

Mathematics of the Inca Empire

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Introduction

- ❖ We have investigated the mathematical aspects of the Nazca Lines, the mathematics used by the Incas in creating quipus, as well as how mathematics is used in the yupana. This research project introduces the concepts and shows how ideas and methods used by the Inca relate to the mathematics used in the United States today.



Nazca Lines

- ❖ The Nazca are a group in the Inca Empire historically known for their detailed and intricate textiles as well as their extensive irrigation systems. The Nazca Lines are found in a vast desert area in Peru. They consist of many geometrical figures such as lines, triangles and trapezoids, and also include zoomorphic and biomorphic figures.
- ❖ The mathematics which is found in the Nazca Lines include geometrical applications as well as statistical/scientific analysis.
- ❖ Many wonder why these lines are present. Different theories proposed with regard to their purpose include:
 - ❖ Astronomical and Calendrical Functions
 - ❖ Geometry
 - ❖ Irrigation and Agriculture
 - ❖ Walking Paths
 - ❖ Artistic Expression
 - ❖ Aliens

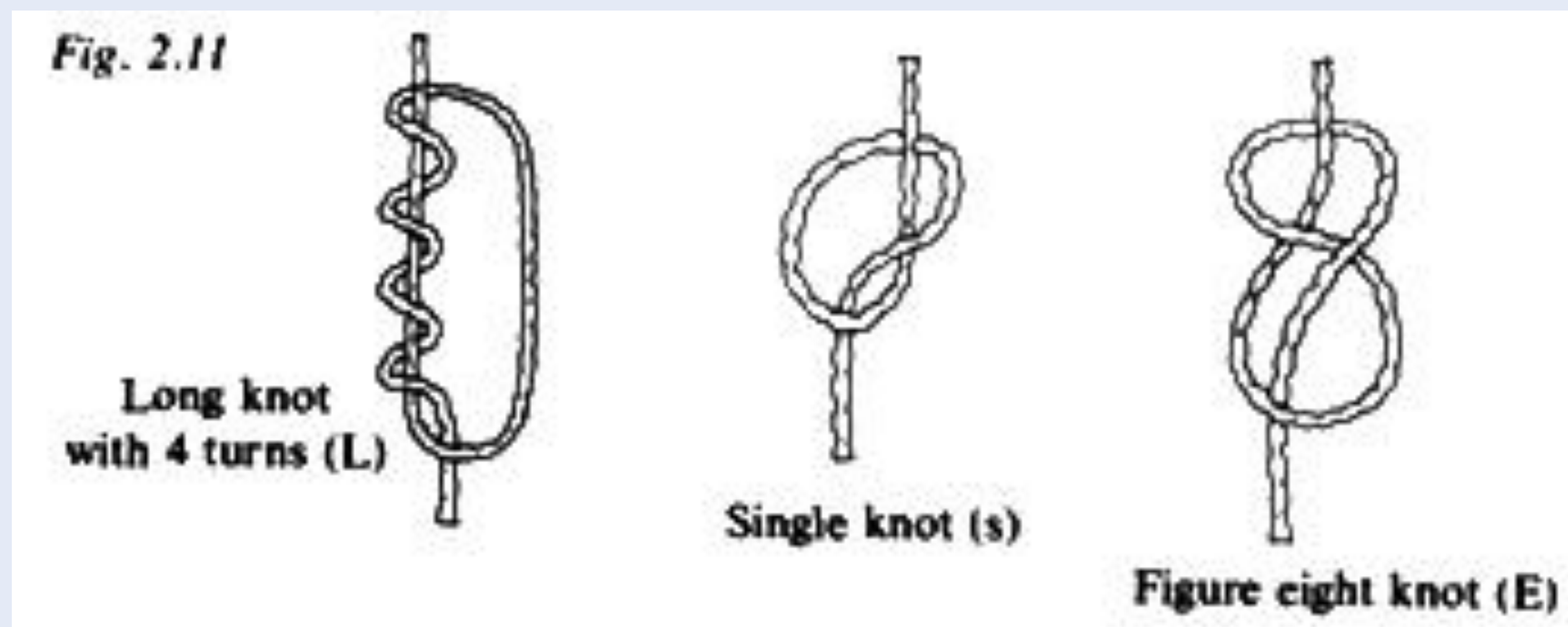
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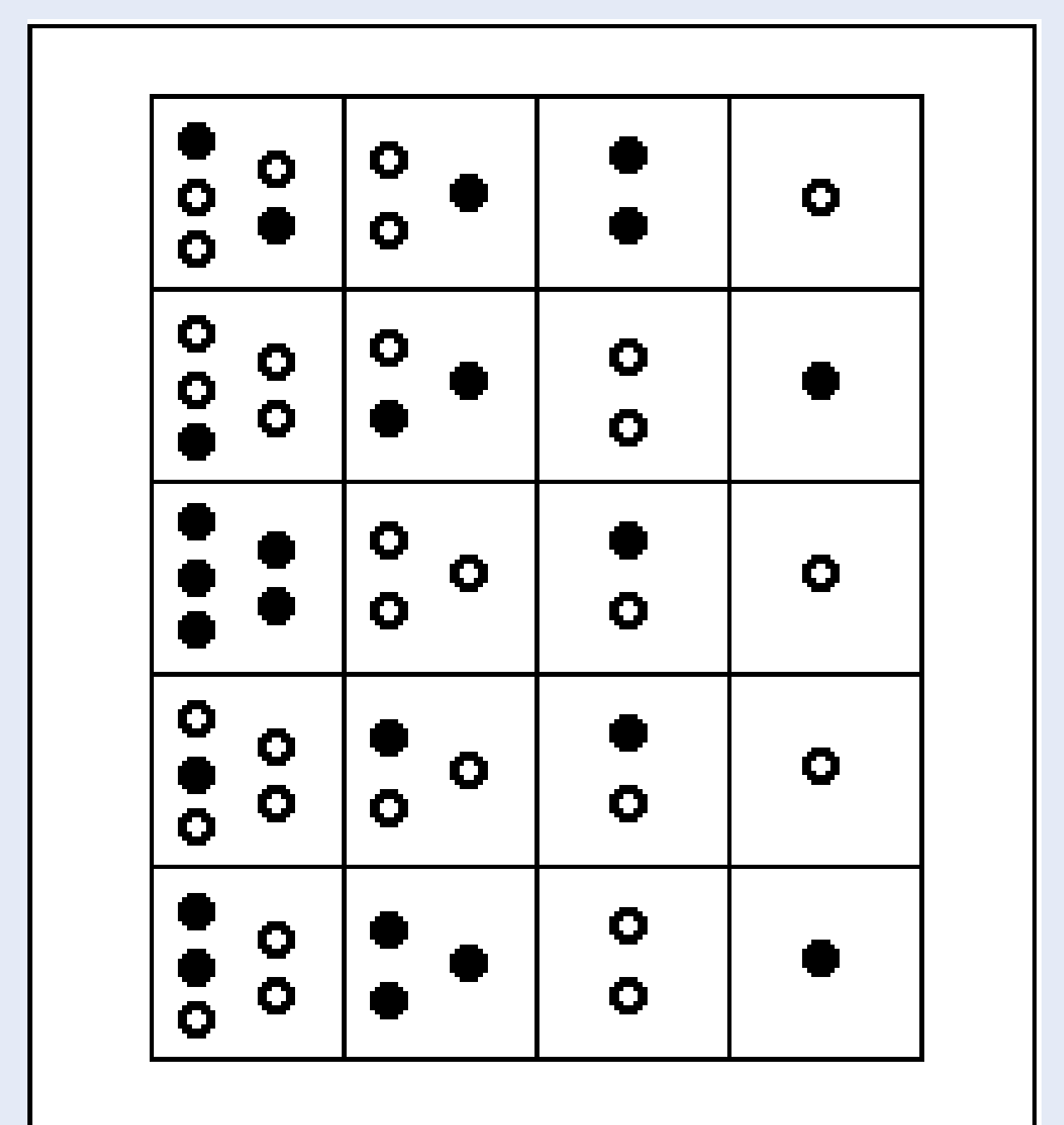
Quipu

