



Mathematical Storytelling

LaSalle MathsConf, 23 June 2018

Philipp Legner

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

SINE RULE

$$\frac{a}{\sin \hat{A}} = \frac{b}{\sin \hat{B}} = \frac{c}{\sin \hat{C}}$$

COSINE RULE

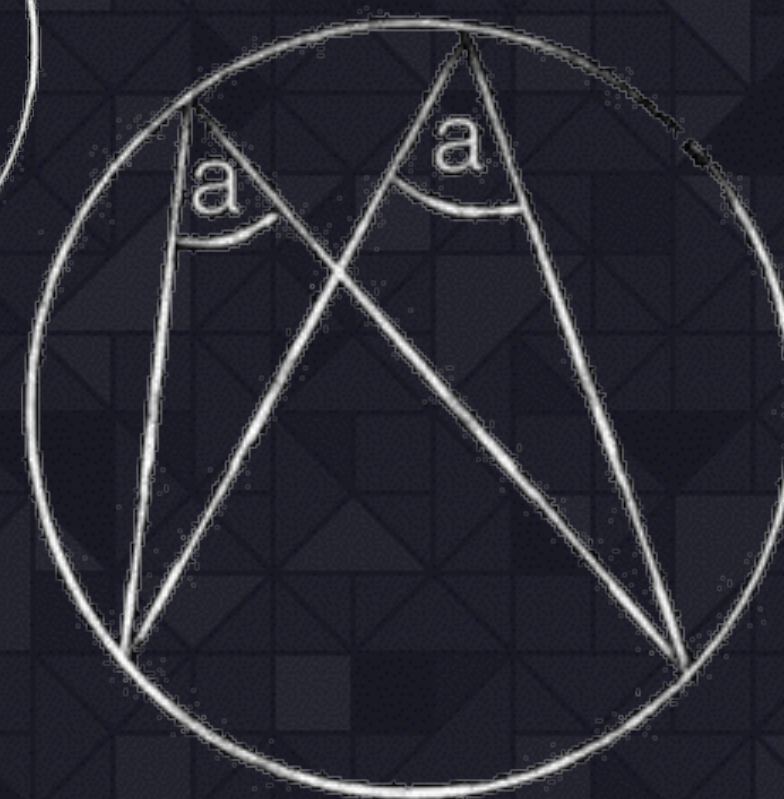
$$a^2 = b^2 + c^2 - 2bc \cos \hat{A}$$

OR $\cos \hat{A} = \frac{b^2 + c^2 - a^2}{2bc}$

$$x^a \times x^b = x^{a+b}$$

$$(x^a)^b = x^{a \times b} = x^{ab}$$

$$x^a \div x^b = x^{a-b}$$



$$\frac{d}{dx}(\sinh(x)) = \cosh(x) \frac{dx}{dx}$$

$$\frac{d}{dx}(\cosh(x)) = \sinh(x) \frac{dx}{dx}$$

$$\frac{d}{dx}(\tanh(x)) = \text{sech}^2(x) \frac{dx}{dx}$$

$$\frac{d}{dx}(\coth(x)) = -\text{csch}^2(x) \frac{dx}{dx}$$

$$\frac{d}{dx}(\text{sech}(x)) = -\text{sech}(x) \tanh(x) \frac{dx}{dx}$$

$$\frac{d}{dx}(\text{csch}(x)) = -\text{csch}(x) \coth(x) \frac{dx}{dx}$$

$$\frac{d}{dx}(\sinh^{-1}(x)) = \frac{1}{\sqrt{x^2 + 1}} \frac{dx}{dx}$$

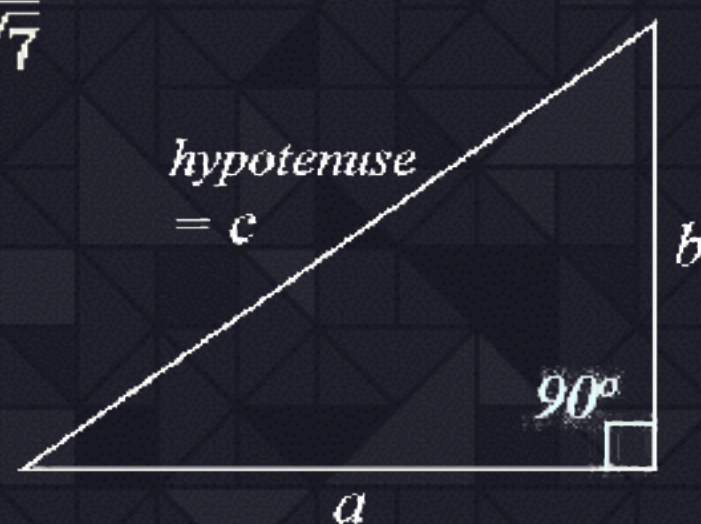
Mathematics

$$\frac{12}{\sqrt{15} - \sqrt{7}} = \frac{12}{\sqrt{15} - \sqrt{7}} \cdot \frac{\sqrt{15} + \sqrt{7}}{\sqrt{15} + \sqrt{7}}$$

$$= \frac{12\sqrt{15} + 12\sqrt{7}}{15 - 7}$$

$$= \frac{12\sqrt{15} + 12\sqrt{7}}{8}$$

$$= \frac{3\sqrt{15} + 3\sqrt{7}}{2}$$



$$c^2 = a^2 + b^2$$



$$a + b + c = 180^\circ$$



$$a + b + c = 180^\circ$$



$$a + b + c + d = 360^\circ$$

SOH



sine

$$\sin = \frac{o}{h}$$

CAH



cosine

$$\cos = \frac{a}{h}$$

TOA

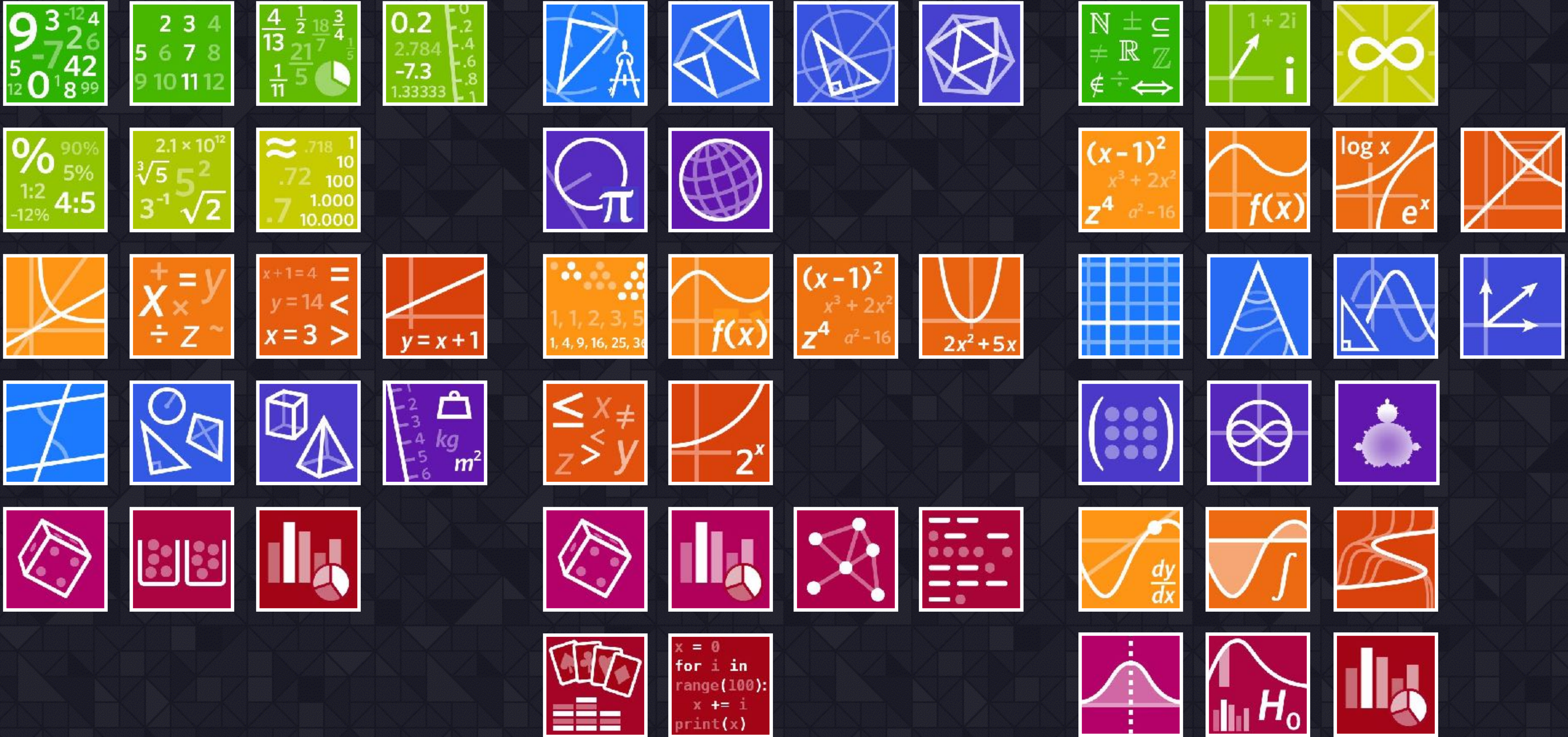


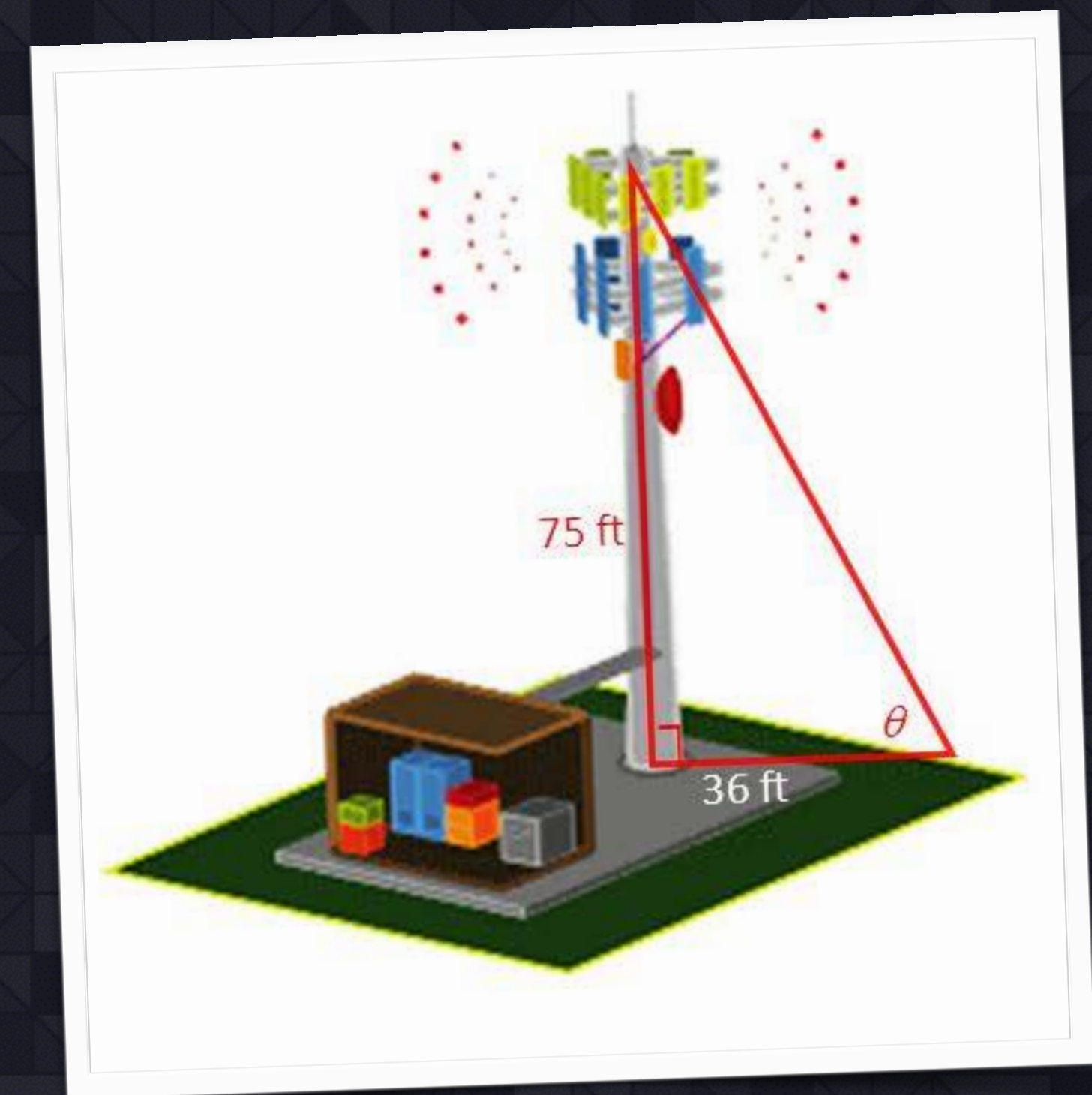
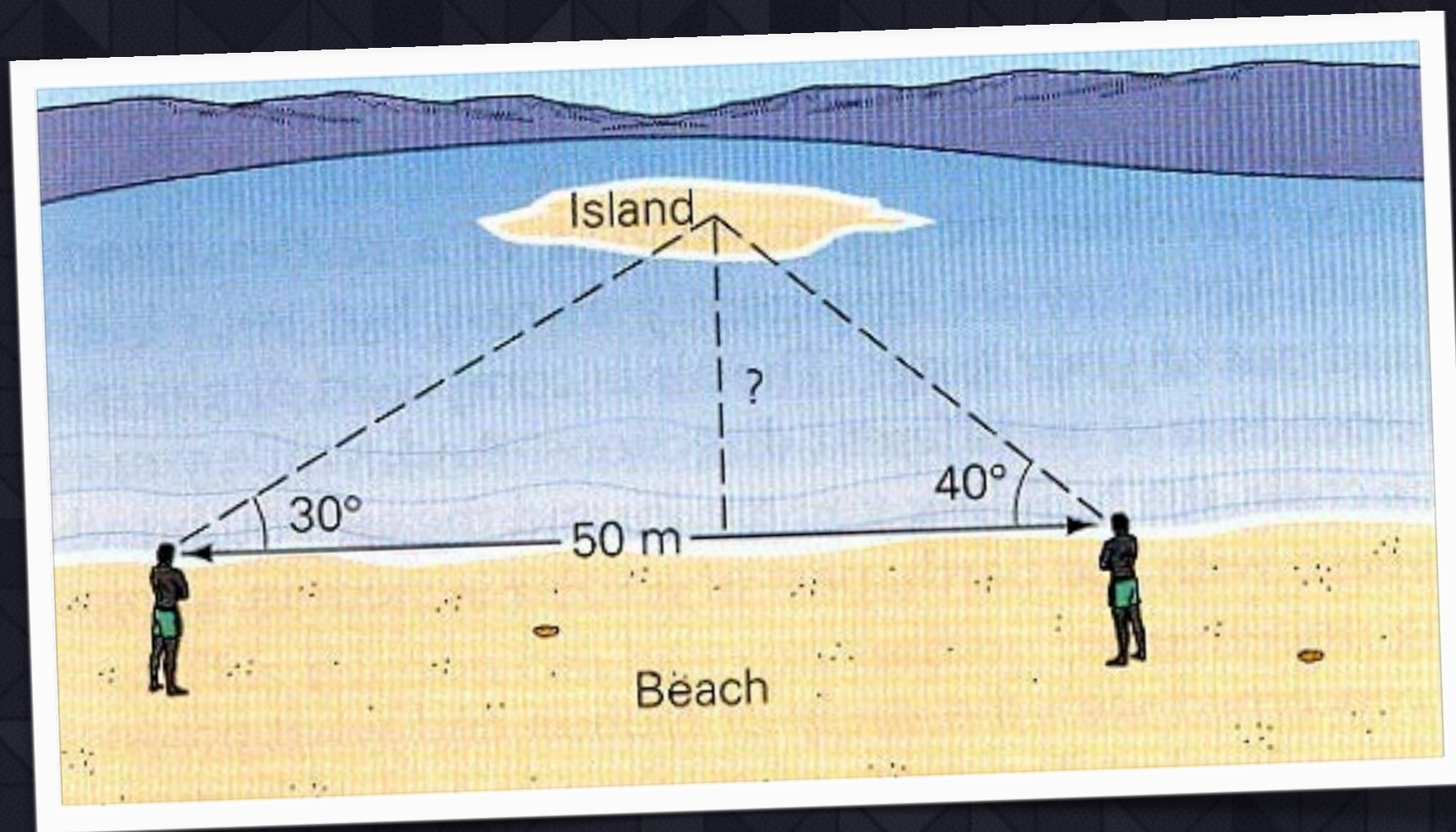
tangent

