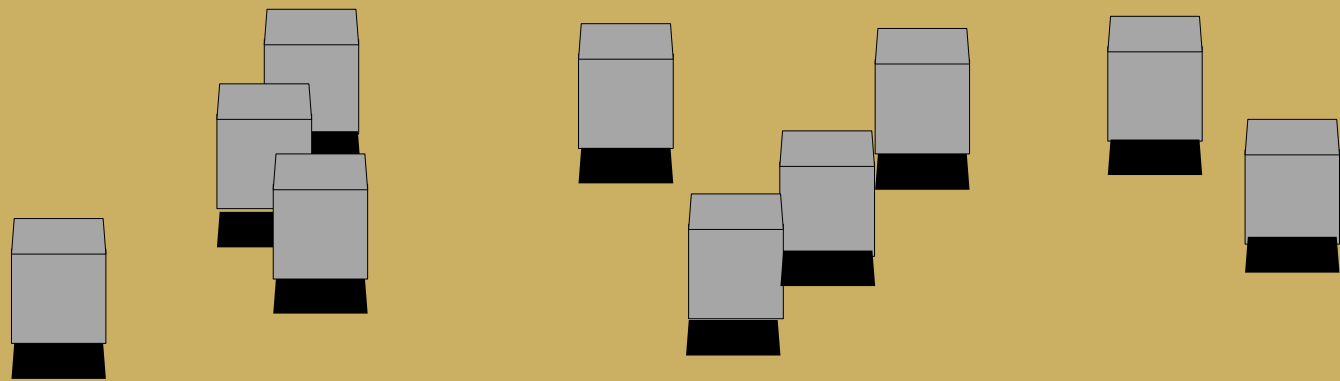
$$0 - -3 - -3$$

Ocean Level **Zero** minus **6**

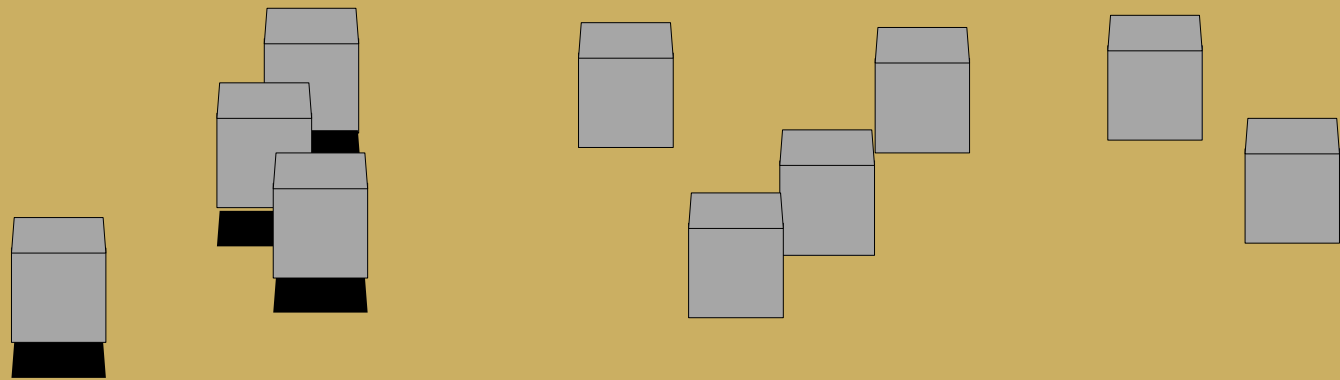
holes **or** **6** liquid cubes

OCEAN LEVEL ZERO

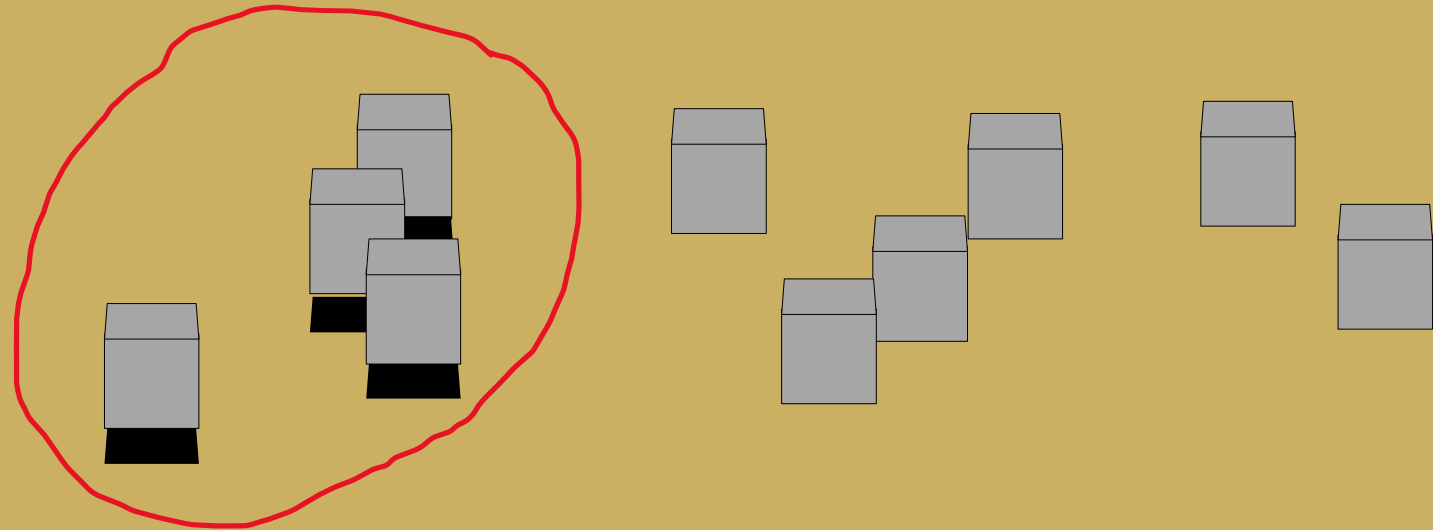
(10 bricks and 10 holes)



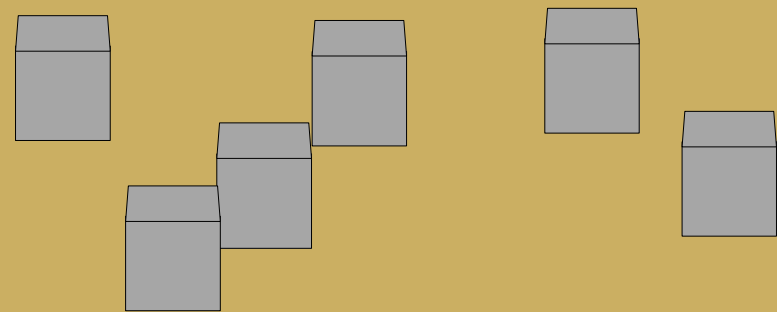
**Zero minus 6 holes or
6 liquid cubes**



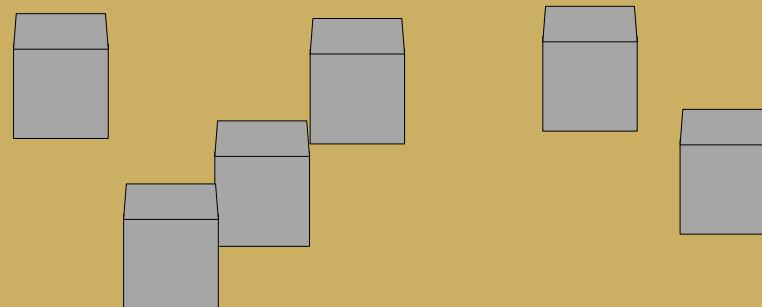
**Zero minus 6 holes or
6 liquid cubes**



**Zero minus 6 holes or
6 liquid cubes \Rightarrow 6 solid cubes**



$$0 - -6 = +6$$



Brahmagupta's 5 Addition Sutras

धनयोर्धनम् ऋणमृणयोः धनर्णयोरन्तरं समैक्यं खम् ऋणमैक्यं च धनमृणधनशून्ययोः शून्ययोः शून्यम्

AS1 positive plus positive is positive

AS2 negative plus negative is negative

AS3 positive plus negative is the difference between the positive and negative

AS4 when positive and negative are equal the sum is zero

positive plus zero is positive

AS5 negative plus zero is negative
zero plus zero is zero

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Brahmagupta's 4 Multiplication Sutras

ऋणमृणधनयोर्घातो धनमृणयोः धनवधो धनं भवति
शून्यर्णयोः खधनयोः खशून्ययोर्वा वधः शून्यम्

MS1 The product of a negative and a positive is negative.

MS2 The product of two negatives is positive.

MS3 The product of two positives is positive.

MS4 The product of zero and a negative,
of zero and a positive, or
of two zeros is zero.

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Brahmagupta's 5 Subtraction Sutras

ऊनमधिकाद्विशोध्यं धनं धनादऋणमृणादधिकमूनात् व्यस्तं तदन्तरं स्यादृणं धनं धनमृणं भवति
शून्यविहीनमृणमृणं धनं धनं भवति शून्यमाकाशम् शोध्यं यदा धनमृणादऋणं धनाद्वा तदा क्षेप्यम्

SS1 A smaller positive subtracted from a larger positive is positive.

SS2 A smaller negative subtracted from a larger negative is negative.

SS3 If a larger negative or positive is to be subtracted from a smaller negative or positive, the sign of their difference is reversed – negative becomes positive and positive negative.

SS4 A negative minus zero is negative,
a positive minus zero is positive,
zero minus zero is zero.

SS5 When a positive is to be subtracted from a negative or a negative from a positive, then it is to be added.

