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were common concepts.

subtraction, and multiplication

millions. Grouping, addition,

counts in the 100s, 1000s, and

and symbols that could express

peoples had numbering words,

not use written numbers, most

10s and 20s. Although they did

numbering systems based on

mathematics. They, too, had

Native peoples in other parts

besu osls assired and to

Other Math Systems

and many employed concepts

MATHEMATICS MATHEMATICS

The Base 20 System

The Mesoamerican civilizations used math notation in terms of history, engineering, architecture, astronomy, calendars, administration, and religious practices. It was the Maya who used "shell" (a true zero symbol) to advance their mathematics to a new level. They understood zero to be a placeholder, a count of zero, and possibly as an abstract number between -1 and +1.

uqiuQ ədT

NATIVE SCIENCE

The Incas counted with knotted strings. The knot colors told what was being counted. Although it was a decimal system, the quipu had no symbol for zero. It was primarily used as a data storage device for recording the census, taxes, food quantities, farm acreage, etc. Evidence is emerging that the knots included a binary code that communicated far more that communicated far more than numbers.

Astronomers studied the night sky at observatories like El Caracol at Chichen Itza.





Sky Predictions



The Dresden Codex is a 78-page Maya astronomy book best known for charting Venus and eclipses of the moon.

The Dresden Codex

NATIVE SCIENCE

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MATHEMATICS Astronomy 1

MATHEMATICS A MODIFICS

The Dresden Codex

The Dresden Codex, written in the 11th century, is the oldest surviving Maya book. Copied from an older 400-year-old text, it contains astronomical data tables of outstanding books and their calendars, the Maya priests knew when the Maya priests knew when ines, plant and harvest crops, nies, plant and harvest crops, and divine the future.

11

in books called codices.

and movements of the planets

solstices, full and new moons,

solar eclipses, equinoxes and

into the future. They recorded

predict when and where these

bodies would be many years

knowledge allowed them to

the cycles of the sun, moon,

bnstsrebnu of elds erew sysM

their use of mathematics, the

With only keen observation and

planets, and stars. This

Sky Predictions

Maya Priest-Astronomers

NATIVE SCIENCE

Of all the cultures in the Americas, the Maya were the most dedicated sky-watchers. Their priest-astronomers, the "wise men who studied the heavens," built many observatories to study the night sky. The Maya believed that celestial bodies were gods that affected their lives directly, bringing both lives directly, bringing both

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At the Sun Dagger, spiral designs on a cave wall are bisected or surrounded by "daggers" of sunlight on the annual solstices and equinoxes (950 - 1150 CE).

Sun Dagger at Chaco Canyon

NATIVE SCIENCE

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MATHEMATICS Astronomy 2

regarded as sacred places.

planets in relation to the

un, moon, and stars and

generally mark the four

directions and events of the

BCE to historic times), they

structure and time: (۲,500

plains, are believed to mark

Medicine Wheels, mainly

Medicine Wheels

found on the North American

Although wheels vary in

certain days of the year.

horizon. Medicine Wheels are



spokes, possibly signifying the days in a lunar month.





The Pawnees depicted the Milky Way, the Pole Star, Venus and Mars, and important star clusters on their map.

Pawnee Star Map

S ymonorteA **MATHEMATICS**

Pawnee Star Map

and hold ceremonies. them when to plant, harvest constellations. The stars told in recognizing the stars and a chart that assisted them ,918 map was a planisphere, celestial body. Their famous cluster was the most important Pawnee believed the Pleiades the position of the stars. The their society according to sky-watchers who organized The Skidi Band of Pawnee were

Sun Dagger

NATIVE SCIENCE

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calendar on interior walls rsloz s gninfish stroq llsma where sunlight sliced through 7721 ni yrotsvraedo ne fliud enweep in Colorado, the people -voH tA. solstices. At Hovmarkers of light and shadow to in Chaco Canyon, they used the site called the Sun Dagger the solar and lunar cycles. At that were designed to capture egniblind bas sətis bətəurtanoə Ancestral Pueblo peoples



The Long Count Calendar





Lone Dog, a Yanktonai Dakota, created a famous Winter Count for the years 1800 to 1871.

