

MATHEMATICS • CLASS 9

CHAPTER 1

Orienting Yourself

The Use of Coordinates

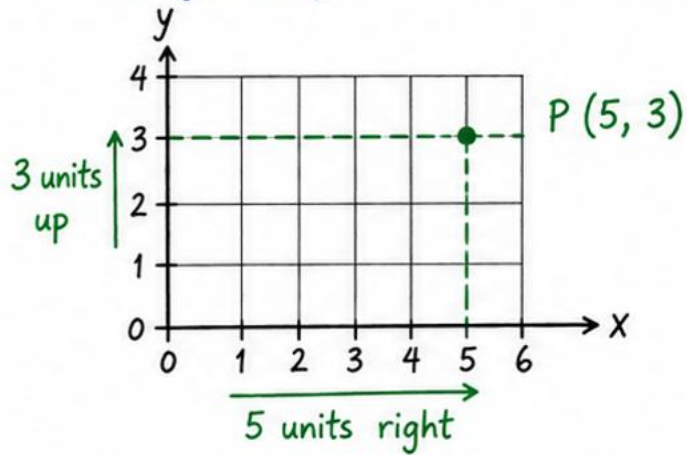
CHAPTER NOTES



WHY COORDINATES? ANCIENT FOUNDATIONS

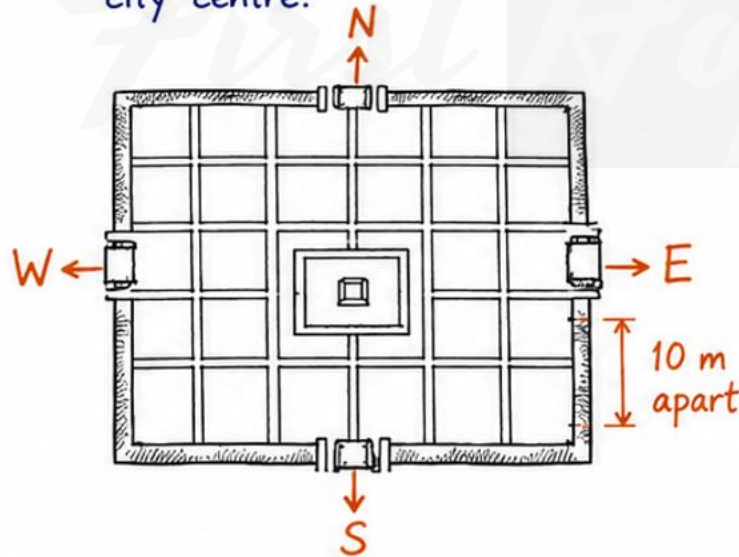
WHY COORDINATES?

- A coordinate system is a structured grid that uses numbers to describe the exact position of a point or object.
- In 2-D space, a point is located by its distances from two perpendicular reference lines.
- Coordinates are useful in maps, navigation, room plans, astronomy and geometry.



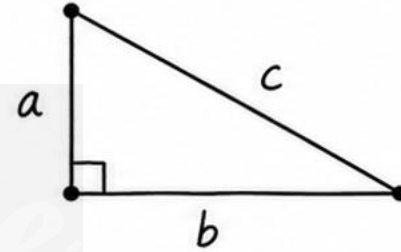
SINDHU-SARASVATI GRID

- Thousands of years ago, city streets were laid with striking precision in North-South and East-West directions.
- Many parallel streets were about 10 metres apart.
- A location could be found by counting North-South and East-West units from the city centre.



BAUDHAYANA (c. 800 BCE)

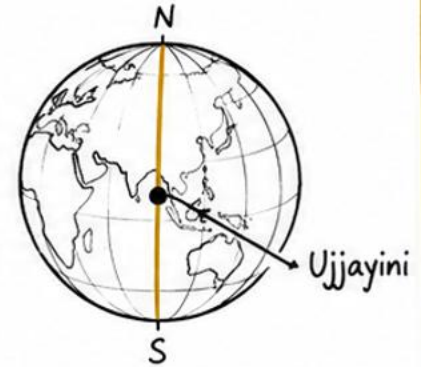
- Used East-West and North-South lines in geometric constructions.
- The Baudhāyana-Pythagoras Theorem helped build the foundation of coordinate geometry.