$$\tan = \frac{o}{a}$$

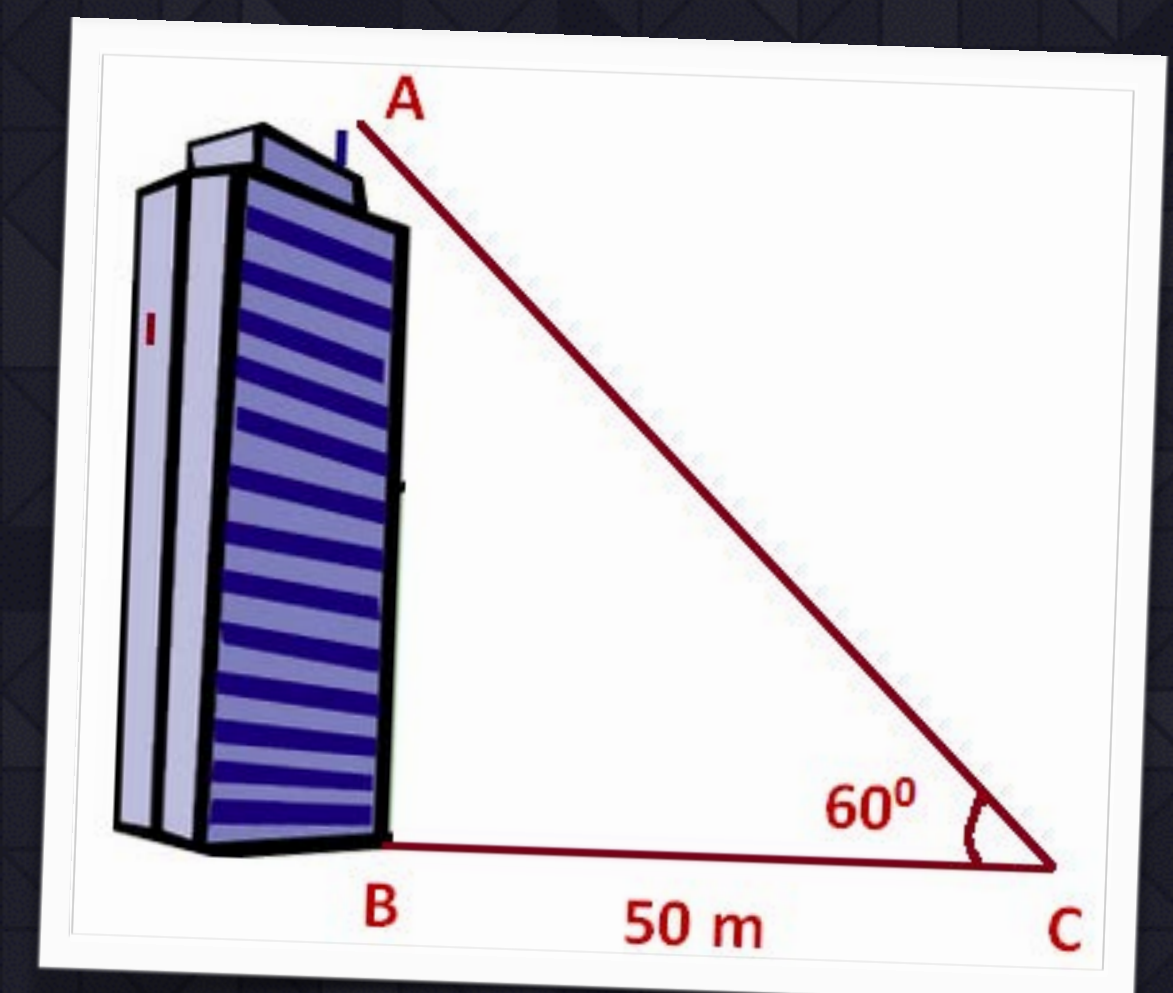
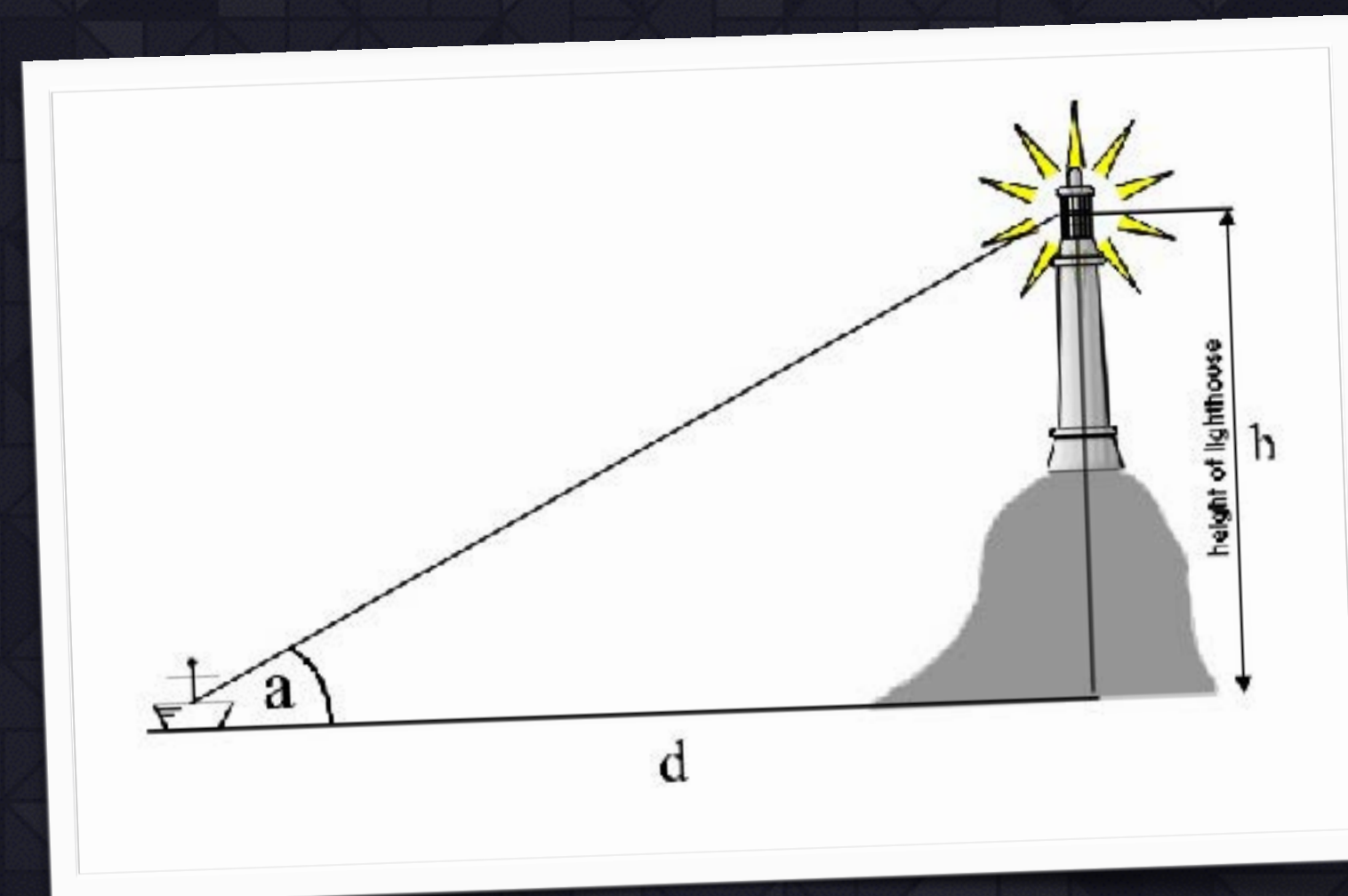
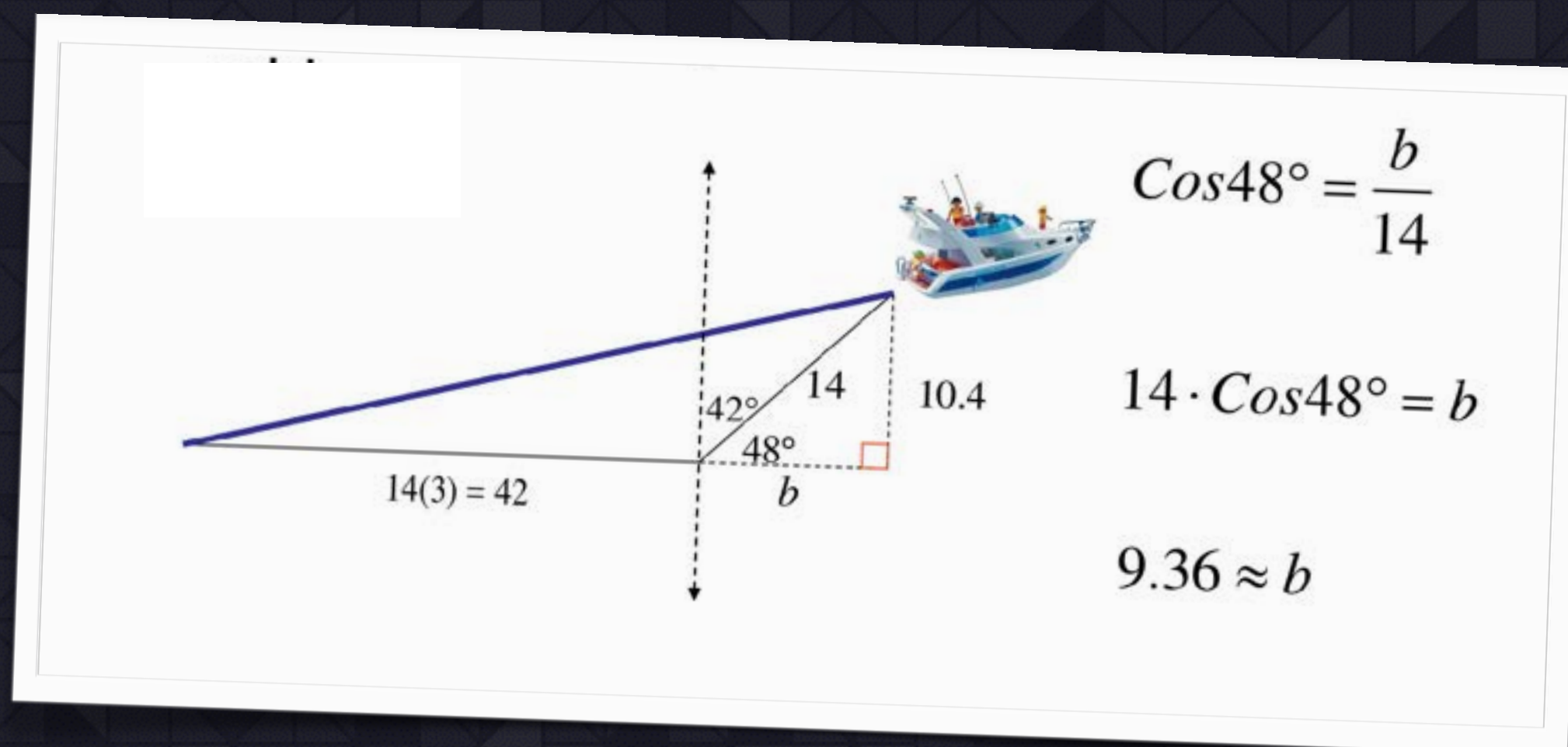
$A \cup B$: "A union B" i.e. A or B or both