Winter Counts



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MATHEMATICS Time Keeping

agricultural events.

were based on the seasons and

vas agrarian; its month names

ceremonial cycles. The purpose

numbers with sacred meanings

based on astronomy, but on

a 260-day ritual calendar.

Solar Calendar

The Mesoamerican

The 260-day calendar was not

a 365-day solar calendar and

The Maya and the Aztecs used

of the 365-day solar calendar

bus noitsnivib of betaler

MATHEMATICS Time Keeping

Winter Counts

Winter Counts were event calendars used by Plains Indians to keep track of their past. Each year was marked with a picture of a memorable event. The Counts were a form detailed memorization of lengthy narratives that the pictures represented. Recorded on animal hides, some Winter Counts illustrated amore than one hundred years of history.

της Σηθ Count

The Mesoamerican

synchronized their solar

and ritual calendars every

52 years, a time of great

Solar Calendar

The Maya and Aztec

ritual significance.

NATIVE SCIENCE

The Long Count is a calendar of days that does not repeat. The Maya adopted it from earlier cultures, establishing its first date, August 11, 3114 BCE, as the beginning of their world. It was used on monuments to commemorate the lives of their rulers far into the future. The Aztecs did not use the Long Count.

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Machu Picchu, built in the 15th century, was a royal estate of the Inca ruler, Pachacuti.

Walled Cities



TECHNOLOGY & ENGINEERING Building Technology



popular today.

llite əre eleirətem gniblind bre

tsən bns rətniw ni bloə tenisşa

in summer, the pueblo style

with thick walls that insulate

Well-adapted to the climate

housed hundreds of families.

lar multi-storied homes that

-imis tlind soldsu'd IsrtesonA

one thousand years old. The

stone and adobe brick, con-

tinue an architectural style

can Southwest, built from

-irəmA ədt fo soldənq ədT

sezuoH tnemtradA

YpolondoaT pribling LECHNOLOGY & ENGINEERING

SeitiD belleW

and ceremonial plazas. systems, fountains, temples, Peru, featured plumbing nilt in the 15th century in residences like Machu Picchu, to earthquake damage. Royal Inca buildings highly resistant rounded corners. This made slightly inclined inward with below ground and were without mortar. Walls extended red stones that fit together many buildings from precisely architects who constructed

The Inca were master

people built their civic and Missouri (800-1200 CE), the purposes. And at Cahokia in euoigilər rof ebimeryq əviseem in Peru also constructed civilizations like the Moche raded pyramids. Other -q99ts fo qot no s9inom9193 Mesoamericans conducted High above the cities, the stone, concrete, and stucco. fo seitic tlind ansorameoseM The Maya, Aztecs, and other Pyramids and Temples

religious life around a great

earthen temple.

Apartment Houses The Hopi pueblo of Old Oraibi, founded about 1100 CE, is the oldest continuously

inhabited town in the U.S.

The Maya Temple of the Jaguar was built in 730 CE at Tikal in Guatemala.

Pyramids

NATIVE SCIENCE







large canals that fed water

to crops in the desert.



reservoirs and deep canals that diverted water for miles from the Salt and Gila Rivers.

constructed elaborate

used today. In the Arizona desert, the Hohokam

technique still successfully

perfected "dry farming," a

infrequent rains. They also

belennsho that channeled

Pueblo ancestors at Chaco

diversion and conservation.

in the American Southwest,

Canyon in New Mexico

rətsw bəəitəsrq əlqoəq

Ancestral Pueblo

mexonoh bne



A "window" leads down into the Cantayoc aqueduct built by the Nazca people of Peru.

Nazca Aqueducts

NATIVE SCIENCE

TECHNOLOGY & ENGINEERING Water Management Systems



NATIVE SCIENCE

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Vazca Aqueducts

In the Andes, where the climate is dry, Native peoples built large systems of from the mountains to their from the mountains to their fields and cities. The Nazca of Peru built the Cantayoc aqueducts, underground water canals that they maintained through openings called "windows." They are still "windows." They are still functioning today after almost functioning today after almost

Aztec Canals PixeM fo soatsA adT

The Aztecs of Mexico were a "hydraulic culture" who built Tenochtitlan, a city constructed on a lake. In the 14th century, Aztec engineers designed aqueducts to bring drinking water to the city, canals for transportation, and irrigation; and dikes and gates to control flooding. The canals brought water to the chinampas– artificial soil beds anchored artificial soil beds anchored into the irrigation system.