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

UJJAYINI MERIDIAN

- Early Siddhāntas, at least by the 4th century BCE, treated Ujjayini as a central longitude reference.
- Other locations could be measured from this meridian for mapping and navigation.



Coordinates give every point a precise numerical address.

FROM STAR MAPS TO THE CARTESIAN PLANE

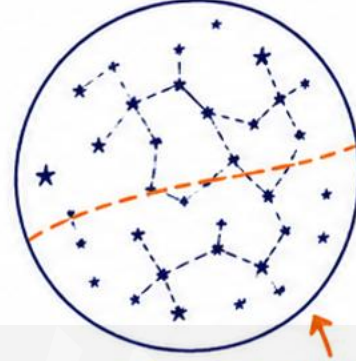
① PTOLEMY (c. 150 CE)

Built on earlier work including Hipparchus. Recorded latitudes and longitudes of thousands of places, including "Ozine" (Ujjayini).



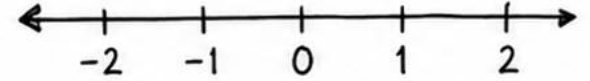
② ARYABHATA (c. 499 CE)

Replaced Greek chord calculations with sines. This made coordinates of stars and cities easier to calculate. Used celestial coordinates measured from the ecliptic.



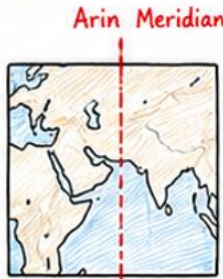
③ BRAHMAGUPTA (c. 628 CE)

Formalised zero and negative numbers as algebraic entities. Modern coordinate planes use zero at the origin and negative axes.



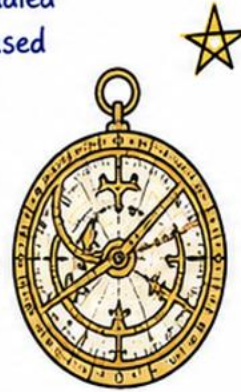
④ ARABIC TRANSMISSION

Brahmagupta's work was translated as the "Sindhind". The Ujjayini meridian entered Arabic geography as "Arin", a zero-longitude reference.



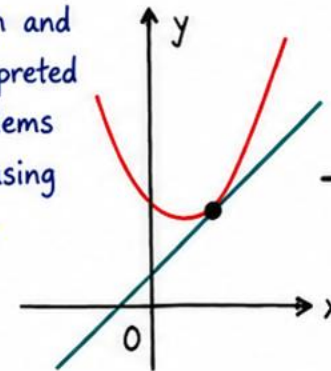
⑤ AL-BIRUNI (c. 1000 CE)

Travelled to India, studied the *Siddhāntas* and used Indian trigonometric methods to calculate coordinates of cities across Asia. The *astrolabe* helped sailors find coordinates from the stars.



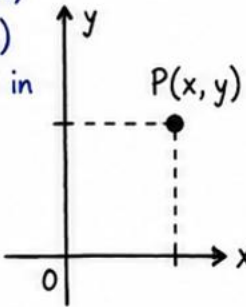
⑥ OMAR KHAYYAM (c. 1100 CE)

Expert in the Indian decimal system and algebra. Interpreted algebraic problems geometrically using coordinates in the plane.



⑦ EUROPE: FERMAT & DESCARTES

The ideas reached Europe by the 12th century. Fermat (1636) developed related work; René Descartes (1637) formalised that a point in a 2-D plane can be described by two numbers.