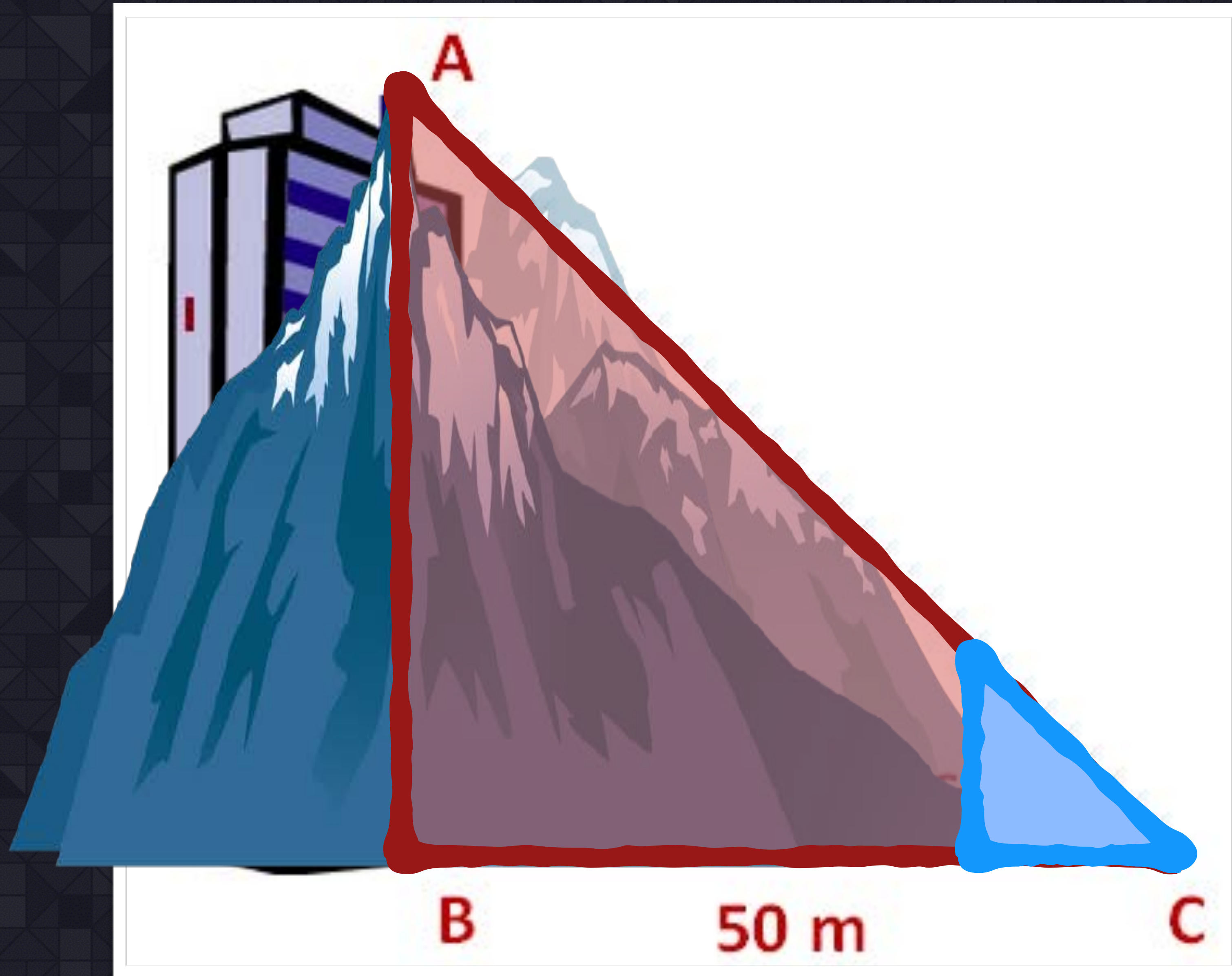
$A \cap B$: "A intersection B" i.e. both A and B





Trigonometry







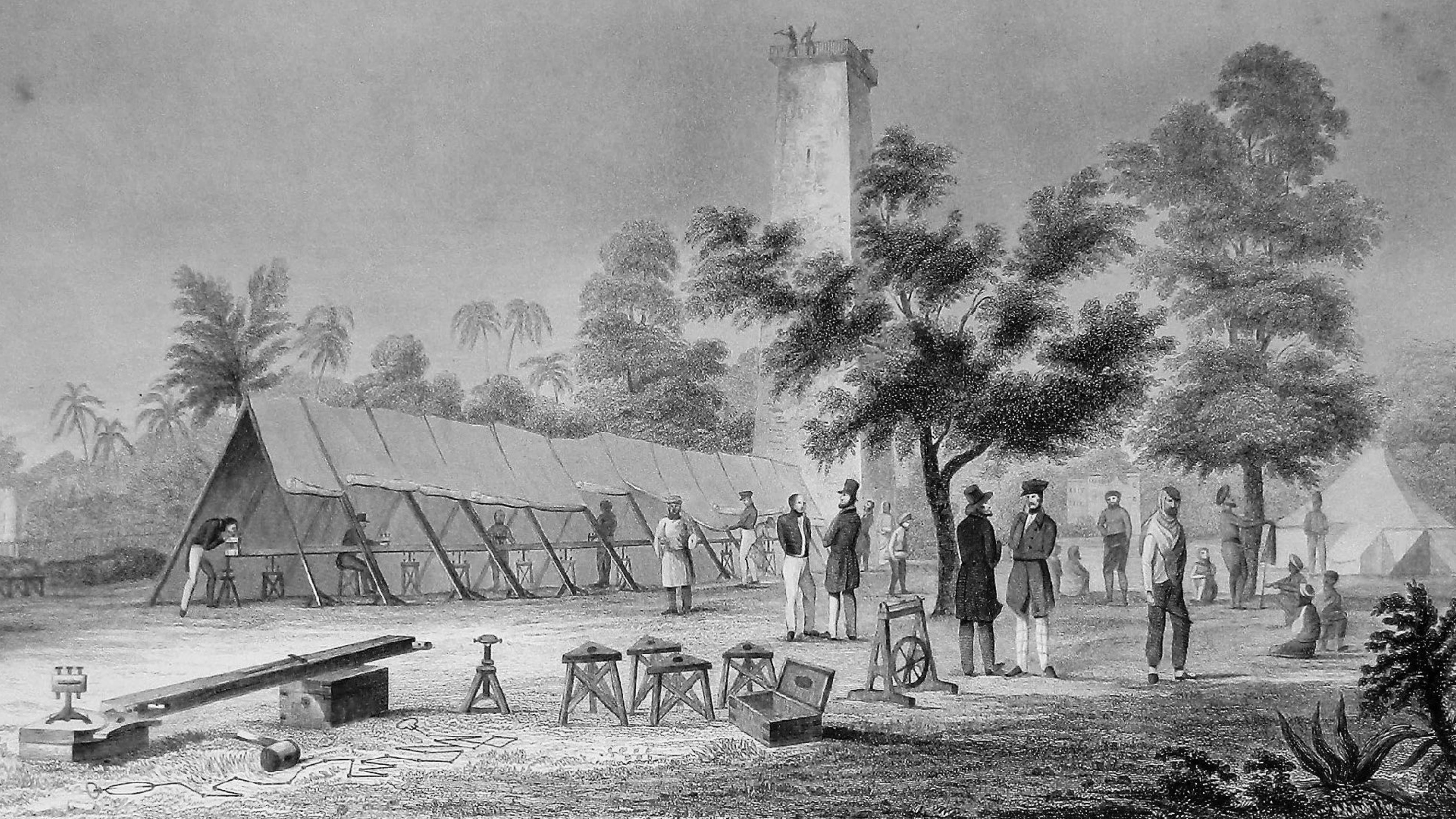


INDEX CHART
TO THE
GREAT TRIGONOMETRICAL SURVEY
OF
INDIA

SHOWING COLONEL LAMBTON'S NET WORK OF TRIANGULATION IN SOUTHERN INDIA.
THE MERIDIONAL AND LONGITUDINAL CHAINS OF PRINCIPAL TRIANGLES,
THE BASE LINES MEASURED WITH THE GOLD'S APPARATUS,
THE LINES OF THE SPIRIT LEVELLING OPERATIONS,
THE ASTRONOMICAL PENDULUM & TIDAL STATIONS,
THE LONGITUDINAL ARCS,
AND THE SECONDARY TRIANGULATION TO FIX THE PEAKS OF
THE HIMALAYAN & THE SULIMAN RANGES,
AND THE POSITIONS OF BANGGON, KANDANAR &c.
(Completed to 1st October, 1870.)

Scale 1 Inch = 60 Miles or 96 Kilometres







Photogravure

Survey of India Offices, Calcutta, December, 1903.

NOJLI TOWER.

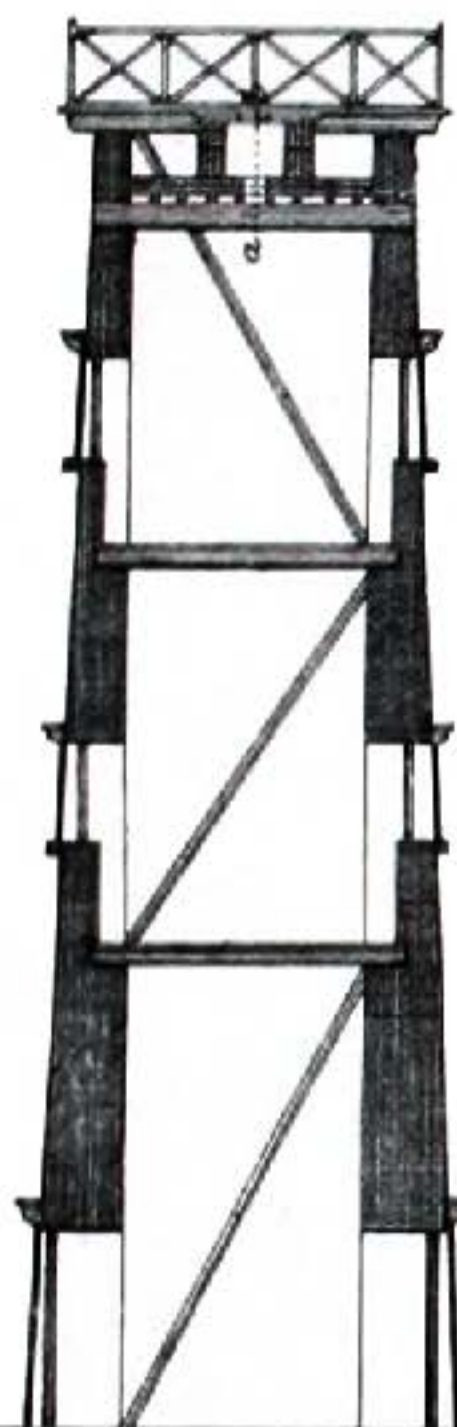
A STATION OF THE GREAT TRIGONOMETRICAL SURVEY BUILT IN THE PLAINS OF UPPER INDIA NEAR ROOREE.
AND FROM WHICH THE HIMALAYAN PEAKS OF BADRINATH, KEDARNATH, JAOLLI AND BANDARPUNCH HAVE BEEN OBSERVED

FROM A PHOTO BY C. C. SIMONS.