The Olmecs, known for their "colossal heads" of rulers, were the first rubber scientists.

The Olmecs of Mexico

miles per hour!

ball could reach speeds of 60

protective padding because the

eight pounds. They wore heavy

Aztec ball players played with

bns sysM. Ilsd dosod s to ozie

a solid ball weighing about

inches in diameter to the

produced approximately

Rubber Balls

The balls ranged from a few

16,000 rubber balls per year.

In the 16th century the Maya



TECHNOLOGY & ENGINEERING Rubber Science & Technology

Making Rubber

to make rubber.

The Olmecs blended the sap from the rubber tree with morning glory juice



NATIVE SCIENCE

Making Rubber

The Maya and later the Aztecs produced rubber with various degrees of elasticity. It was used for balls of different bounciness, rubber bands, cloth, dolls, and adhesives. The Spanish also described sandals. Rubber industries in the U. S. and Europe would in the U. S. and Europe would not be as advanced as the mot be as advanced as the spin experient until the per seconteries and the per per seconteries and be are as advanced as the states are advanced as the seconteries are and desonation of the mot be as advanced as the and be as advanced as the and be as advanced as the are advanced as the and be as advanced as the are advanced as the and be as advanced as the and advanced as the and advanced as the and advanced as the and advanced as the advanced a

The Rubber People

Royal Ball Player

in size.

A Maya king hits a rubber

ball that has been exaggerated

Rubber was first developed by the Olmecs, the mother culture of Mesoamerica, almost 3,600 years ago. They sold and shared their technology of writing, calendars, and mathematics. One of their other great inventions was the Mesoamerican ballgame, a cross between basketball and soccer, which was played with a soccer, which was played with a rubber ball.



NATIVE SCIENCE

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TECHNOLOGY & ENGINEERING Transportation Technology

TECHNOLOGY & ENGINEERING TECHNOLOGY & ENGINEERING

NATIVE SCIENCE

Toboggans "Toboggan"

Land Travel in Cold Climates

Native peoples in North America developed two inventions for snow travel: the snowshoe and the toboggan—a curved by people and dogs, it made the lives of northern peoples much easier. Today, toboggans are used mostly for recreation. The "offspring" of toboggans, like the bobsled, luge, and skeleton, have become oflympic sports. Dog sled races are also rety popular today. The most famous race is the Iditarod. It is run from Anchorage to Nome, Alaska—almost 1,049 miles.

Vater Travel in the Sub-Arctic

The Inuit and Yup'ik are the masters of the kayak, a vessel that has been called the best one-man boat ever built. Used to hunt seal and walrus, the traditional kayak watertight skins. The hunter, sitting in an opening at the center of the boat, propelled it with a double-bladed paddle. For whaling, they used the umiak, a much larger open boat with several paddlers. Today, the world has adopted kayaking as a popular world has adopted kayaking as a popular outdoor activity and sport.



On 2.5 acres of the Aztec's chinampas, a form of hydroponic gardening, twenty people were fed for a year.

Hydroponics

The terraced gardens of the Incas fed an empire of millions.

Terracing

NATIVE SCIENCE



FOOD PRODUCTION Growing Techniques



pnitnel9 noineqmo

The "three sisters" help each other. The cornstalk is a trellis for the beans, the beans fix nitrogen in the soil, and the squashes maintain soil moisture. Nutritionally, the companions complement each other, too. Corn provides carbohydrates, fiber, and some vitamins and minerals, but beans and squash together provide much higher amounts of protein and vitamin A.

FOOD PRODUCTION FOOD PRODUCTION

Hydroponics

Companion

Planting The "three sisters," corn,

squash, and beans, is the

example of companion gardening in the Americas.

most common

The Aztec's chinampas remain the most productive agricultural system ever created, in terms of food produced per unit of space. Farmers built plots of mud and vegetation above a lake bed in which they planted corn, squash, beans and tomatoes. The oxygenated water and rich artificial soil produced as many as two to seven harvests a year.