- ❖ A quipu is a tool that the Inca used to pass on information. While it is still debated to what extent quipus represent a writing system, experts agree that quipus were used as mnemonic devices and were used to keep accounting records.
- ❖ There are many different types of cords, colors, and knots used to depict the information contained on the quipu and all constitute an element of the code.
- ❖ According to Marcia Ascher and Robert Ascher, the quipu uses base 10 to record information. The main cord of the quipu is the top horizontal cord and the pendant cords come off of the main cord. The pendant cords contain the information represented on the quipu. Each pendant cord is read using base 10. The ones column is closest to the bottom, the tens column is the row above the ones, followed by hundreds, thousands, and ten thousands which brings us to the main cord.



Yupana

- ❖ A number of theories as to what the yupanas were: different models of architectural buildings, a fortune game, or an ancient calculating device. We have focused on the yupana's use as an ancient calculating device that the Inca used every day. In this sense, it is similar to an abacus.
- ❖ Yupanas are also believed to have used different bases, including base 40 and base 10, as well as incorporating the Fibonacci Sequence. We have focused on the yupana's use of base 10 because base 10 was commonly used in both the yupana and quipu.
- ❖ Using the yupana as an ancient calculating device, we can perform many mathematical operations. The various wells in the yupana—depending on the theory being used—represent different place values. In base 10 we can perform addition, subtraction, multiplication, and division easily.



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