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Brahmagupta's 4 Division Sutras

धनभक्तं धनम् ऋणहतमृणं धनं भवति खं खभक्तं खम्
भक्तमृणेन धनमृणं धनेन हतम् ऋणमृणं भवति
खोद्धतमृणं धनं वा तच्छेदं खमृणधनविभक्तं वा
ऋणधनयोर्वर्गः स्वं खं खस्य पदं कृतिर्यत् तत्

DS1 A positive divided by a positive is positive.

DS2 A negative divided by a negative is positive.

DS3 A positive divided by a negative is negative.

DS4 A negative divided by a positive is negative.

Acknowledgement: I am grateful to Avinash Sathaye, K. Ramasubramanian, Clemency Montelle, Kim Plofker and Agathe Keller. Analysis, interpretation (& any mistakes) by Jonathan J. Crabtree.

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Brahmagupta's 5 Addition Sutras

धनयोर्धनम् ऋणमृणयोः धनर्णयोरन्तरं समैक्यं खम् ऋणमैक्यं च धनमृणधनशून्ययोः शून्ययोः शून्यम्

AS1 positive plus positive is positive

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AS4 when positive and negative are equal the sum is zero

AS5 positive plus zero is positive
negative plus zero is negative
zero plus zero is zero

Brahmagupta's 5 Addition Sutras

धनयोर्धनम् ऋणमृणयोः धनर्णयोरन्तरं समैक्यं खम् ऋणमैक्यं च धनमृणधनशून्ययोः शून्ययोः शून्यम्

AS1 positive plus positive is positive

AS2 negative plus negative is negative

 ZERO 

AS3 positive plus negative is the difference between the positive and negative

AS4 when positive and negative are equal the sum is zero

AS5 positive plus zero is positive
negative plus zero is negative
zero plus zero is zero

Brahmagupta's 5 Addition Sutras

धनयोर्धनम् ऋणमृणयोः धनर्णयोरन्तरं समैक्यं खम् ऋणमैक्यं च धनमृणधनशून्ययोः शून्ययोः शून्यम्

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Brahmagupta's 5 Addition Sutras

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Brahmagupta's 5 Addition Sutras

धनयोर्धनम् ऋणमृणयोः धनर्णयोरन्तरं समैक्यं खम् ऋणमैक्यं च धनमृणधनशून्ययोः शून्ययोः शून्यम्

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AS4 when positive and negative are equal the sum is zero

AS5 positive plus zero is positive
negative plus zero is negative
zero plus zero is zero

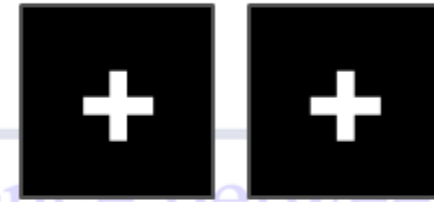
Brahmagupta's 5 Addition Sutras

धनयोर्धनम् ऋणमृणयोः धनर्णयोरन्तरं समैक्यं खम् ऋणमैक्यं च धनमृणधनशून्ययोः शून्ययोः शून्यम्

AS1 positive plus positive is positive

AS2 negative plus negative is negative

0 - 2



AS3 positive plus negative is the difference between the positive and negative

AS4 when positive and negative are equal the sum is zero

AS5 positive plus zero is positive
negative plus zero is negative
zero plus zero is zero

$$-a \times -b =$$

$-a$ *subtracted from*
zero b *times*

$$-1 \times -1 =$$

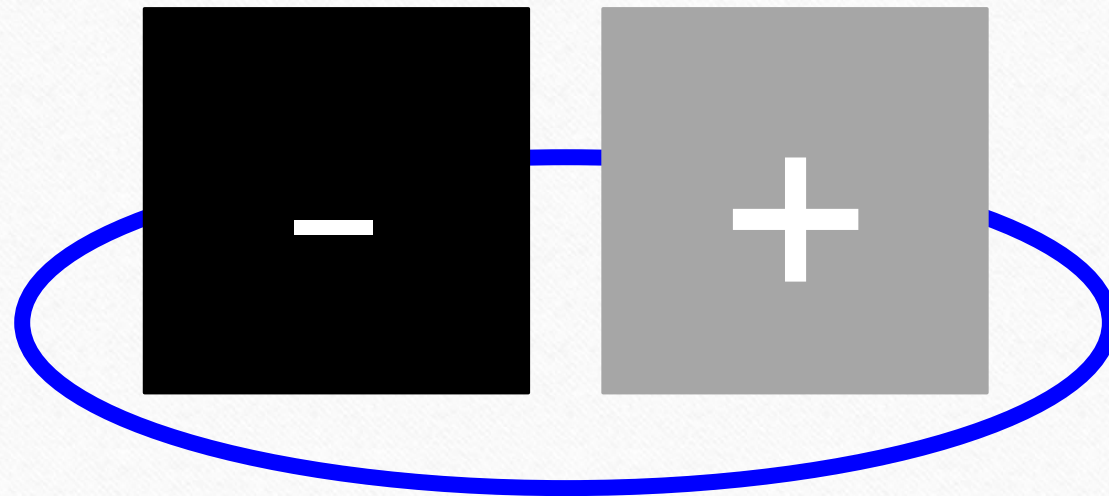
-1 *subtracted from*
zero 1 *times*

$$-a \times -b =$$

$-a$ *subtracted from*
zero b *times*

$$-1 \times -1 =$$

-1 *subtracted from*
zero 1 *times*



$$-a \times -b =$$

$-a$ *subtracted from*
zero b *times*

$$-1 \times -1 =$$

-1 *subtracted from*
zero 1 *times* $= +1$



+

$$-a \times -b =$$

$-a$ *subtracted from*
zero b *times*

$-1 \times -1 = +1$ *is a
consequence of
the definition of*

$$-1 \times -1 =$$

-1 *subtracted from*
zero 1 *times* $= +1$



zero

“To say we define $-1 \times -1 = +1$ to preserve the distributive property of multiplication is inane.

“To say we define $-1 \times -1 = +1$ to preserve the distributive property of multiplication is inane.

There are no negative terms in $(a - b)(c - d)$, just positive terms being subtracted.”

REALITY CHECK!

$$+12 - -4$$

-
- 12 positives minus 4 negatives is impossible

REALITY CHECK!

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- We don't have any negatives to subtract!

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REALITY CHECK!

$$+12 - -4$$

- 12 positives minus 4 negatives is impossible
- We don't have any negatives to subtract!
- So, we add the identity element 0 as $+4 + -4$
- Therefore, $+12 + +4 + -4 - -4 = +16$

Brahmagupta's 5 Addition Sutras

धनयोर्धनम् ऋणमृणयोः धनर्णयोरन्तरं समैक्यं खम् ऋणमैक्यं च धनमृणधनशून्ययोः शून्ययोः शून्यम्

AS1 positive plus positive is positive

AS2 negative plus negative is negative

AS3 positive plus negative is the difference between the positive and negative

AS4 when positive and negative are equal the sum is zero

positive plus zero is positive

AS5 negative plus zero is negative
zero plus zero is zero

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Brahmagupta's 5 Addition Sutras

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AS1 positive plus positive is positive

AS2 negative plus negative is negative

AS3 positive plus negative is the difference between the positive and negative

AS4 when positive and negative are equal the sum is zero

AS5 positive plus zero is positive
negative plus zero is negative
zero plus zero is zero

Adding ZERO is a
simple power tool

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How to reveal 2 – 5 to seven year-olds.



**BRICKS FOR SALE!
BUY YOUR BRICKS!**

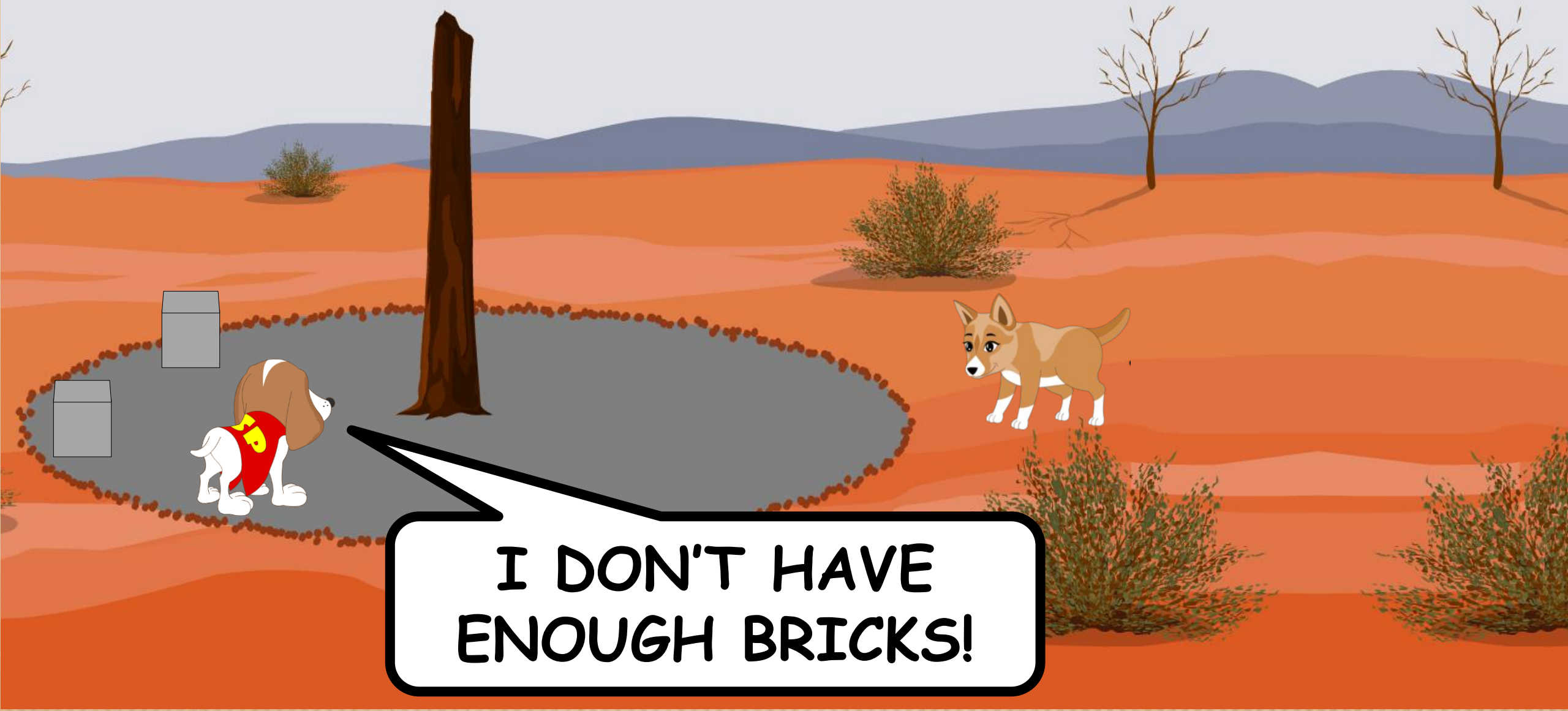
**Podo the Puppy has
two Bricks for Sale**