Terracing

NATIVE SCIENCE

The Inca built terraces on the the dry soils of hillsides in the Andes. They grew potatoes, corn, and peanuts on the stepped terraces, irrigating them through canals that brought water from melting mountain snows. Their ancestors' efficient use of ancestors' efficient use of encouraging Andean people today to rebuild many terraces today to rebuild many terraces proday to rebuild many terraces planting methods.





the food was tasty!

bne—seol tnsirtun bne yessb

was the "power bar" of the

day. These methods prevented

of dried meat, fruit, and tallow,

ment berote and stored them

meat and fish, and even freeze-

vegetables, dried and smoked

water content. They parched

foods by removing their

Preserving

Native peoples preserved

Plains, pemmican, a mixture

as flakes. On the American



Preserving

The Ancestral Pueblo stored crop surpluses in storerooms along canyon overhangs.

Storing

NATIVE SCIENCE

Sad

FOOD PRODUCTION Food Processing and Storage



Storing

keep out mice.

were plastered with clay to

while farmers in the Ohio

above ground corn cribs that

Southeastern farmers favored

Valley built underground silos.

to house dried corn and beans,

constructed stone storerooms

centers. The Ancestral Pueblo

that served as distribution

stockpiled it in warehouses

The Maya and Aztecs stored

granaries and the Incas

corn surpluses in large

Processing

NATIVE SCIENCE

.məteye aisease of the skin and nervous yeople can develop a deficiency called niacin. Without niacin, or ashes to release a nutrient corn by cooking it with lime they also learned to process pread. Thousands of years ago, starches can be used to make their poisons. These detoxified California buckeye to remove plants like cassava, acorns, and Native peoples have processed



FOOD PRODUCTION

EOOD PRODUCTION

NATIVE SCIENCE

Plant Domestication

Foods That Feed the World

(nro) szieM

vorld. It provides 20% of a staple of life for the whole the Americas. Today, corn is thousands of varieties across corn as a life-giver, cultivated own. Native peoples, revering eannot release its seeds on its ti əsusəəd nroə taslq tsum not exist in the wild. Humans grass called teosinte. It does 7,000 years ago from a wild the Valley of Mexico almost ni bətsətteset domesticated in

Plastics, insulation, and glue! gasoline, medicines, fabrics, poultry, and is a component of Corn also feeds livestock and all calories eaten by people.

and More Potatoes, Tomatoes,

them so popular today that the of potato varieties, some of people developed thousands 10,000 years ago. Native -000,7 nəəwtəd səbnA ədt ni Potatoes were domesticated

Sifts to the world! Native Americans gave these wonder what people ate before and peanuts, and it makes us toes, pineapples, strawberries, squash, avocados, sweet pota-, sns of Asia. Add beans, in Europe, the Middle East, and transformed cooking styles their way onto the world's plate from Aztec gardens also found per person each year. Tomatoes world population eats 73 lbs.



FOOD PRODUCTION Spices & Treats

discovered the fun of chewing tree sap: spruce sap in New England and chicle in Mesoamerica.

Maple sugar: Where Maple trees grew, the people collected and boiled the sap until it produced sugar and syrup. Think pancakes.

Other flavorings: Native peoples also were the first to enjoy sassafras, mesquite, allspice, and paprika.

> chocolate drink flavored with chilies. Europeans later added milk and sugar.

Vanilla: Mexican peoples first cultivated vanilla, an orchid pod. Where would ice cream be without it?

Popcorn: Popcorn is one of the major types of corn. When it "exploded" in popularity all over the Americas, the popcorn popper was born.

Chewing gum: Indians in different geographic locations

Spices and Treats

NATIVE SCIENCE

Chili pepper: The Aztecs ate chilies for breakfast, lunch, and dinner. Dozens of varieties were developed in Mesoamerica for their different tastes and degree atround the globe to become an essential ingredient in euisines of India, China, Africa, Eastern Europe, and the Africa, Eastern Europe, and the Africa, Eastern Europe, and the

Спосоlate: Мезоятетісапя processed chocolate from cacao beans. Тhey made a **hot**