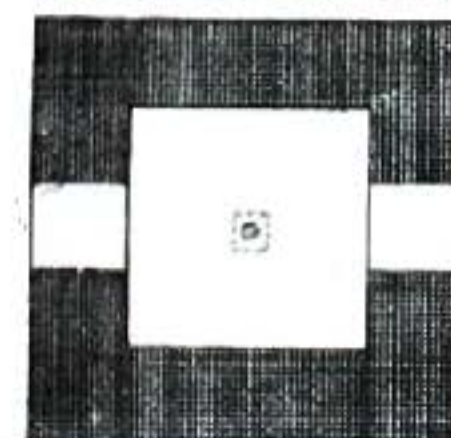
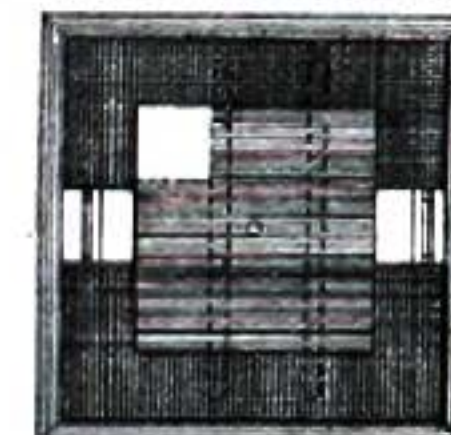
ELEVATION, SECTIONS & PLANS.

Illustrative of Colonel Everest's Towers on the Great Arc.

Transverse Section

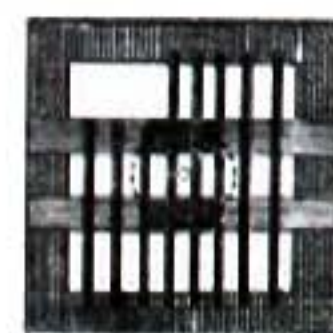


Plan of Platform



Plan of 1st Story
Ground Plan

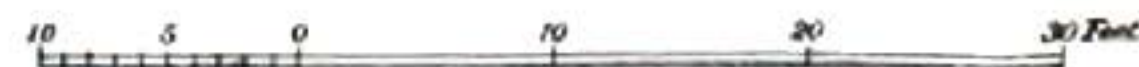
Elevation



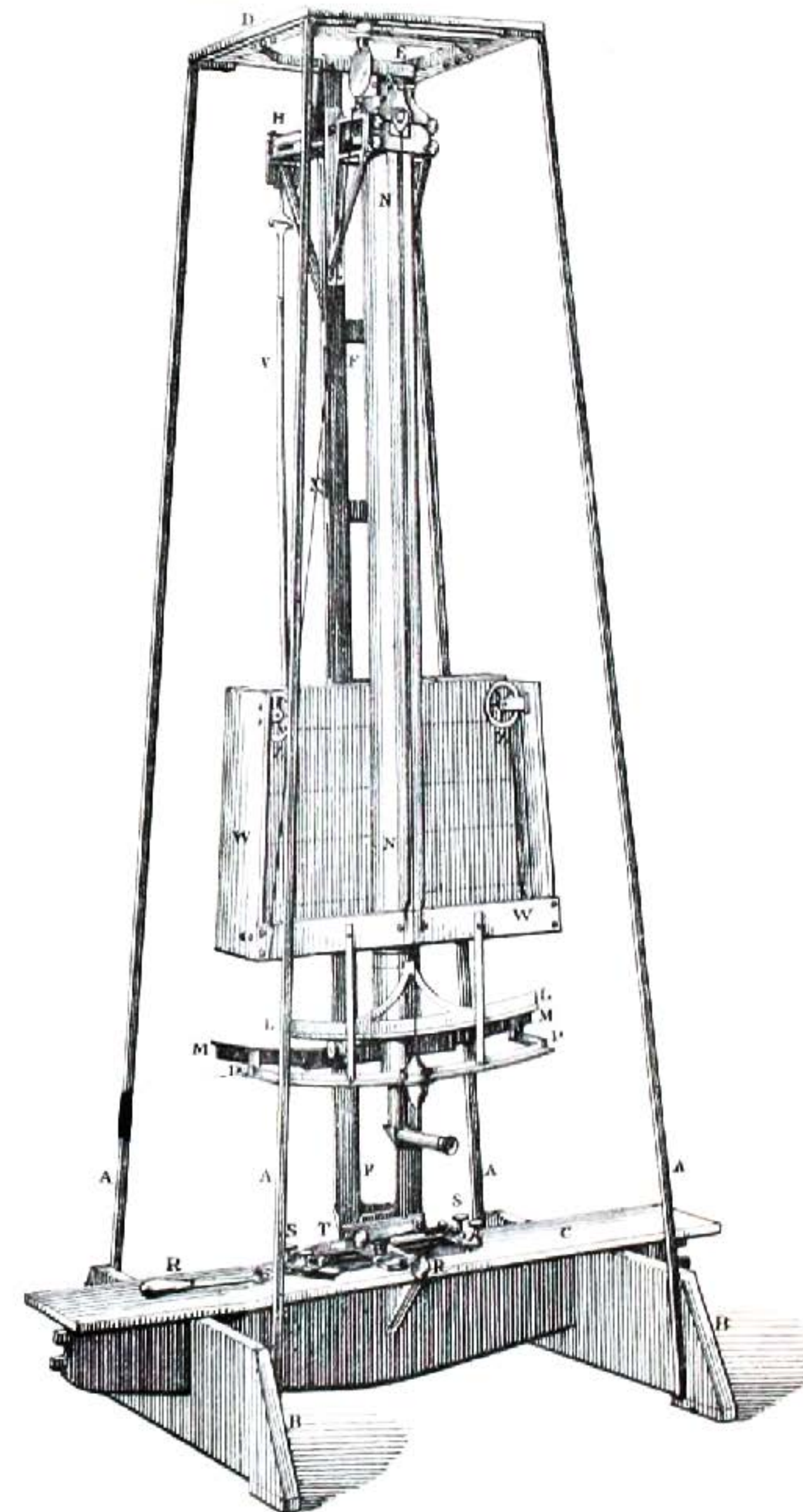
Plan of Platform showing joists.



Section on line a-b



OLD ZENITH SECTOR, (RAMSDEN'S)





Radhanath Sikdar





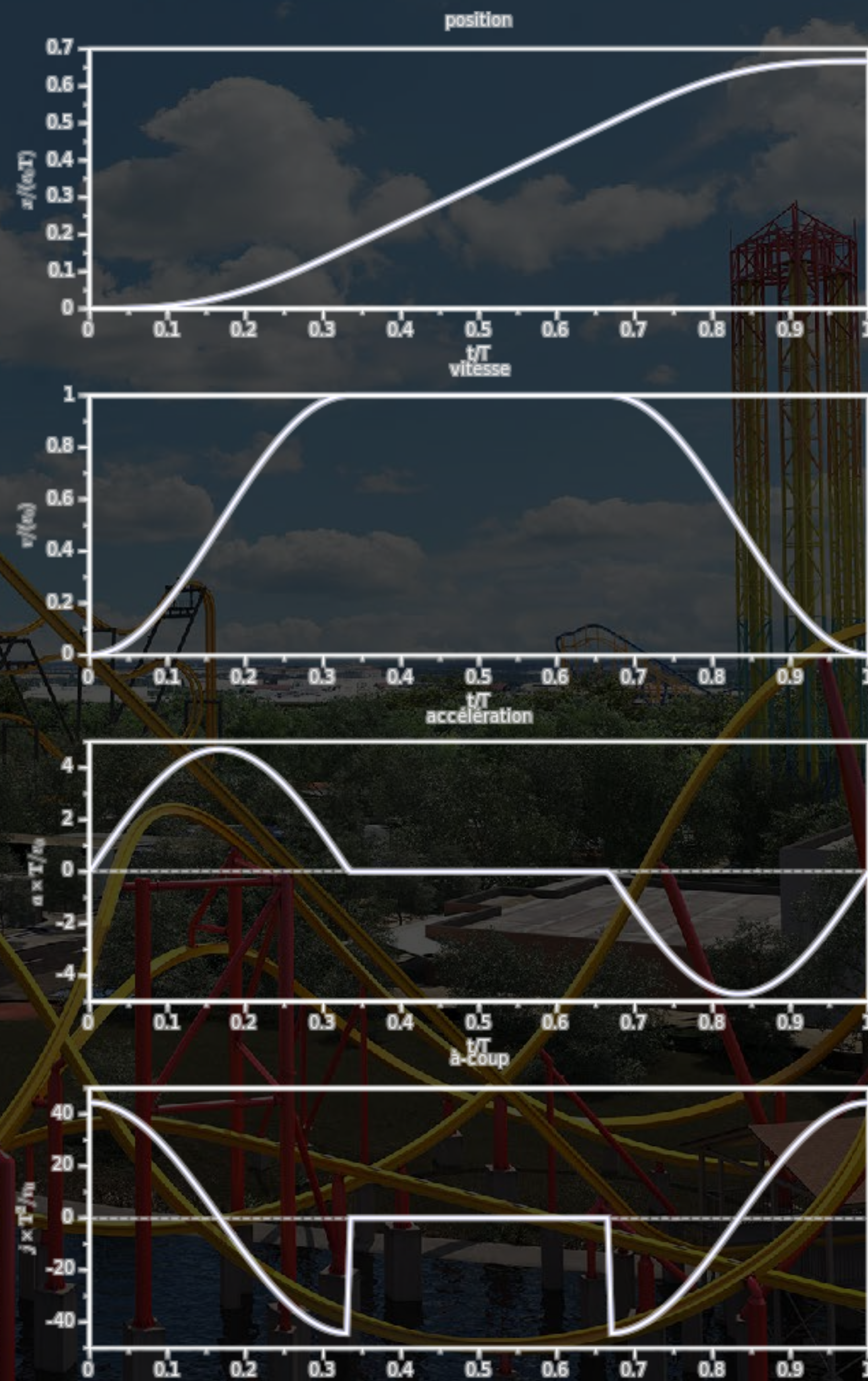
Football





Roller Coasters

Roller Coasters





Cicadas

A close-up photograph of a cicada resting on a large green leaf. The cicada's wings are spread, showing intricate patterns of veins and colors including brown, grey, and hints of blue. Two semi-transparent colored circles are overlaid on the image: a light green circle on the left containing the number '13' and a light orange circle on the right containing the number '17'.