How to reveal 2 – 5 to seven year-olds.



I WANT FIVE
BRICKS PLEASE

How to reveal 2 – 5 to seven year-olds.

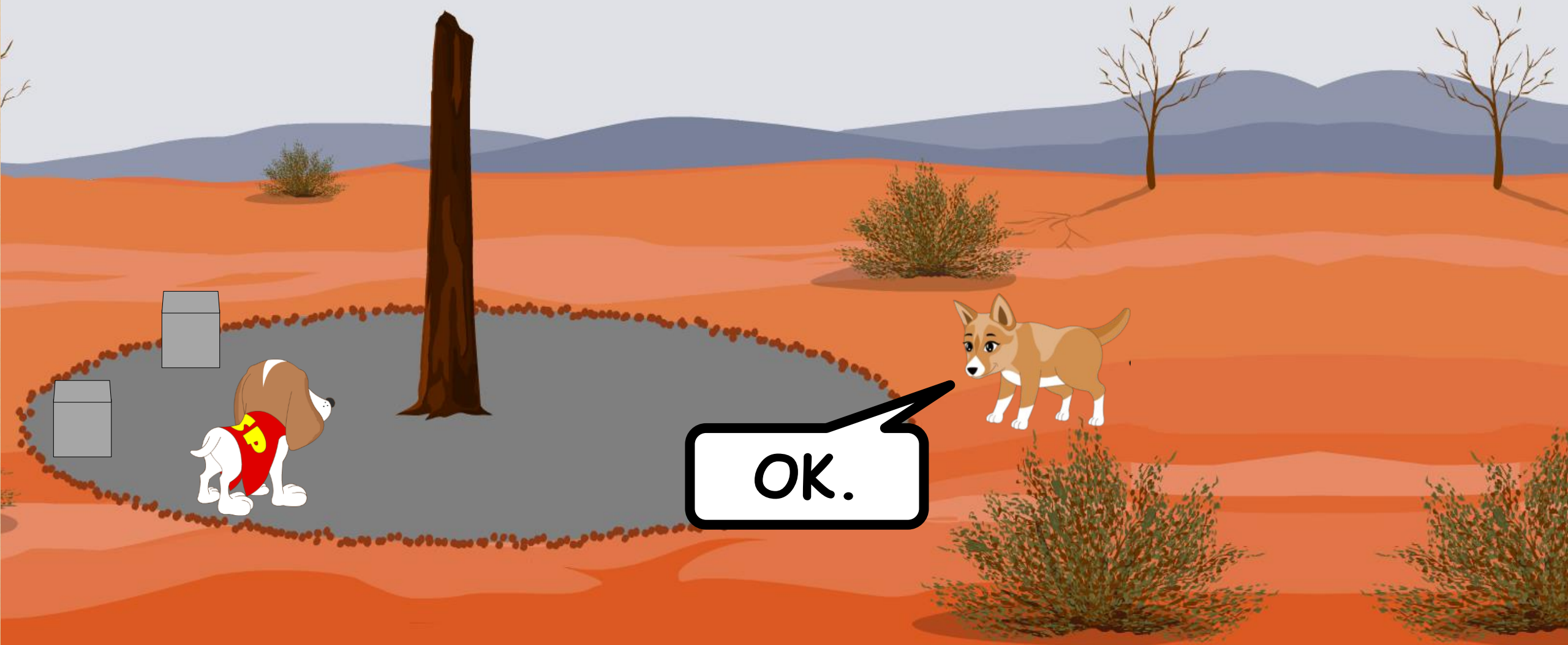


**I DON'T HAVE
ENOUGH BRICKS!**

How to reveal 2 – 5 to seven year-olds.



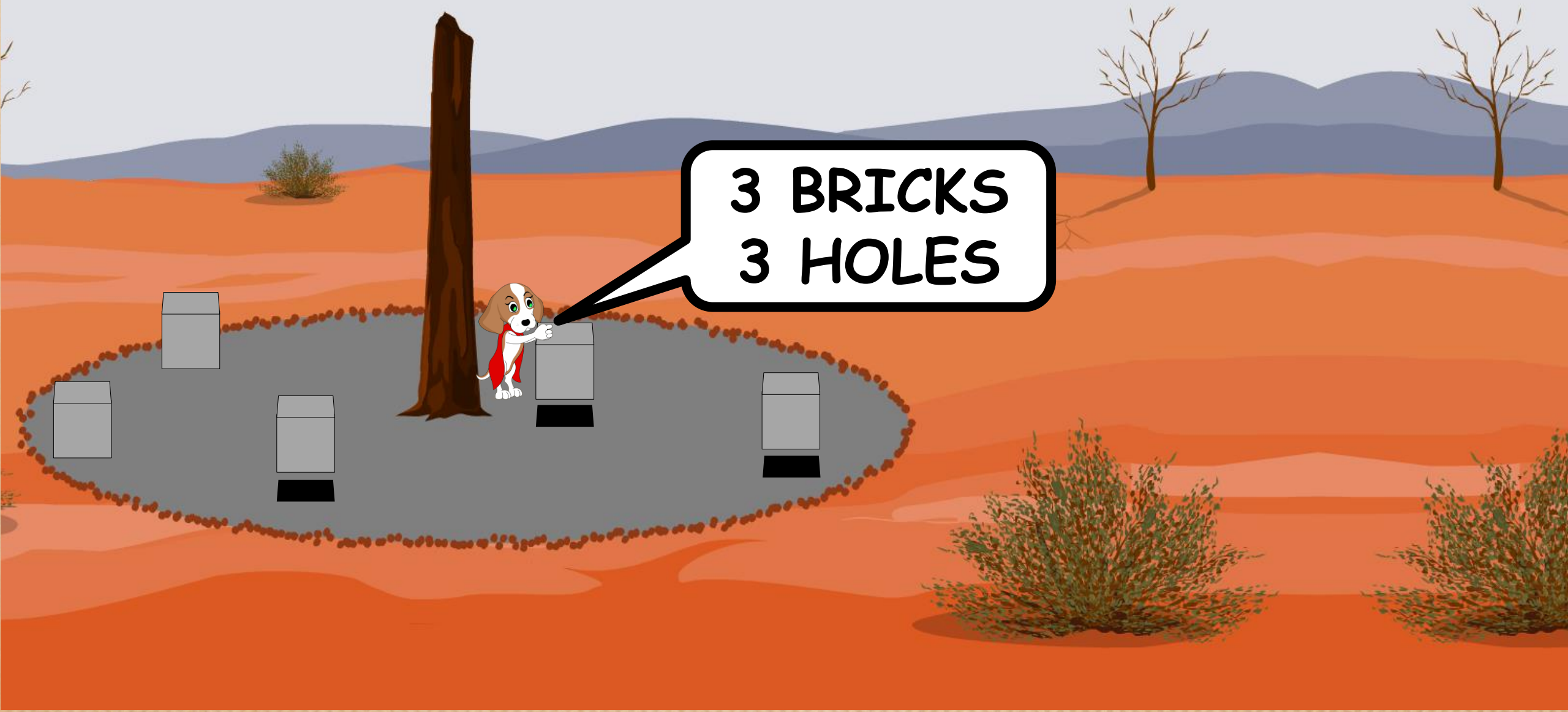
How to reveal 2 – 5 to seven year-olds.



How to reveal 2 – 5 to seven year-olds.