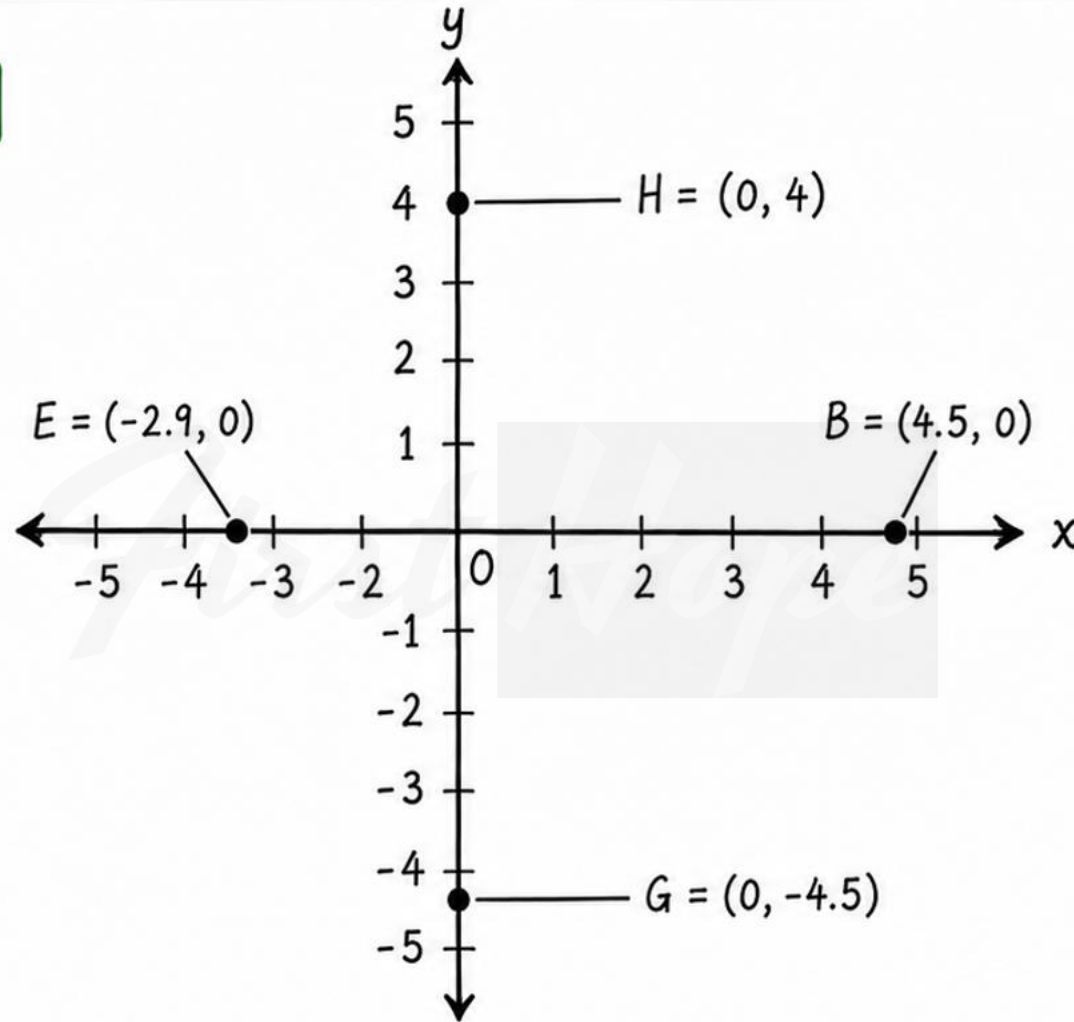


Coordinate geometry brings algebra and geometry together.

CARTESIAN PLANE: AXES, ORIGIN & SCALE

THE 2-D CARTESIAN PLANE

- The plane containing two perpendicular coordinate axes is called the Cartesian plane, coordinate plane or xy -plane.
- The horizontal line is the x -axis.
- The vertical line is the y -axis.
- The axes meet at the origin O . Its coordinates are $O = (0, 0)$.
- Mark distances from O in equal units. A chosen scale tells what one unit represents.



POINTS ON THE AXES

- Any point on the x -axis has the form $(x, 0)$.
- Any point on the y -axis has the form $(0, y)$.
- The origin has the form $(0, 0)$.

RIGHT: $+x$

LEFT: $-x$

UP: $+y$

DOWN: $-y$

★ First read x , then y : horizontal position comes before vertical position. ★



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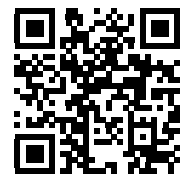


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