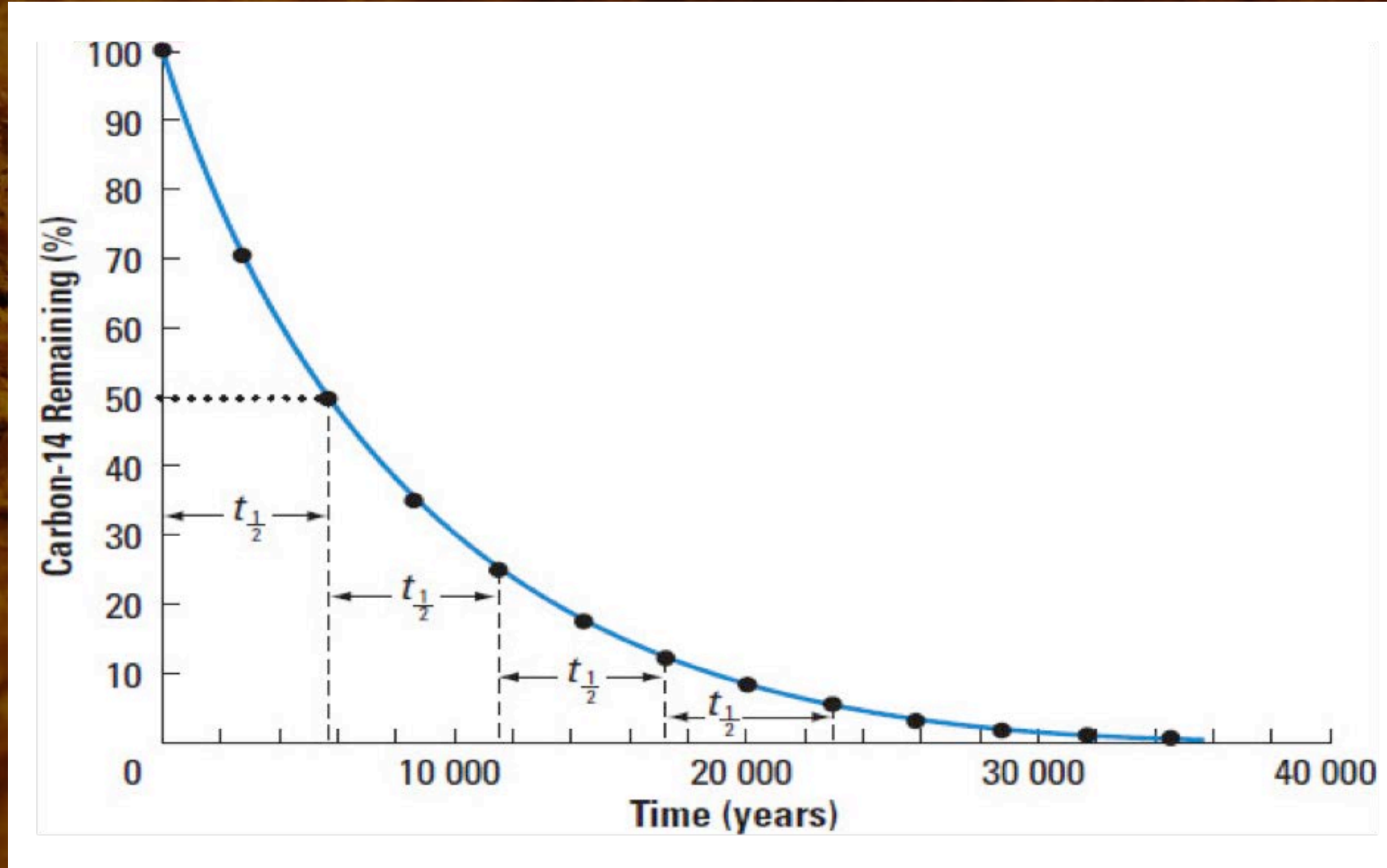
13

17

Cicadas



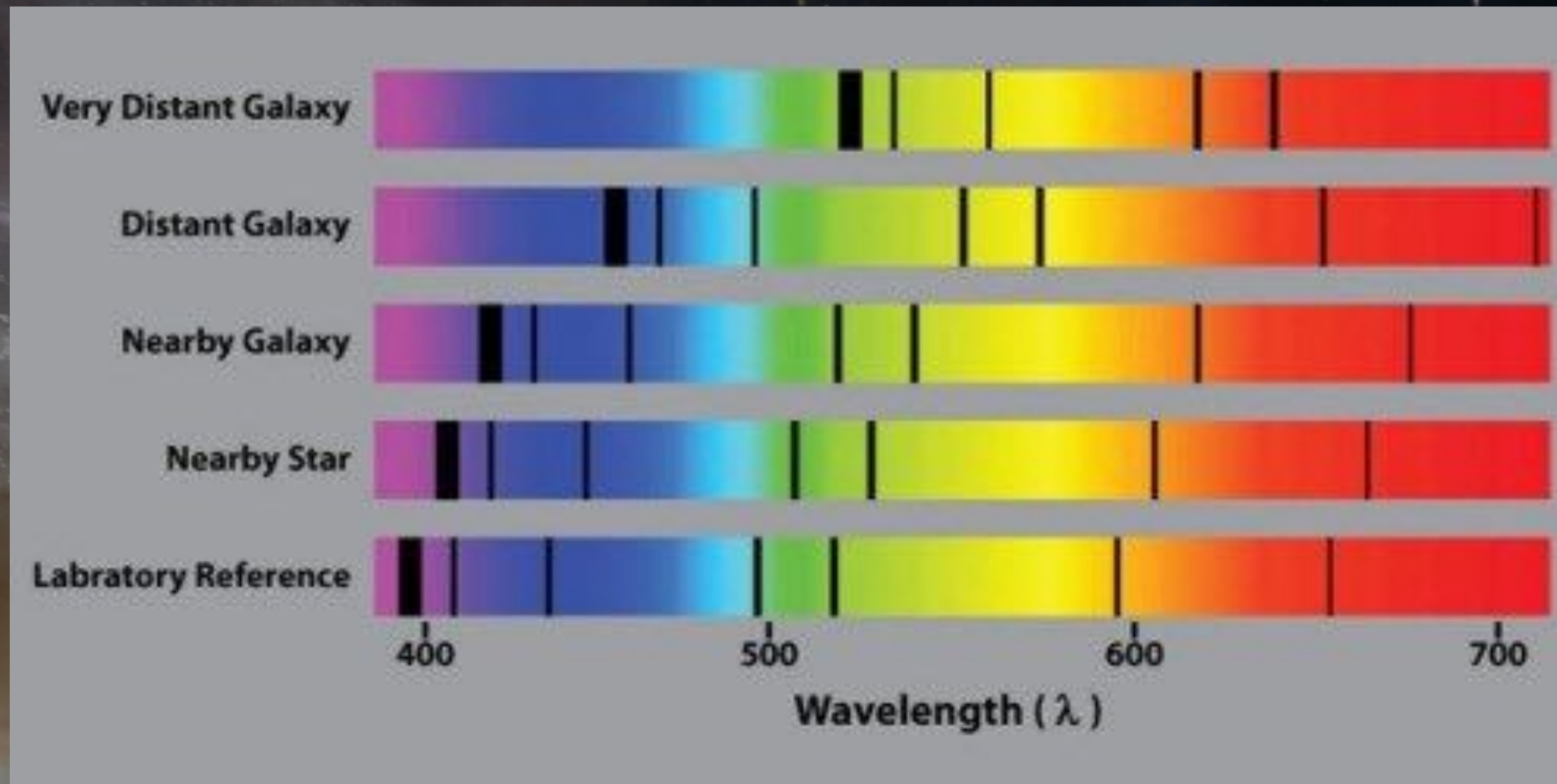
Carbon Dating



Carbon Dating







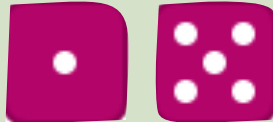
































Age of the Universe



Age of the Universe

Monopoly



2	3	4	5	6	7	8	9	10	11	12
										
										
										
										
										
										

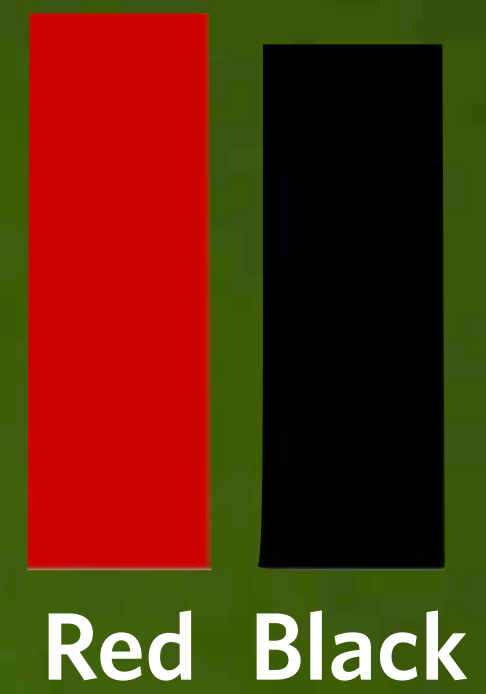




Roulette



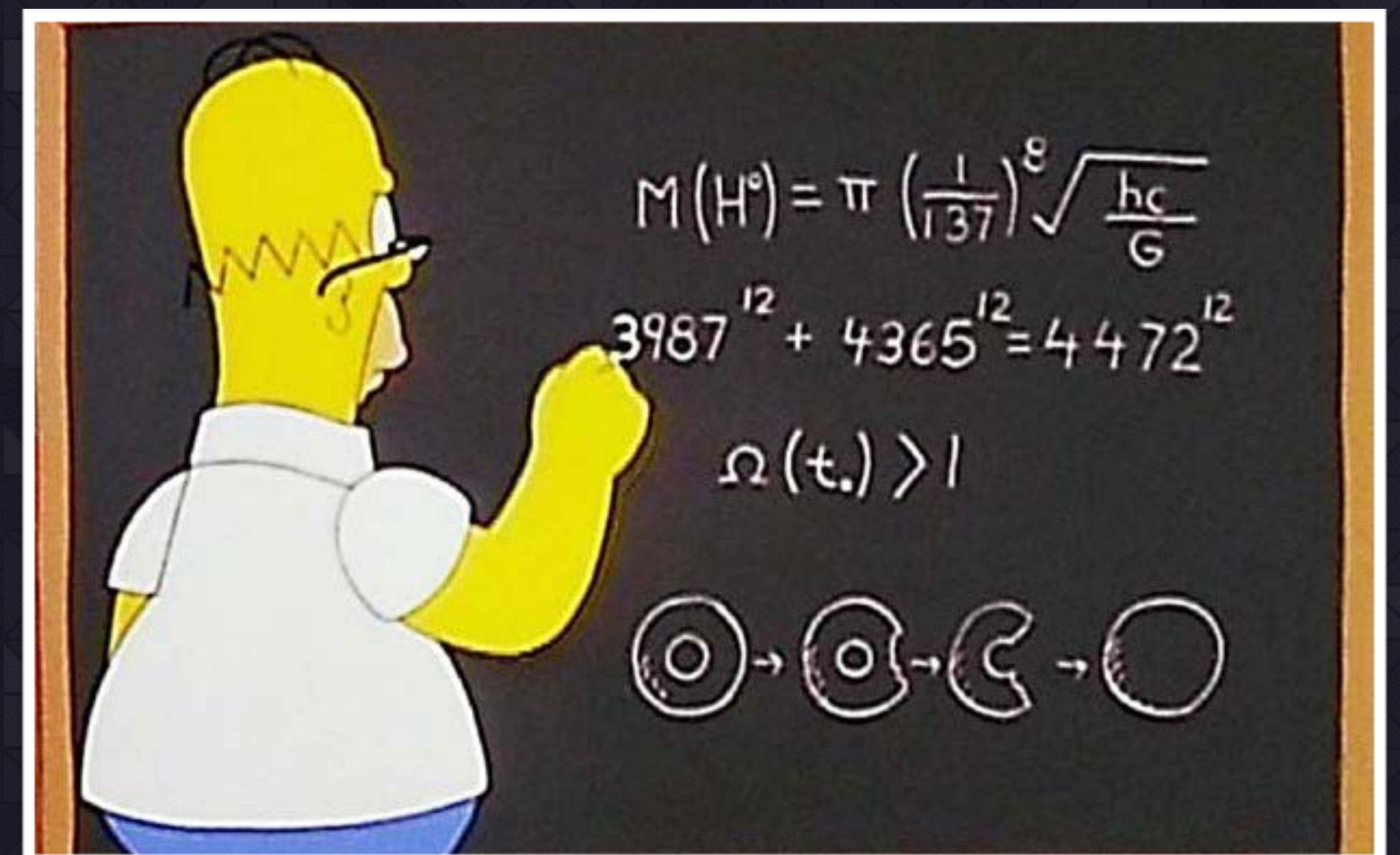
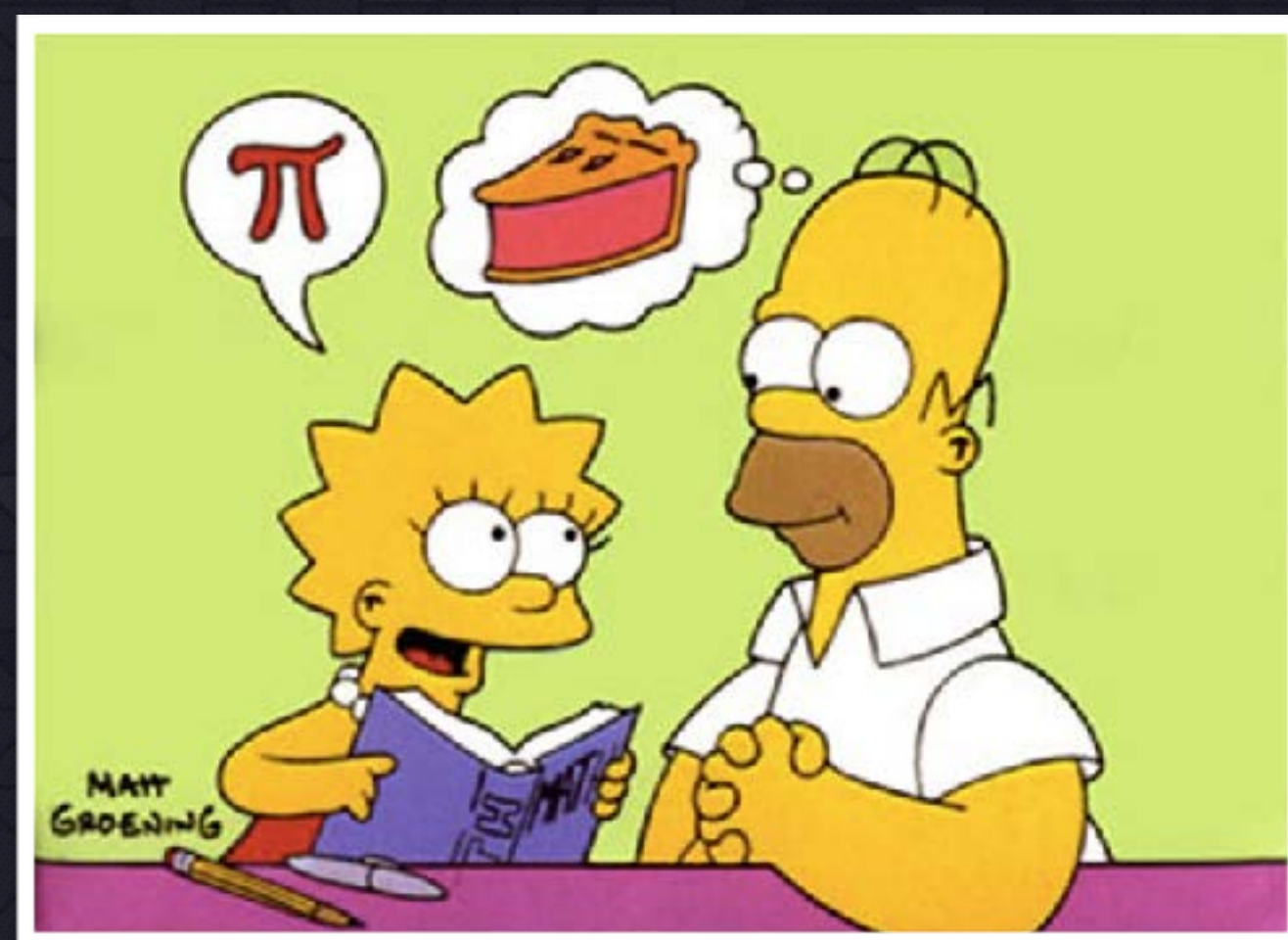
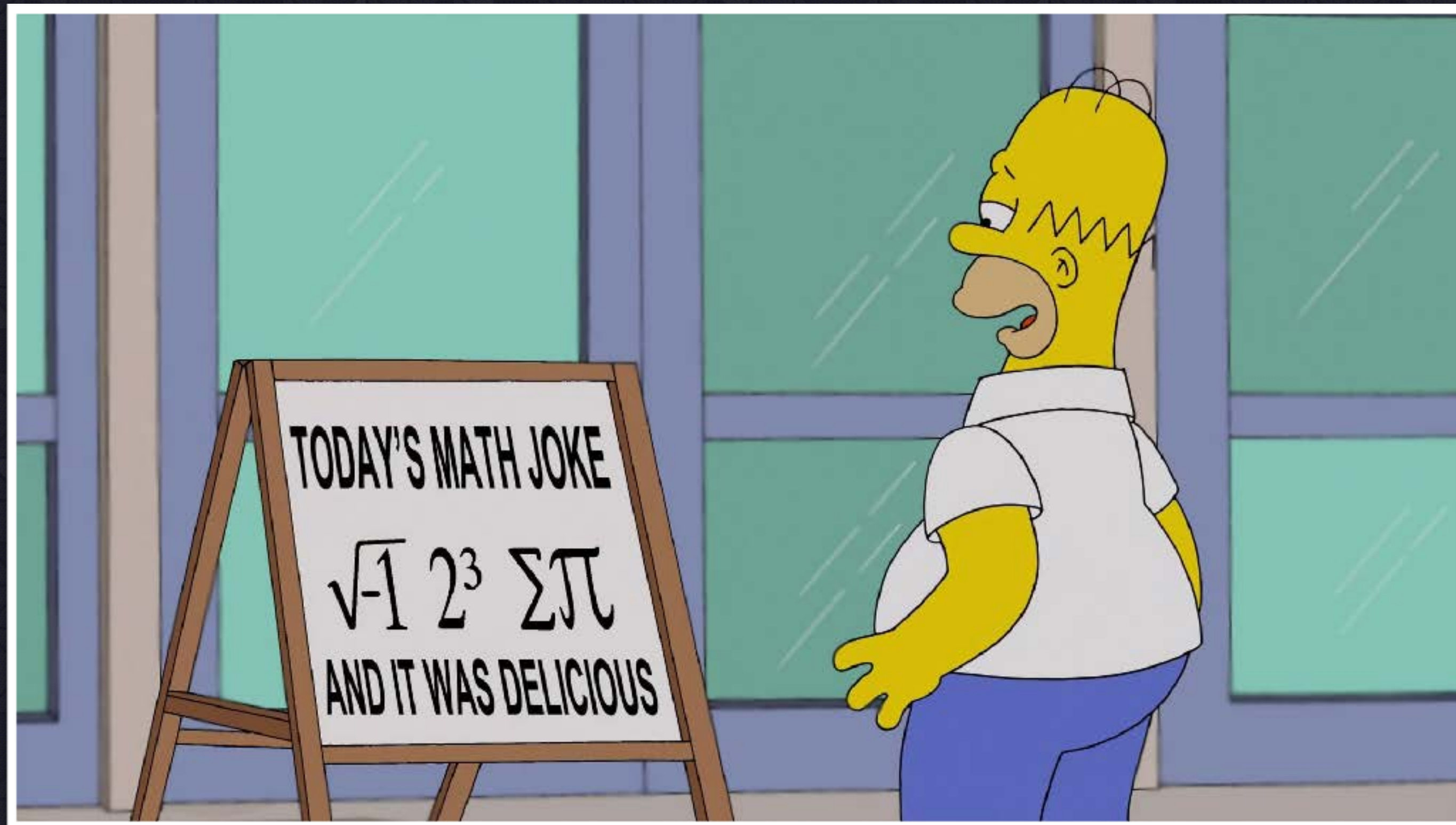
Roulette