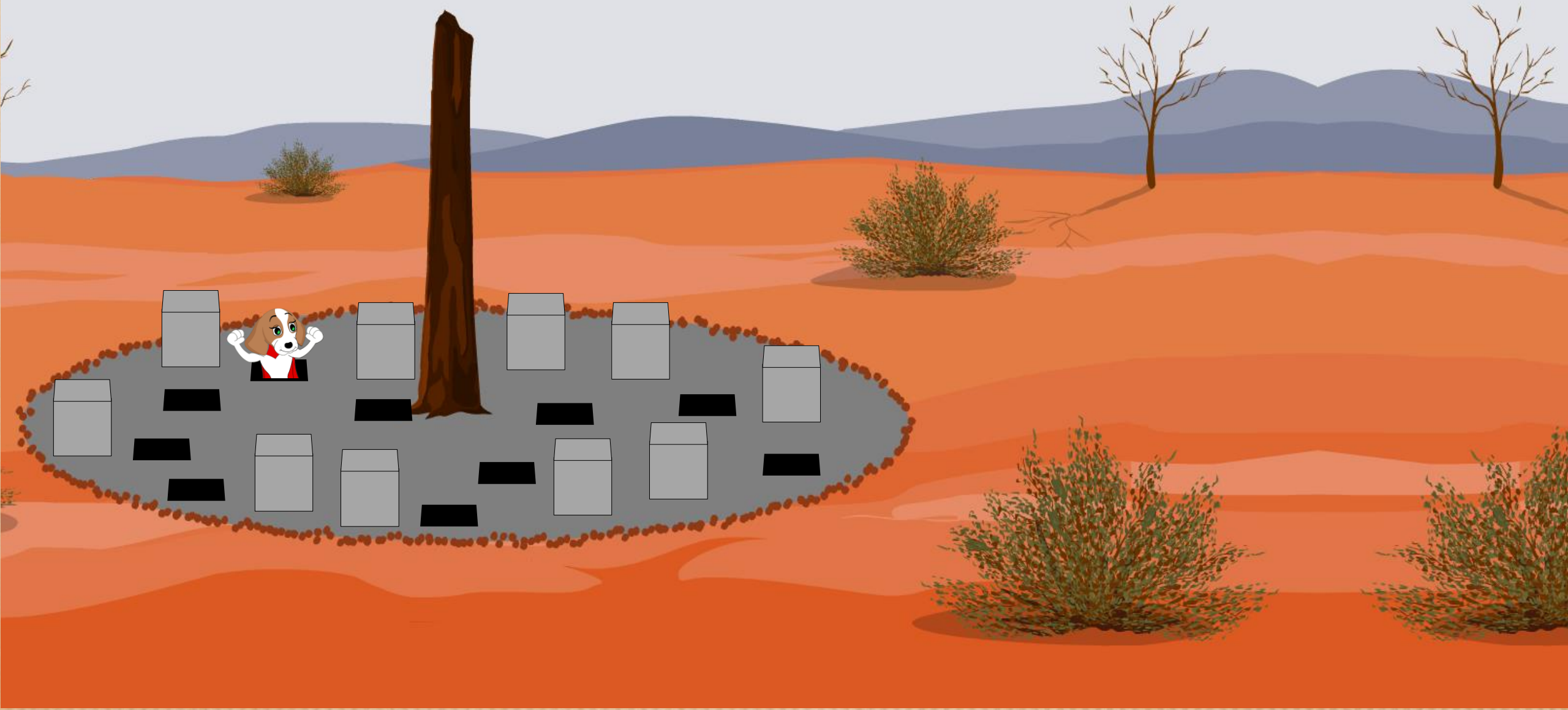
In India Children Play the Happy Harappan Positive Brick and Negative Hole Game!

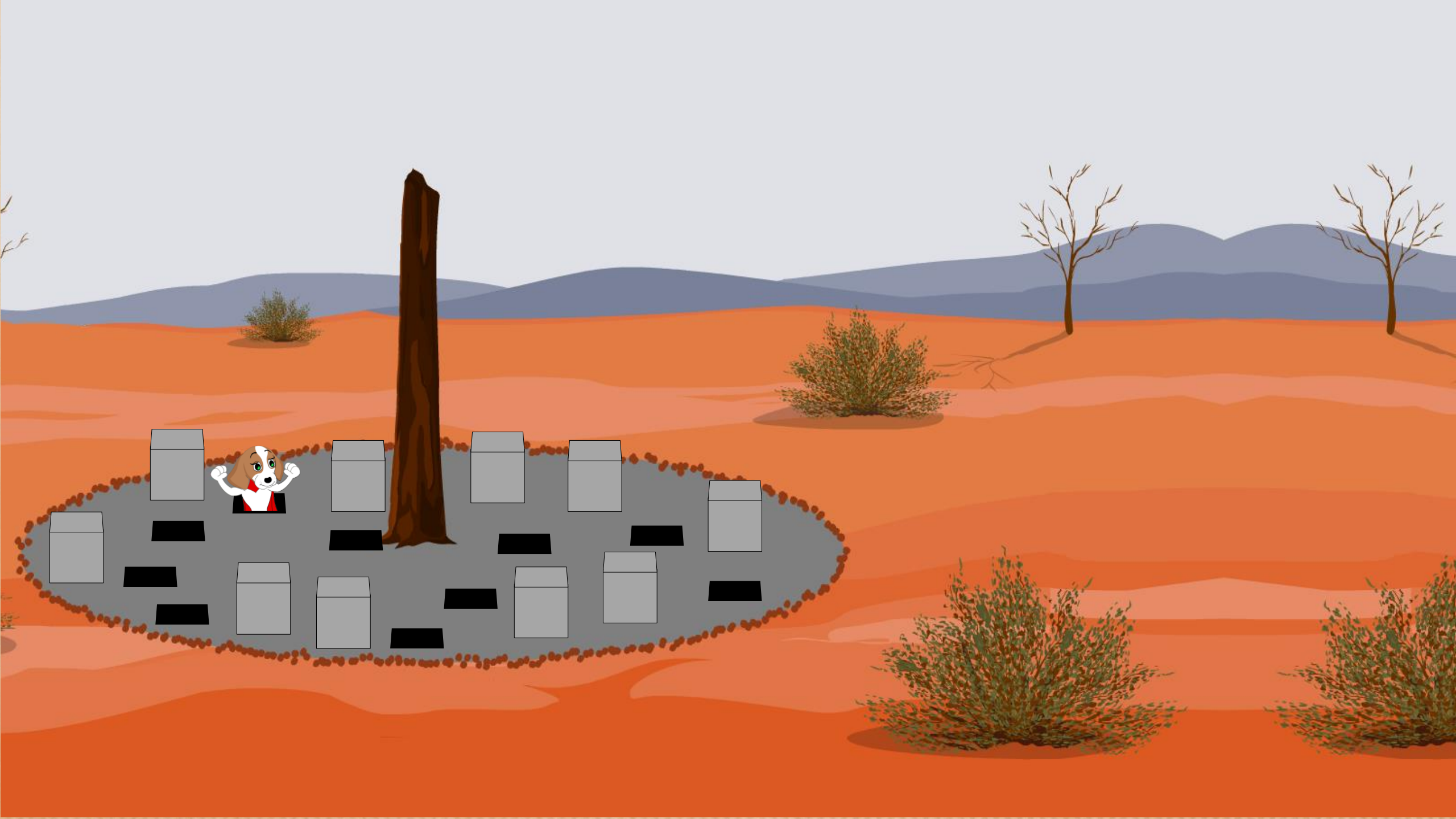


In India Children Play the Happy Harappan Positive Brick and Negative Hole Game!



In India Children Play the Happy Harappan Positive Brick and Negative Hole Game!





“

THE LAW OF ZERO +

”

WHAT WE DO TO ZERO TO MAKE AN ADDEND
THAT WE DO TO THE AUGEND TO MAKE A SUM

“

THE LAW OF ZERO +

”

WHAT WE DO TO ZERO TO MAKE AN ADDEND
THAT WE DO TO THE AUGEND TO MAKE A SUM

AUGEND + ADDEND



“ THE LAW OF ZERO + ”

WHAT WE DO TO ZERO TO MAKE AN ADDEND
THAT WE DO TO THE AUGEND TO MAKE A SUM

AUGEND + ADDEND



THE LAW OF ZERO +

WHAT WE DO TO ZERO TO MAKE AN ADDEND
THAT WE DO TO THE AUGEND TO MAKE A SUM

SUM



“

THE LAW OF CONSERVATION OF MATTER

”

“

THE LAW OF CONSERVATION OF MATTER

”

WE CAN'T DUPLICATE QUANTITIES IN THE EXPRESSION

THE MOST WE SHOULD SEE IN 'THREE PLUS TWO' IS FIVE

THE LAW OF CONSERVATION OF MATTER

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AUGEND + ADDEND = SUM



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THE LAW OF CONSERVATION OF MATTER

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AUGEND + ADDEND = SUM

For every operation there's an
equal and opposite operation



THE LAW OF CONSERVATION OF MATTER

WE CAN'T DUPLICATE QUANTITIES IN THE EXPRESSION

THE MOST WE SHOULD SEE IN 'THREE PLUS TWO' IS FIVE

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THE LAW OF CONSERVATION OF MATTER

WE CAN'T DUPLICATE QUANTITIES IN THE EXPRESSION

THE MOST WE SHOULD SEE IN 'THREE PLUS TWO' IS FIVE

AUGEND + ADDEND = SUM



LAW OF ZERO +

- WHAT WE DO TO ZERO
TO MAKE OUR B

$$A + B = C$$

AUGEND + ADDEND = SUM

0

B

--	--

Direct Variation →

A

C

LAW OF ZERO +

- WHAT WE DO TO ZERO TO MAKE OUR B
- THAT WE DO TO A TO MAKE OUR C

$$A + B = C$$

AUGEND + ADDEND = SUM

0

B

--	--

Direct Variation →

A

--	--	--

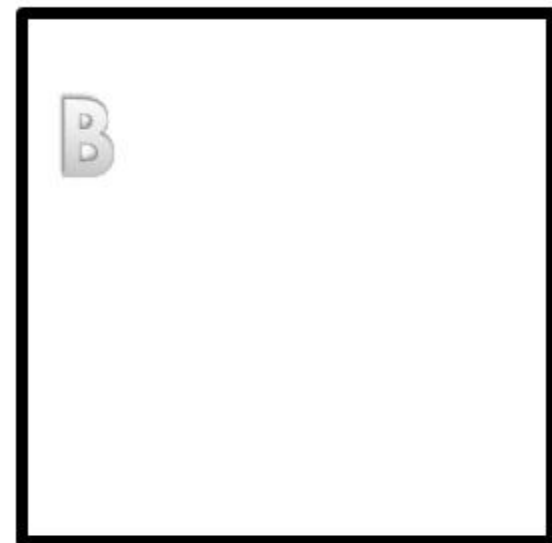
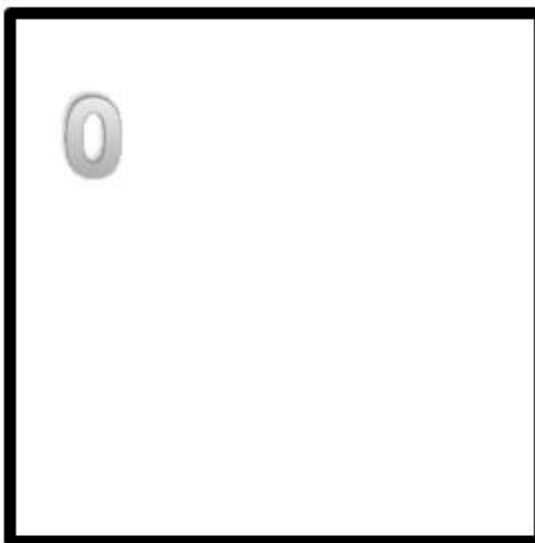
C