Lottery

[illegible]



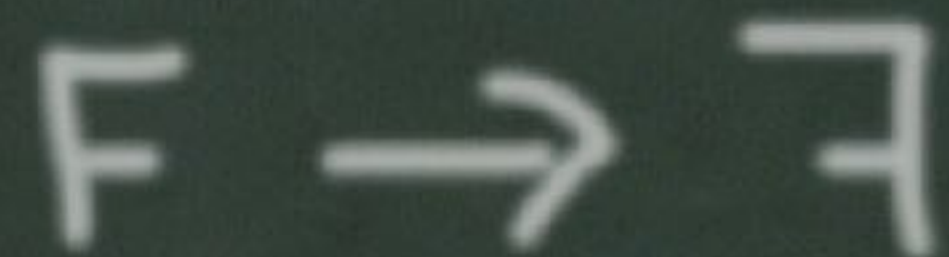


Divination

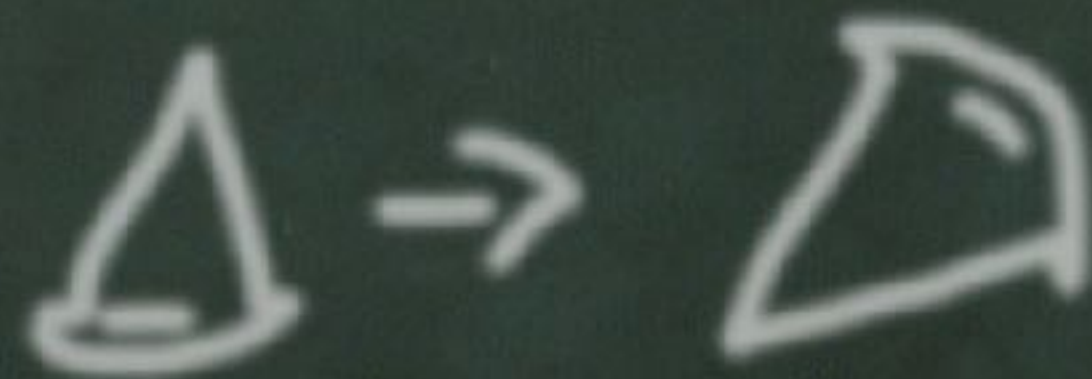
Translation



Reflection



Rotation



Transfiguration

MATHIGON'S
ALICE
IN
FRACTALAND



Mathematics is full of stories!



Applications



**Science
and Nature**



**Games and
Puzzles**



**History and
Mathematicians**



Fiction

Stories are great for teaching!

**Get students
excited and
motivated**

**Make the
content more
memorable**

**Show careers
& applications
that use maths**

**Encourage
students to
study maths
post 16.**



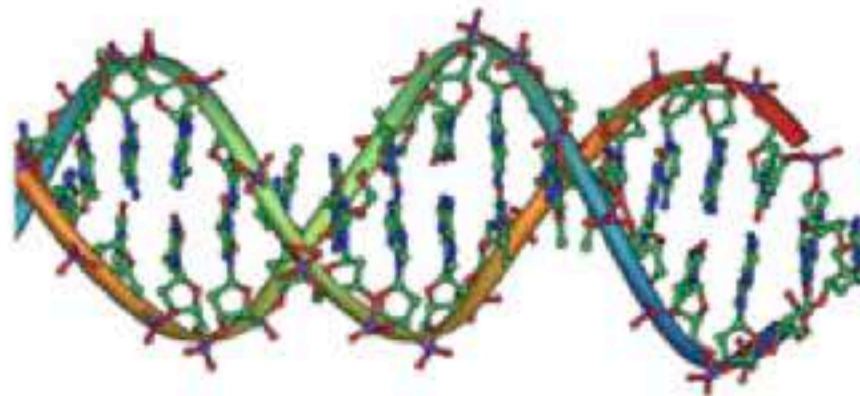
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Welcome to the FIFA World Cup!

From making penalties fairer or taking the perfect free kick, to designing an ideal ball and predicting results using an octopus, it's all there in our collection of football articles. Take your pick!



Genetics: Nature's digital code

Is nature using digital tools to deal with genetic information?



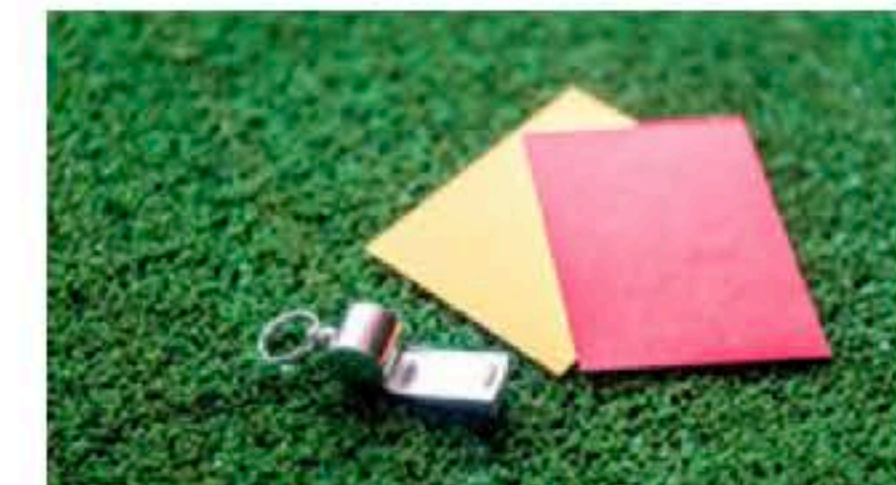
Maths in a minute: Chomp

Explore a game that involves biscuits and comes with a surprising mathematical twist — what could be better?



The real numbers and Cauchy sequences

We take the real numbers for granted, but what are they really? Here's an interesting way of looking at them.



Clocking the schedule

The way many football leagues schedule their fixtures can lead to unfair effects — and unsolved maths problems! Dries Goossens, who schedules the



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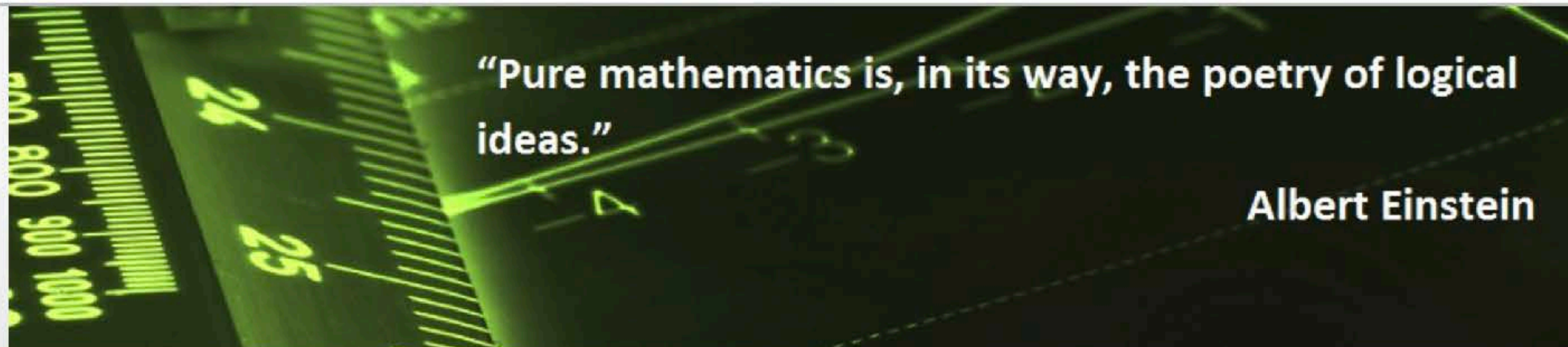
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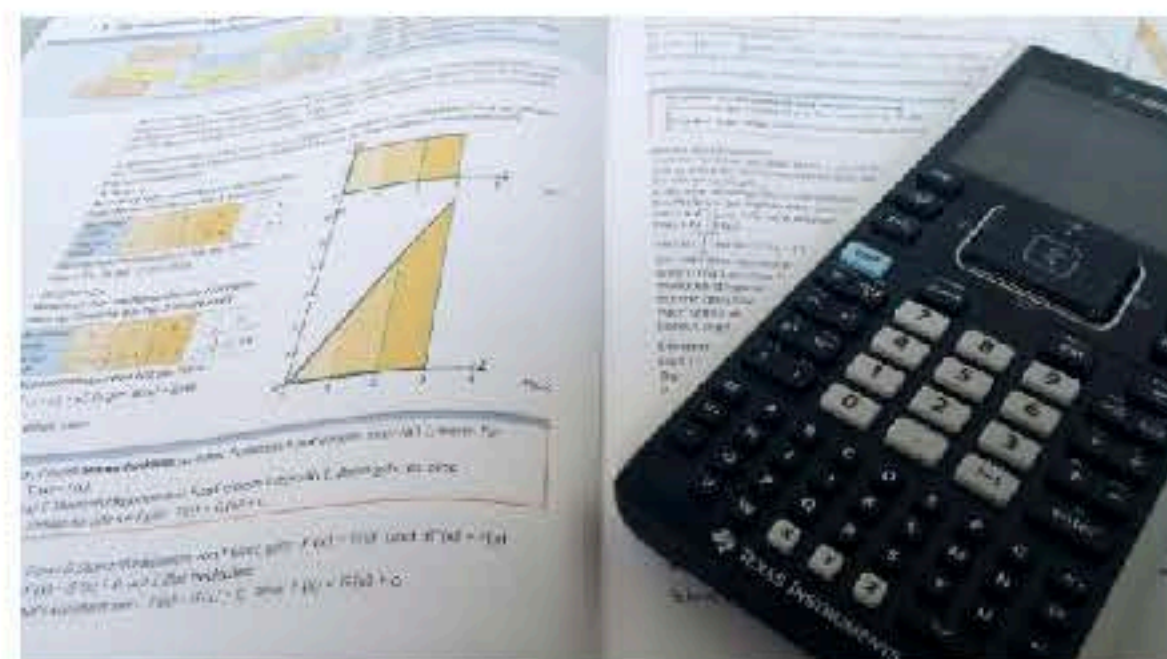