LAW OF ZERO +

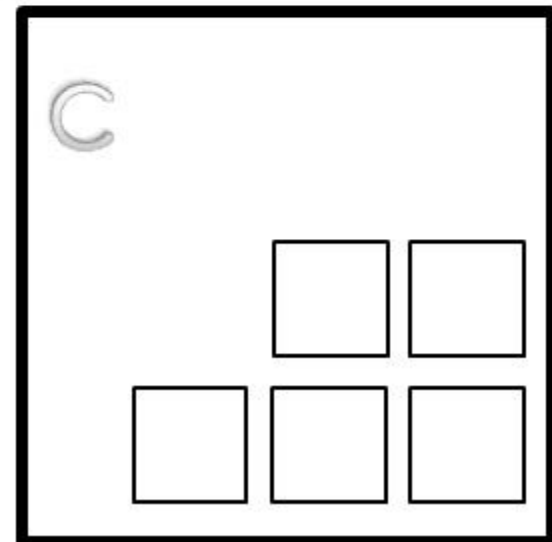
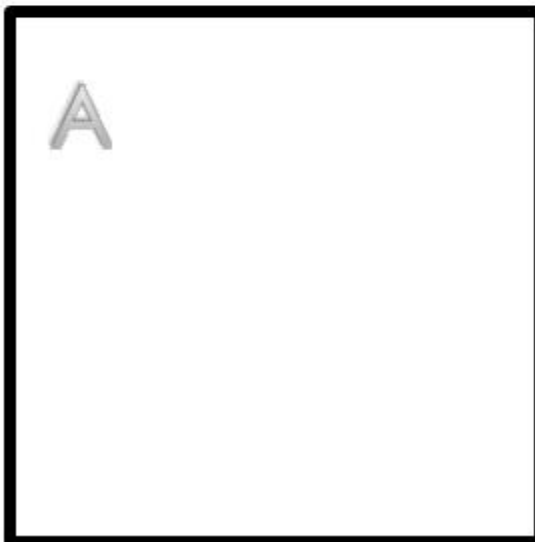
- WHAT WE DO TO ZERO TO MAKE OUR B
- THAT WE DO TO A TO MAKE OUR C

$$A + B = C$$

AUGEND + ADDEND = SUM



Direct Variation →



“

THE LAW OF ZERO —

”

WHAT WE DO TO THE SUBTRAHEND TO MAKE ZERO
THAT WE DO TO THE MINUEND TO MAKE A DIFFERENCE

THE LAW OF ZERO –

WHAT WE DO TO THE SUBTRAHEND TO MAKE ZERO
THAT WE DO TO THE MINUEND TO MAKE A DIFFERENCE

MINUEND – SUBTRAHEND



THE LAW OF ZERO –

WHAT WE DO TO THE SUBTRAHEND TO MAKE ZERO
THAT WE DO TO THE MINUEND TO MAKE A DIFFERENCE

MINUEND – SUBTRAHEND

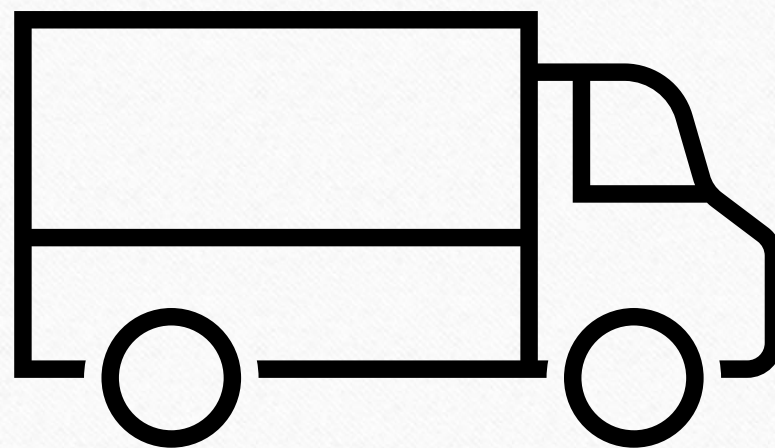
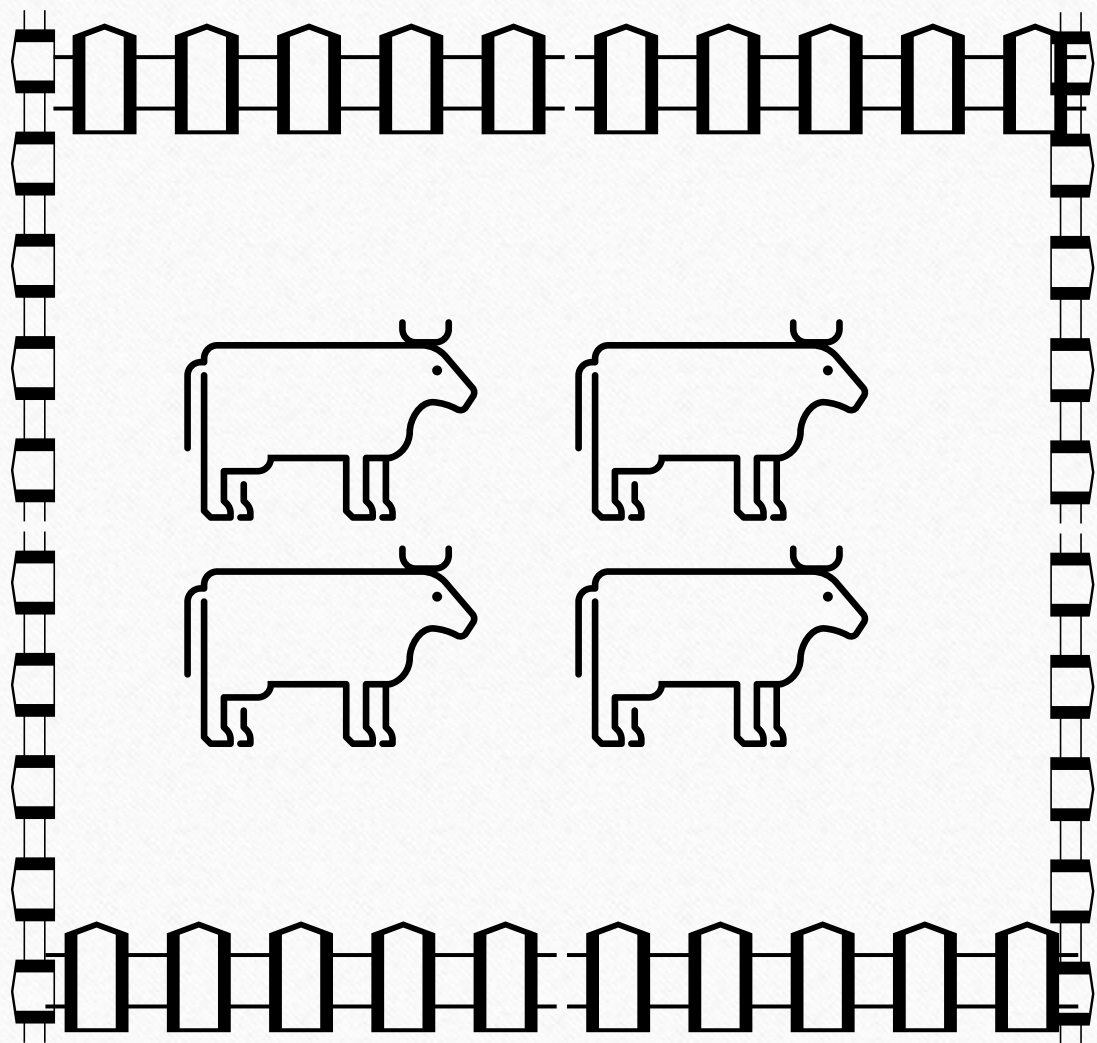


THE LAW OF ZERO –

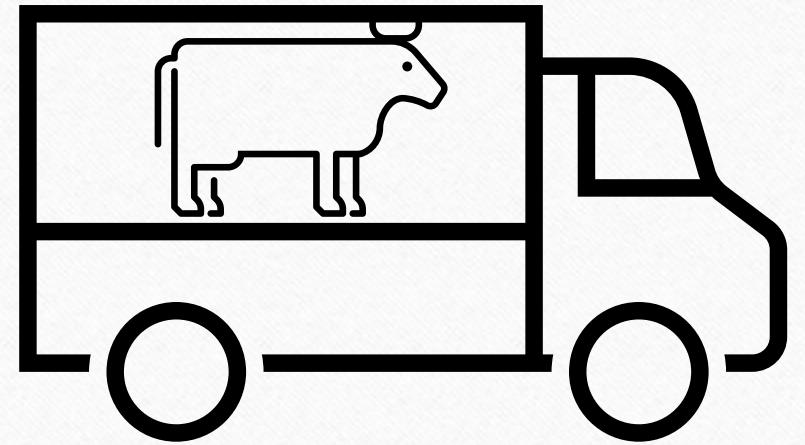
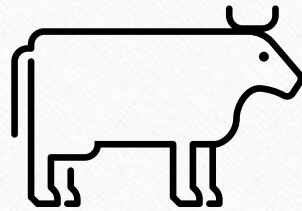
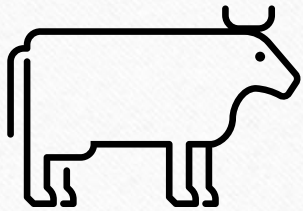
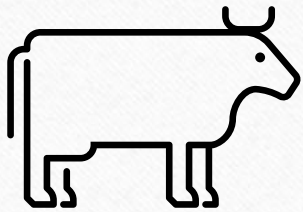
WHAT WE DO TO THE SUBTRAHEND TO MAKE ZERO
THAT WE DO TO THE MINUEND TO MAKE A DIFFERENCE
DIFFERENCE



**NOTE: Somewhere
else, two were added.**



1 SUBTRACTED



1 ADDED

LAW OF ZERO –

- WHEN WE SUBTRACT **B**
TO MAKE OUR **ZERO**

$$A - B = C$$

MINUEND – SUBTRAHEND = DIFFERENCE

B

0

Direct Variation →

A

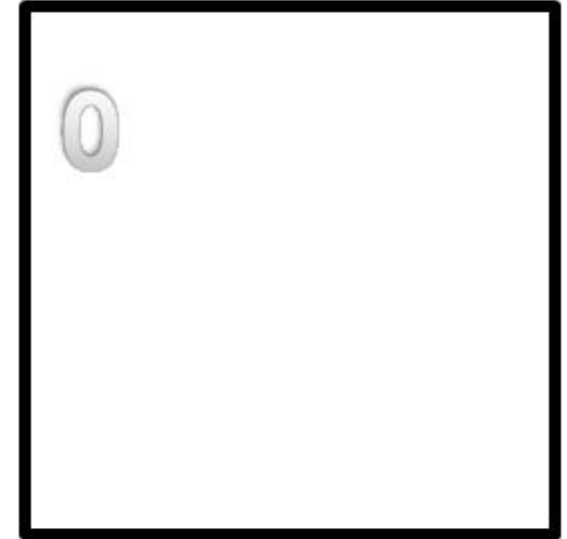
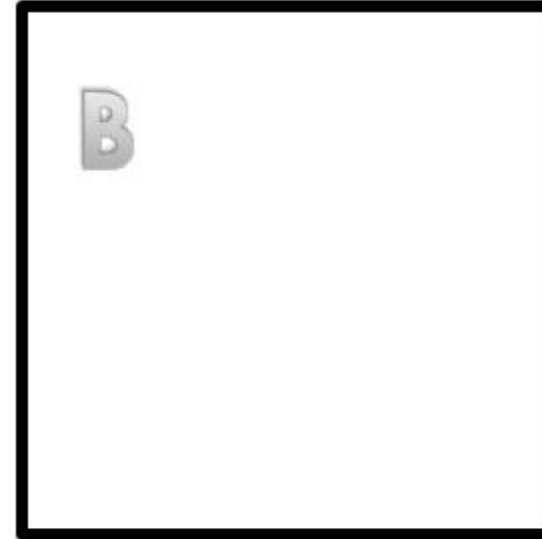
C

LAW OF ZERO –

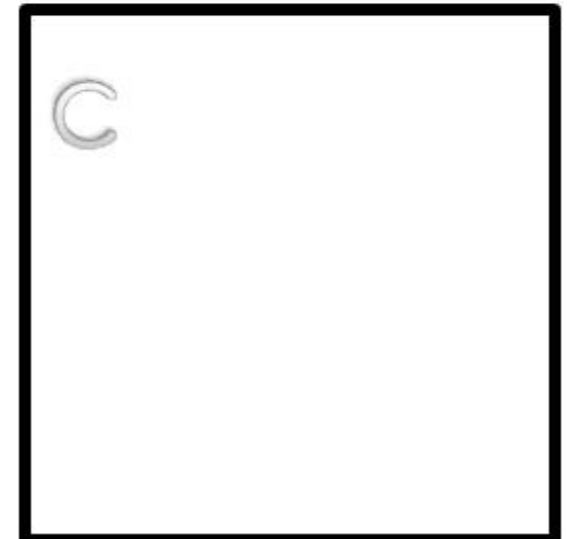
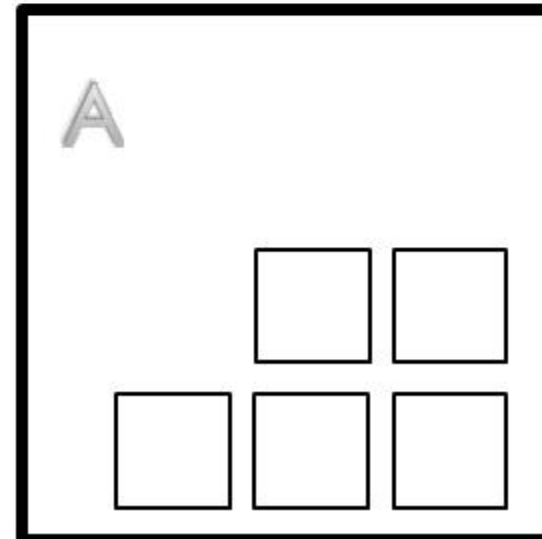
- WHEN WE SUBTRACT **B** TO MAKE OUR **ZERO**
- THEN WE REPEAT ON **A** SO **C** IS OUR HERO

$$A - B = C$$

MINUEND – SUBTRAHEND = DIFFERENCE



Direct Variation →



LAW OF ZERO –

- WHEN WE SUBTRACT **B** TO MAKE OUR **ZERO**
- THEN WE REPEAT ON **A** SO **C** IS OUR HERO

$$A - B = C$$

MINUEND – SUBTRAHEND = DIFFERENCE

B

0

Direct Variation →

A

C



“ THE LAW OF ZERO –

”
WHAT WE DO TO THE SUBTRAHEND TO MAKE ZERO
THAT WE DO TO THE MINUEND TO MAKE A DIFFERENCE

MINUEND – SUBTRAHEND = DIFFERENCE
2 negatives **minus** 4 negatives



THE LAW OF ZERO –

WHAT WE DO TO THE SUBTRAHEND TO MAKE ZERO
THAT WE DO TO THE MINUEND TO MAKE A DIFFERENCE

MINUEND – SUBTRAHEND = DIFFERENCE
2 negatives **minus** 4 negatives

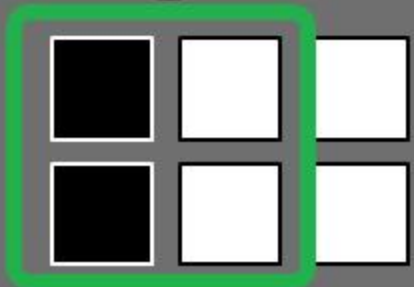


THE LAW OF ZERO –

WHAT WE DO TO THE SUBTRAHEND TO MAKE ZERO
THAT WE DO TO THE MINUEND TO MAKE A DIFFERENCE

MINUEND – SUBTRAHEND = DIFFERENCE

2 negatives **minus** 4 negatives



THE LAW OF ZERO –

WHAT WE DO TO THE SUBTRAHEND TO MAKE ZERO
THAT WE DO TO THE MINUEND TO MAKE A DIFFERENCE

DIFFERENCE

2 negatives **minus** 4 negatives



“

THE LAW OF ONE ×

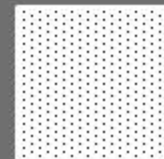
”