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Albert Einstein

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A-level Mathematics is one of the most widely accepted and respected subject

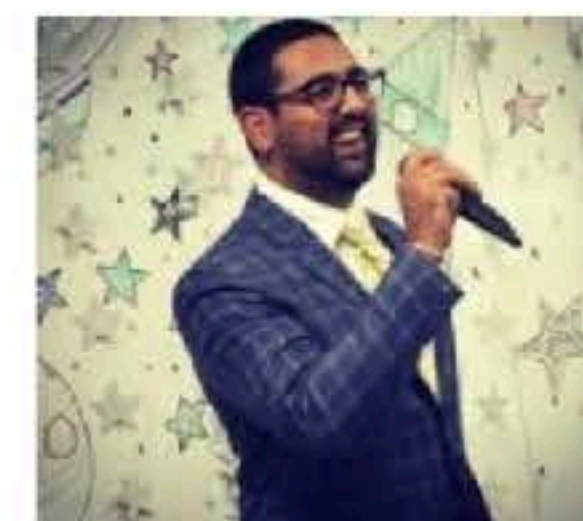
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Joint degrees including mathematics

Choosing what to study at university can

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Philipp Legner

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WEEK 15
Blackboard Equation

WEEK 14
Sumaze

WEEK 13
Good Will Hunting

WEEK 12
Maths Jokes

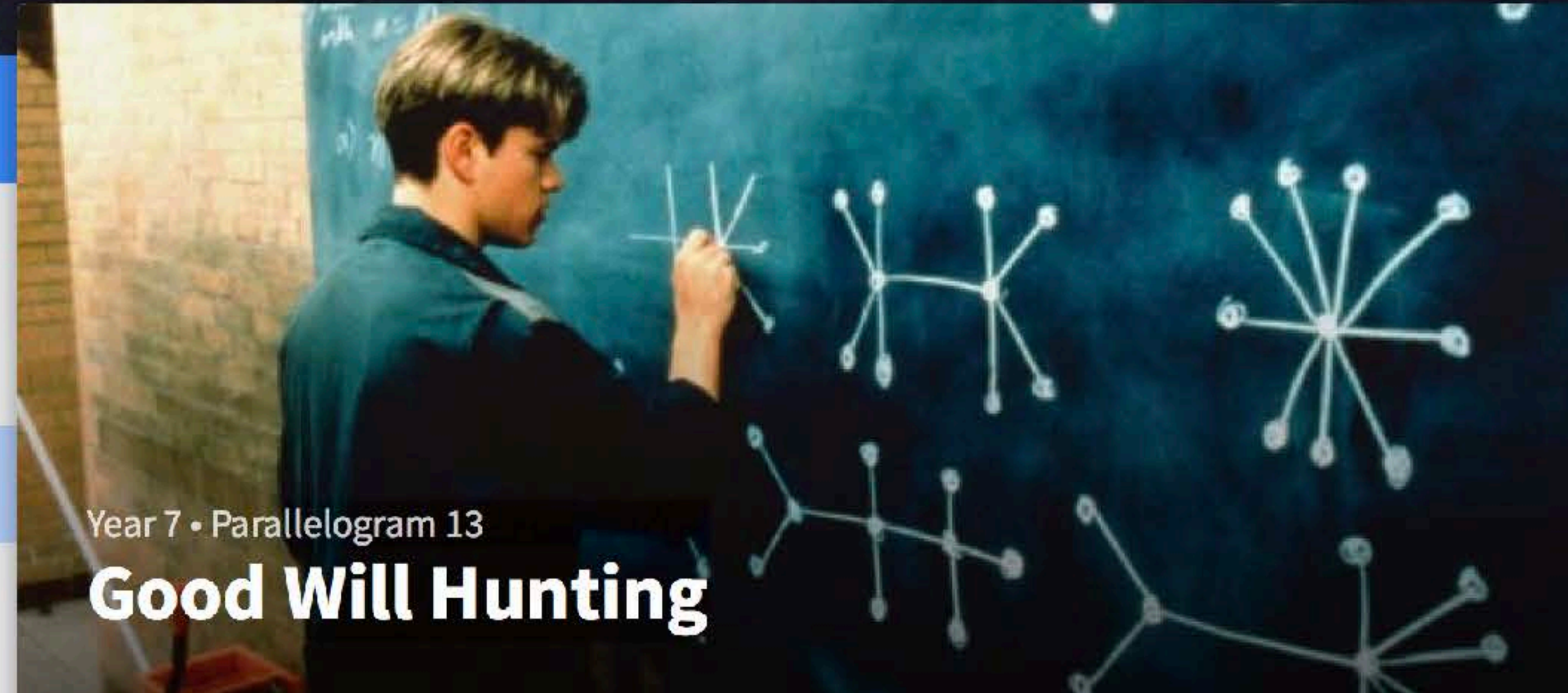
WEEK 11
The Secret of Happiness

WEEK 10
A matter of factorial!

WEEK 9
Easter challenges

WEEK 8
Tricky parking problem

WEEK 7
Optimising your pizza money



Year 7 • Parallelogram 13

Good Will Hunting

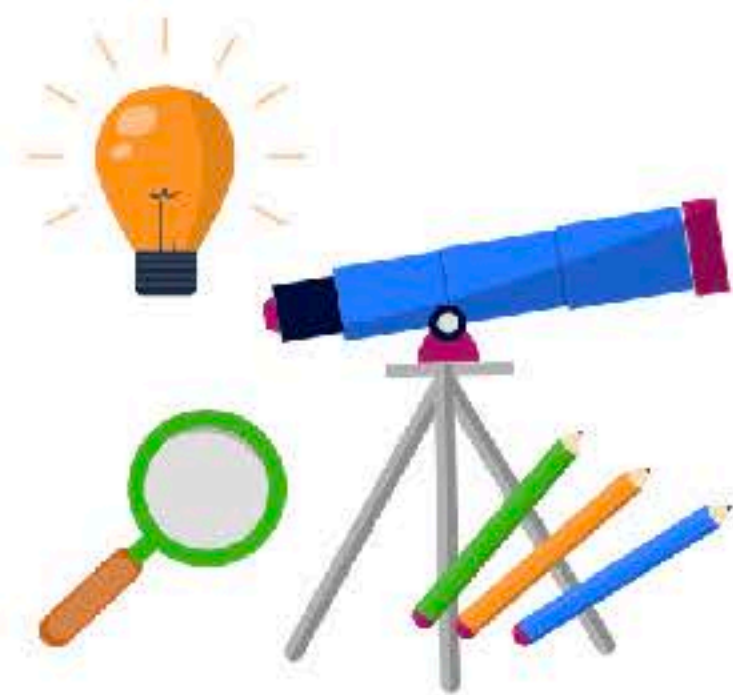
Noun: Parallelogram **Pronunciation:** /,parə'leləgram/

1. a portmanteaux word combining parallel and telegram. A message sent each week by the Parallel Project to bright young mathematicians.

There are only 3 more Parallelograms this year, as we will be starting our summer break at half-term. If you score highly enough in the last 4 Parallelograms (#12, this one, #14 & #15) by June 1, **then you will receive a Parallel certificate**. An average of more than



Textbooks come to Life!

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Active Learning

Our innovative new content format makes mathematics **more interactive** than ever before. At every step students have to actively participate, explore, and discover new ideas.

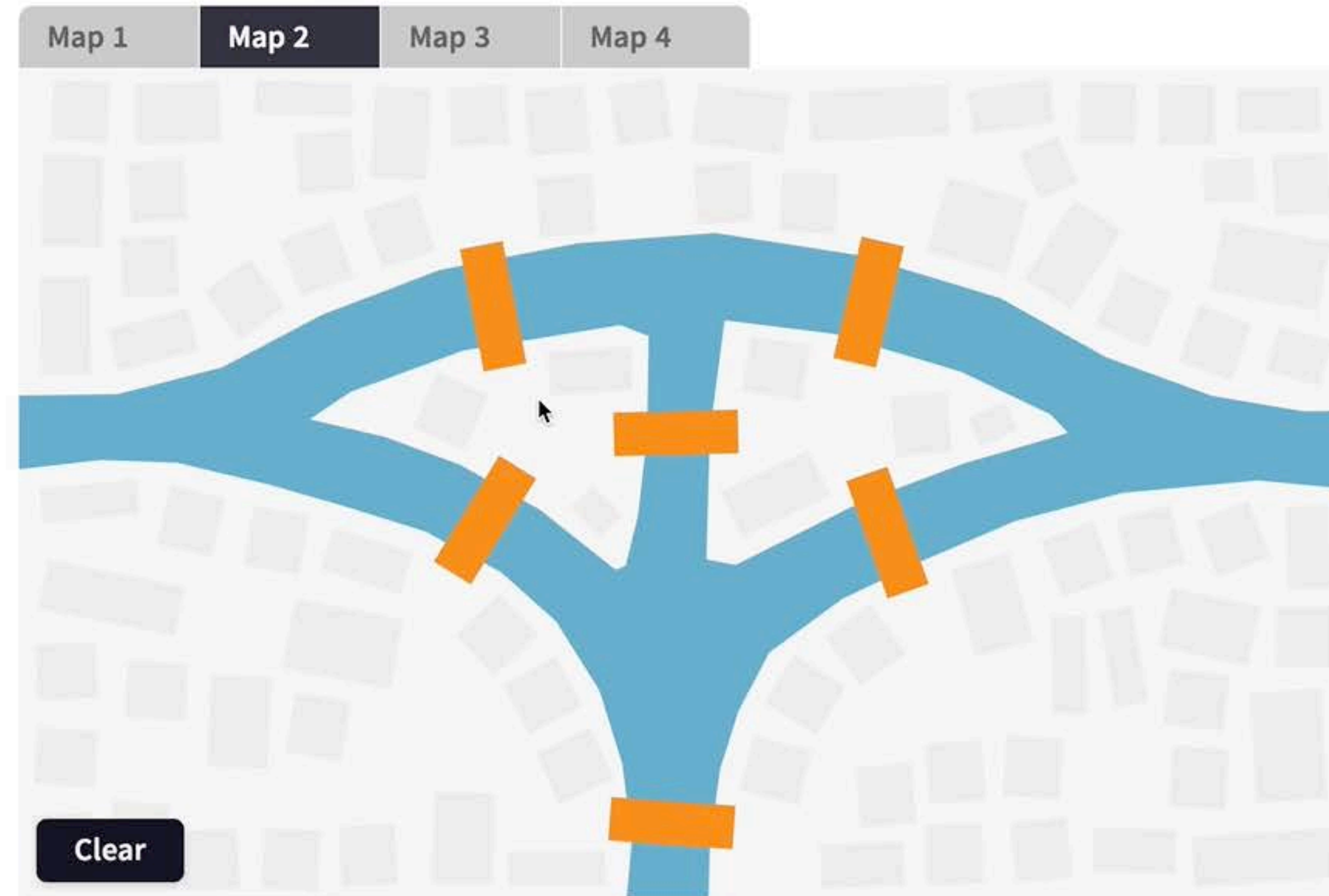
Unlike videos and other textbooks, students don't just *consume* information: they *engage* through **problem solving**, reasoning and **creativity**.



Graphs and Networks

[Introduction](#)[Parties and Dating](#)[The Bridges of Königsberg](#)[Planar Graphs](#)[Euler's Formula](#)[Map Colouring](#)[The Travelling Salesman Problem](#)[Graphs in Everyday Life](#)

Try to find a valid route by drawing on these maps:

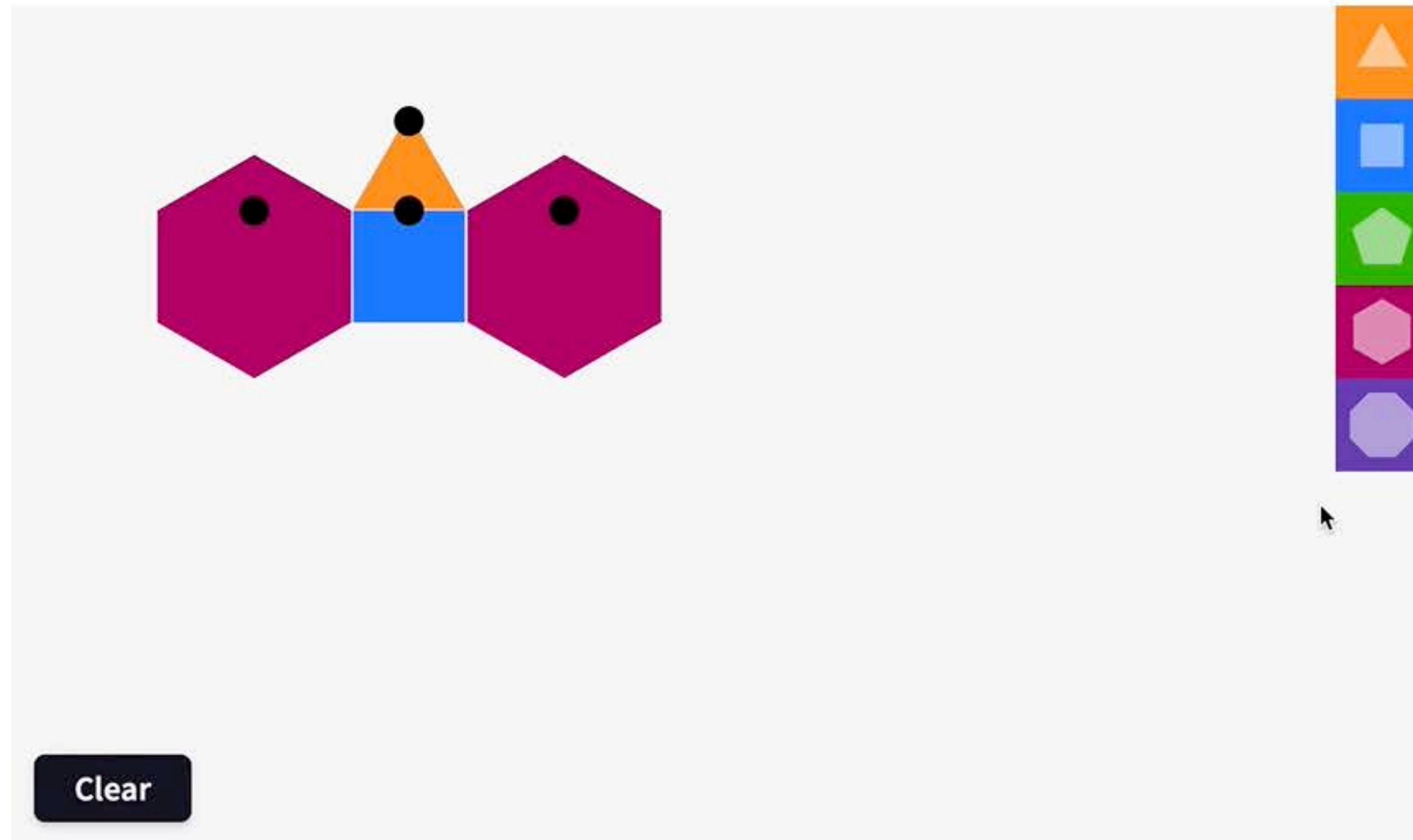


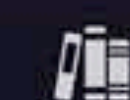


Polygons and Polyhedra

- ☐ Polygons
- ☐ Quadrilaterals
- ☒ Tessellations
- ☐ Polyhedra
- ☐ Platonic Solids
- ☐ More on Polyhedra
- ☐ Nets and Cross Sections

Here you can create your own tessellations using regular polygons. Simply drag new shapes from the sidebar onto the canvas. Which shapes tessellate well? Are there any shapes that don't tessellate at all? Try to create interesting patterns!





Triangles and Trigonometry

Introduction

Properties of Triangles

The Triangle Inequality

Triangles Congruence

Pythagoras' Theorem

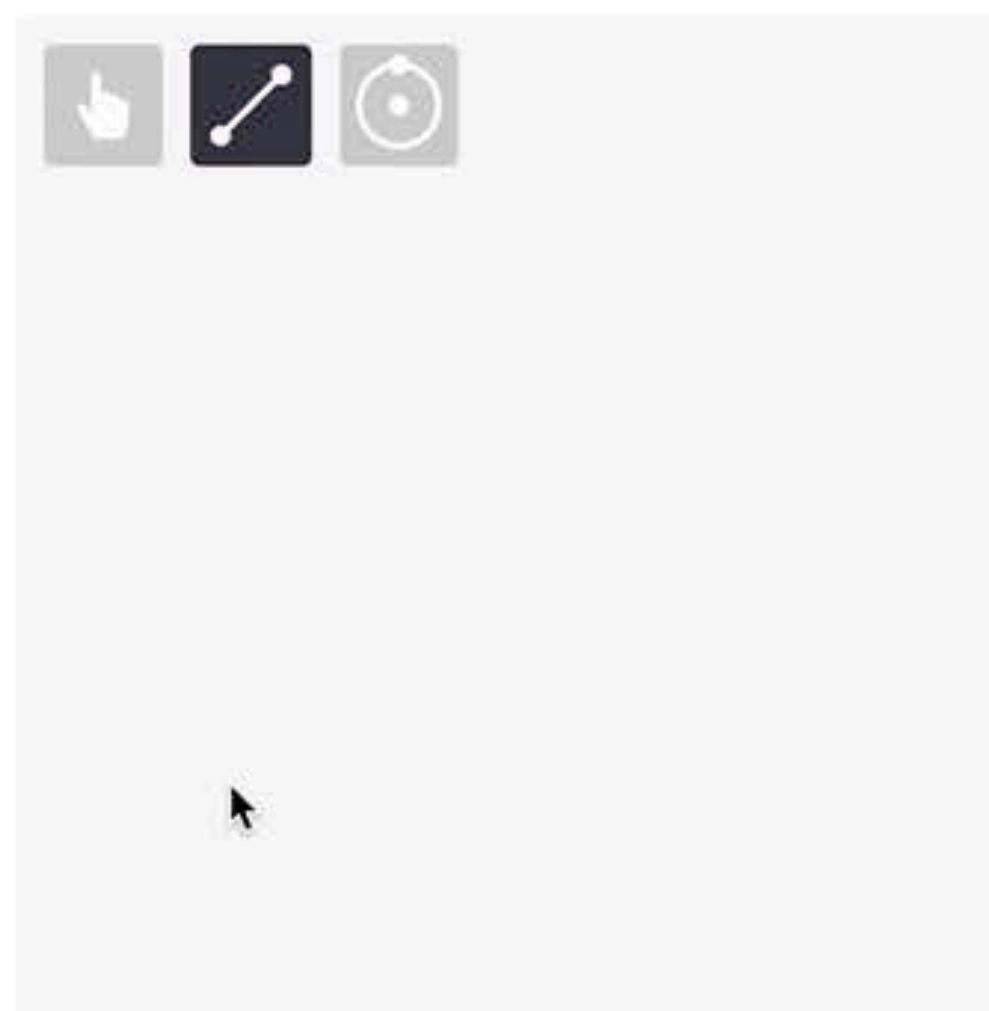
Isosceles and Equilateral Triangles

Trigonometry

Applications

Triangles Congruence

Now that we can check if three sides can form a triangle, let's think about how we would actually *construct* a triangle with these sides.



Draw a triangle that has sides of lengths 4cm, 5cm and 6cm.

In the box of the length, draw the longest side of the triangle, which is **6cm**.



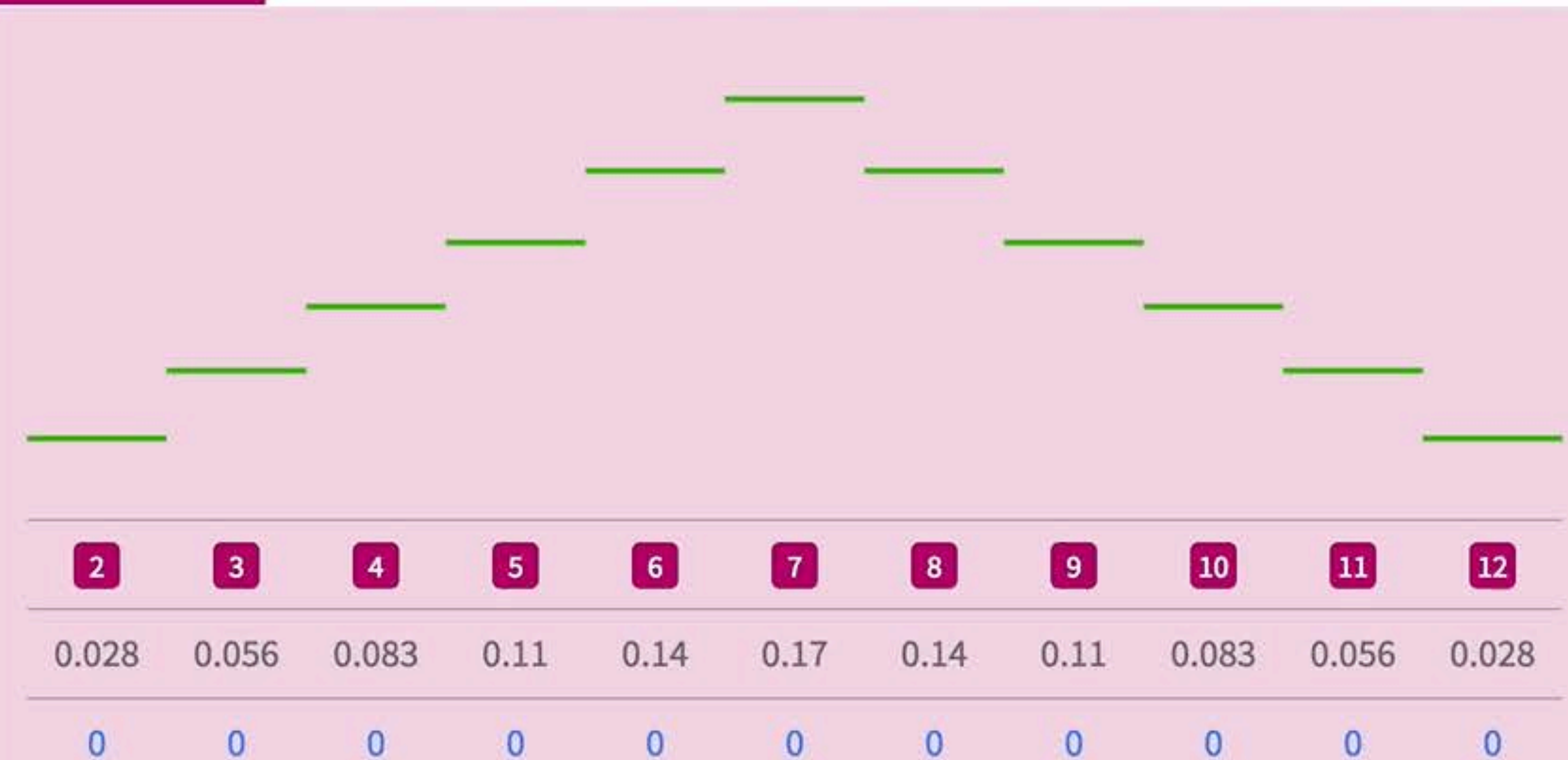


Probability

[Introduction](#)[What are Probabilities](#)[Analysing Roulette](#)[Beat the Dealer](#)[Predicting the Future](#)[Monty Hall](#)[True Randomness](#)

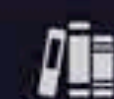
In this animation you can roll many “virtual” dice at once and see how the results compare to the predicted probabilities:

Rolling Dice



We roll **2** dice at once and record the **SUM** of their scores. The **green lines** represent the probabilities of every possible outcome predicted by probability theory and the **blue bars** show how often each outcome happened in this computer generated experiment.

[Roll once](#)[Roll 100 times](#)[Roll 1000 times](#)



Probability

[Introduction](#)[What are Probabilities](#)[Analysing Roulette](#)[Beat the Dealer](#)[Predicting the Future](#)[Monty Hall](#)[True Randomness](#)

Welcome to the most spectacular game show on the planet! You now have a once-in-a-lifetime chance of winning a fantastic sports car which is hidden behind one of these three doors. Unfortunately, there are only goats behind the other two doors. Select one to make your choice!



Free, online resources



plus.maths.org

parallel
by Simon Singh

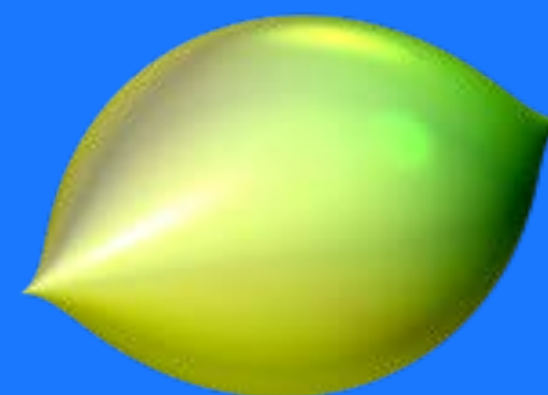
parallel.org.uk



Mathigon
mathigon.org

Numberphile

numberphile.com



Imaginary
imaginary.org



Maths Careers
mathscareers.org.uk

Discussion

Any questions or comments?

What parts of maths do you find most difficult to make exciting?

Let's try to come up with new stories for those topics!