WHAT WE DO TO ONE TO MAKE A MULTIPLIER
THAT WE DO TO THE MULTIPLICAND TO MAKE A PRODUCT

THE LAW OF ONE ×

WHAT WE DO TO ONE TO MAKE A MULTIPLIER
THAT WE DO TO THE MULTIPLICAND TO MAKE A PRODUCT

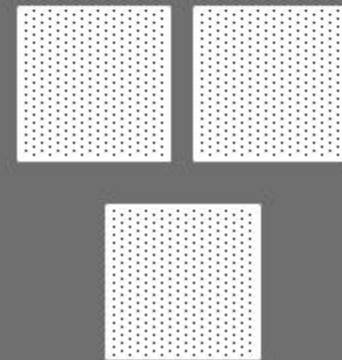
MULTIPLICAND × MULTIPLIER



THE LAW OF ONE ×

WHAT WE DO TO ONE TO MAKE A MULTIPLIER
THAT WE DO TO THE MULTIPLICAND TO MAKE A PRODUCT

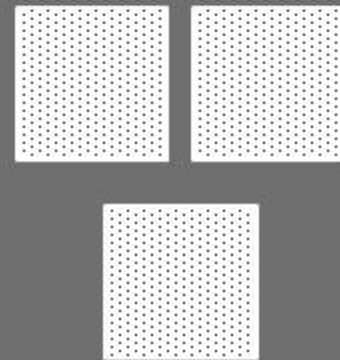
MULTIPLICAND × MULTIPLIER



THE LAW OF ONE ×

WHAT WE DO TO ONE TO MAKE A MULTIPLIER
THAT WE DO TO THE MULTIPLICAND TO MAKE A PRODUCT

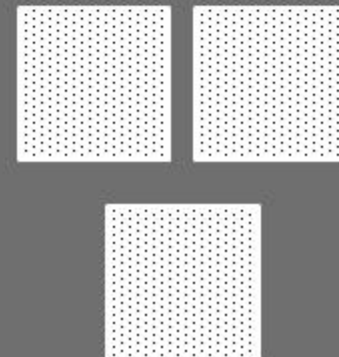
MULTIPLICAND × MULTIPLIER



THE LAW OF ONE ×

WHAT WE DO TO ONE TO MAKE A MULTIPLIER
THAT WE DO TO THE MULTIPLICAND TO MAKE A PRODUCT

PRODUCT

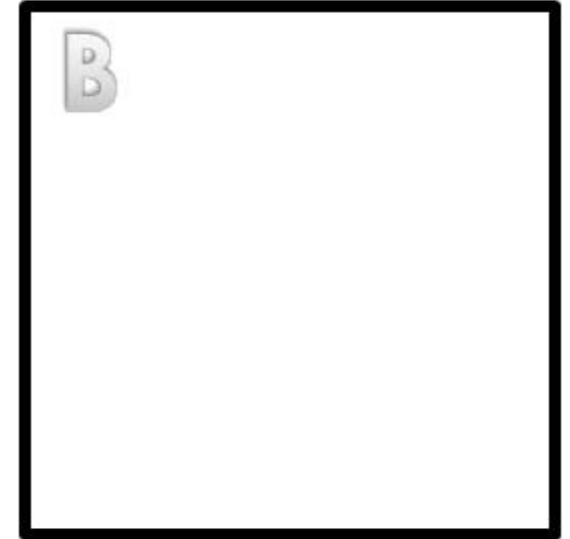
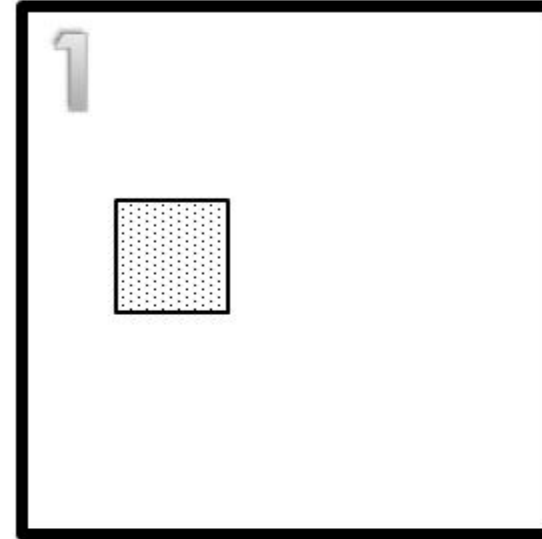


LAW OF ONE ×

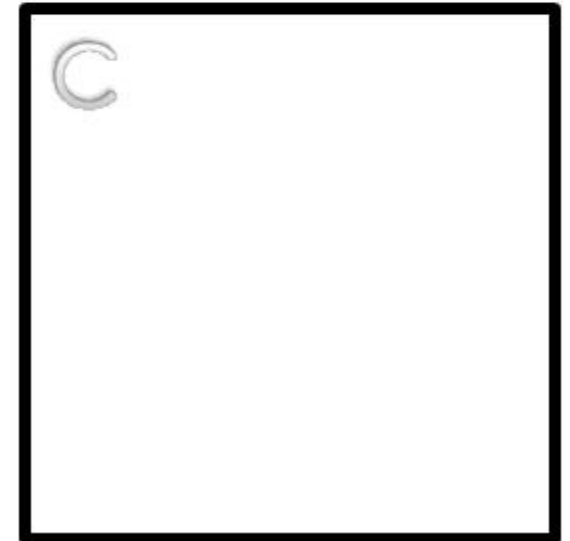
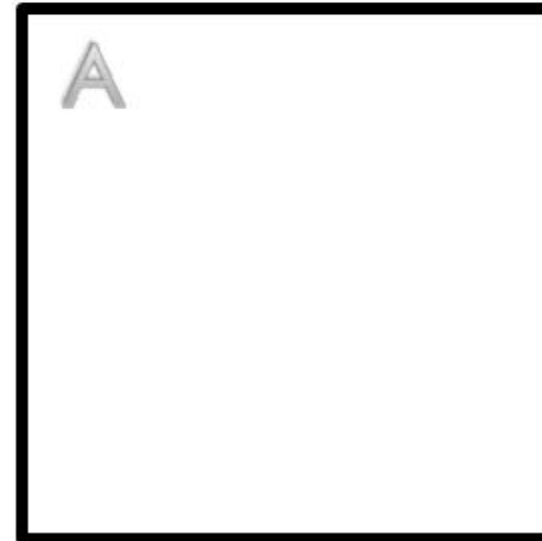
- MULTI-PLAYING CAN BE FUN YOU C
- DO TO A AS ONE MADE B

$$A \times B = C$$

MULTPLICAND × MULTIPLIER = PRODUCT



Proportional Covariation →

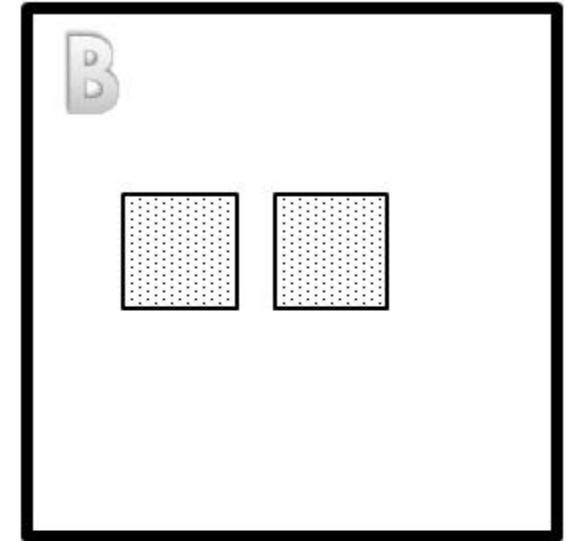
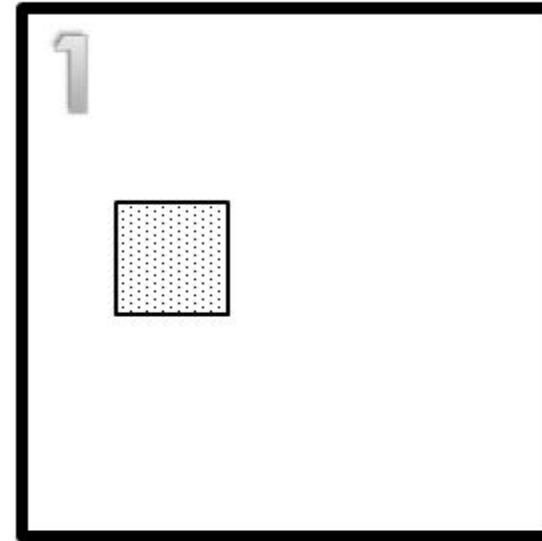


LAW OF ONE ×

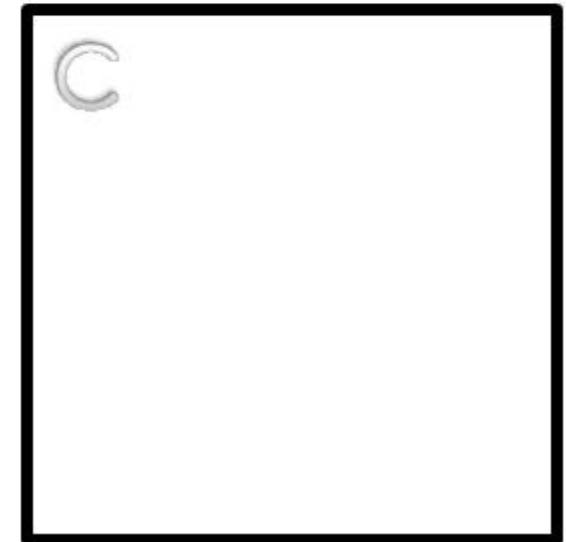
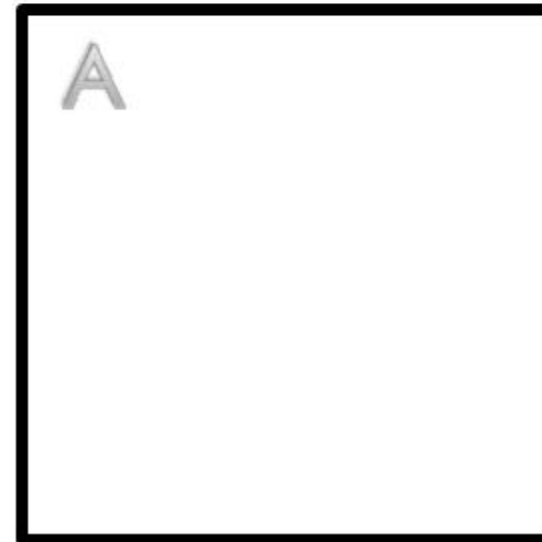
- MULTI-PLAYING CAN BE FUN YOU **C**
- DO TO **A** AS **ONE** MADE **B**

$$A \times B = C$$

MULTPLICAND × MULTIPLIER = PRODUCT



Proportional Covariation →

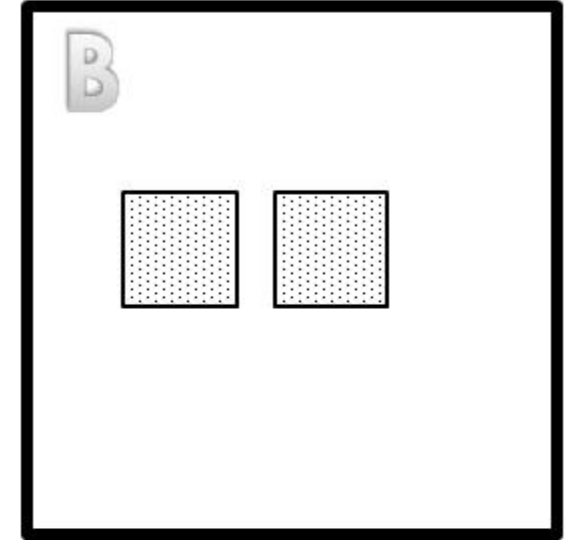
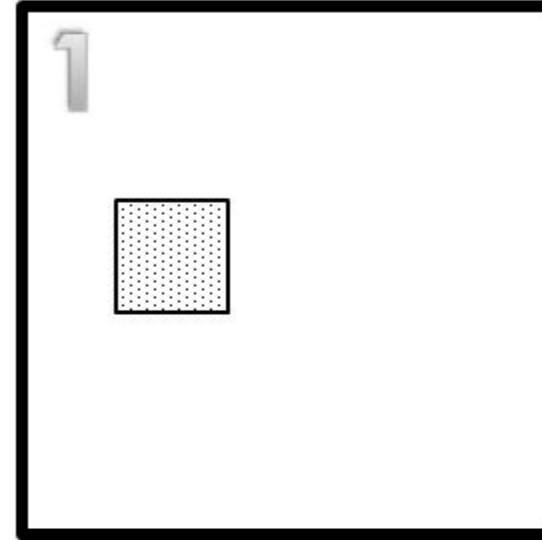


LAW OF ONE ×

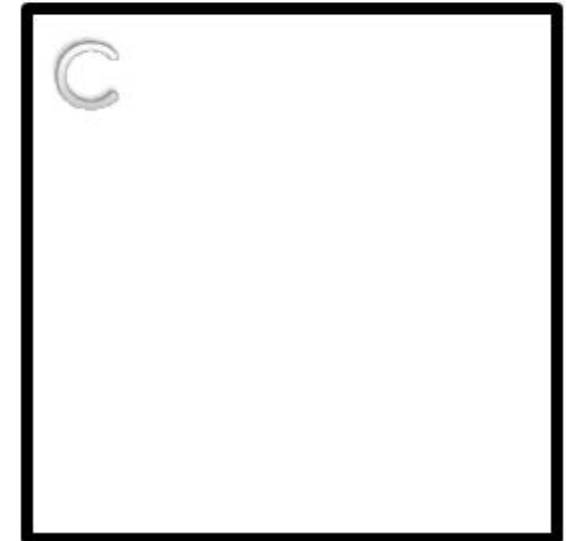
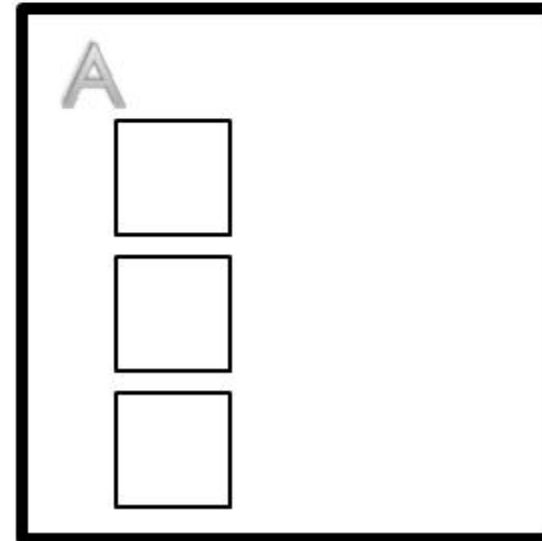
- MULTI-PLAYING CAN BE FUN YOU **C**
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MULTPLICAND × MULTIPLIER = PRODUCT



Proportional Covariation →

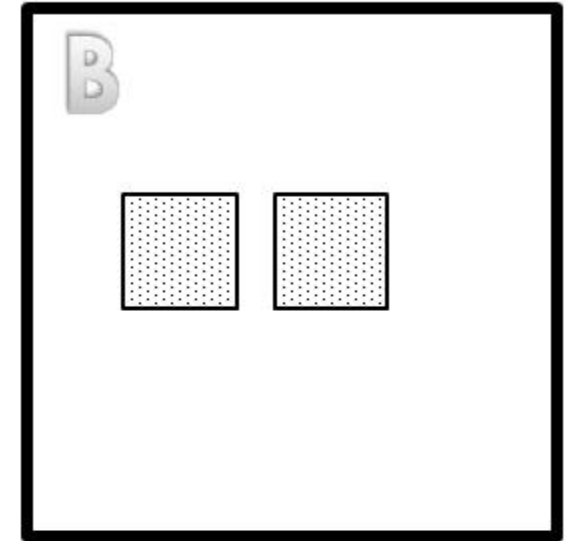
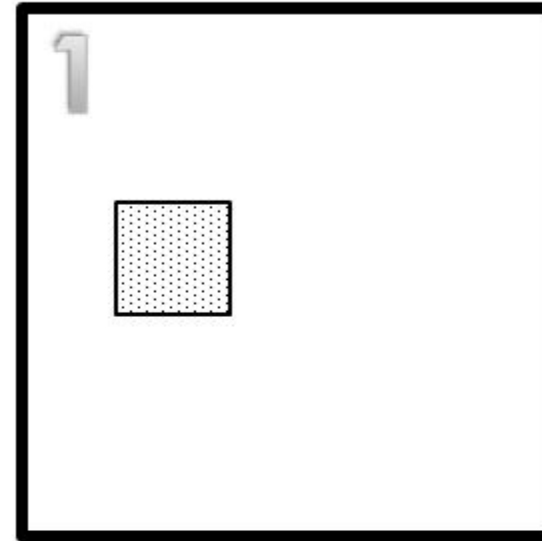


LAW OF ONE ×

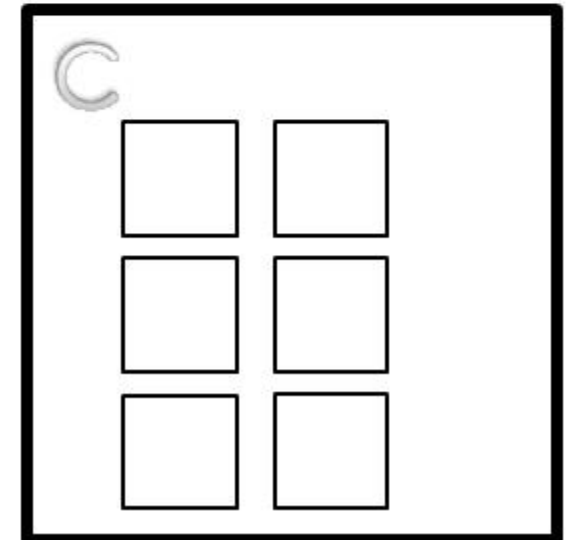
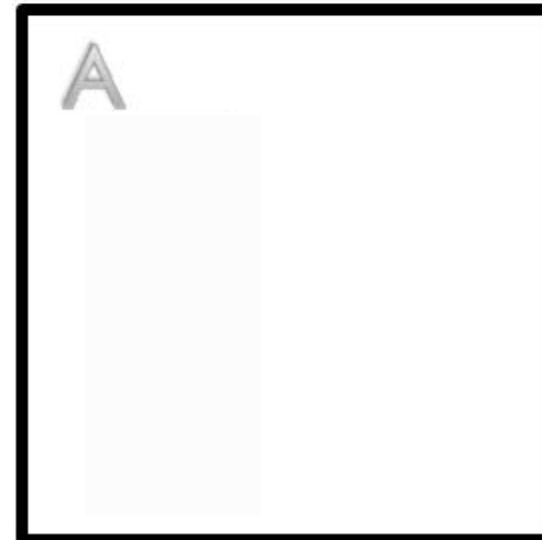
- MULTI-PLAYING CAN BE FUN YOU **C**
- DO TO **A** AS **ONE** MADE **B**

$$A \times B = C$$

MULTPLICAND × MULTIPLIER = PRODUCT



Proportional Covariation →



The Podometric Multi-Play Song

Traditional Arrangement. Lyrics by Jonathan J. Crabtree @jcrabtree

$$a \times b = c$$

$$a \div b = c$$

The musical score consists of three staves, each with a treble clef and a 4/4 time signature. The melody is composed of eighth and quarter notes. The lyrics are written below the notes, with mathematical symbols a , b , and c italicized. The first staff ends with a double bar line.

Mul-ti ply-ing can be fun you c Do to a as 1 made b

Division you c is lots of fun Do to a as b made 1

Mul-ti PLAY-ing can be fun you c Do to a as 1 made b

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ShareAlike 4.0 International License. More Maths @ www.podometric.in

$$\begin{array}{ccccc} \text{a} & \times & \text{b} & = & \text{c} \\ \text{Multiplicand} & & \text{Multiplier} & & \text{Product} \end{array}$$
$$1 : B :: A : C$$
$$B : 1 :: A : C$$

♪ ♪ Multiplying can be fun you'll c
 ♪ ♪ Do to a as 1 made b

$$\begin{array}{ccccc} a & \div & b & = & c \\ \text{Dividend} & & \text{Divisor} & & \text{Quotient} \end{array}$$

♪♪ Division you'll c is lots of fun
 ♪♪ Do to a as b made 1

Thank You for Watching!

Jonathan J. Crabtree

www.podometic.in

www.jonathancrabtree.com