

Chapter 5: Indian Mathematics

Locations: India (including Pakistan)

Time: 476 A.D

Civilizations: Harappa.

"little known about their mathematics"

Major contributions:

- 1- They treated Arithmetic as pure object (No link Geometry).
- 2- They used the notion of
 - Zero.
 - Negative numbers.
 - Irrational numbers.

§1 - Symbols

Brahmi

1 2 3 4 5 6 8 9

1 2 3 4 5 6 7 8 9

(West Arabic)

(East Arabic)

Indian numeration system was a positional system (base-10). For the zero, they used place holder

(101 → 1 0 1)

1- Homework: "prove this"

If $a = p_1^{a_1} p_2^{a_2} \dots p_r^{a_r}$, $b = p_1^{b_1} p_2^{b_2} \dots p_r^{b_r}$

then

$$lcm(a, b) = p_1^{\max(a_1, b_1)} p_2^{\max(a_2, b_2)} \dots p_r^{\max(a_r, b_r)}$$

2.

Derive the quadratic formula by completing the square.

§4 - Geometry:

• Formulated the verbal expression of the Pythagorean theorem.

• They approximated

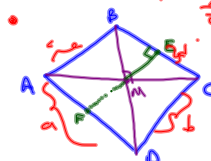
$$\sqrt{2} = \frac{1}{1} + \frac{1}{3} + \frac{1}{3 \cdot 4} - \frac{1}{3 \cdot 4 \cdot 34} \approx 1.414213$$

• They approximated π using modern language

$$\pi = 4 - \frac{4}{3} + \frac{4}{5} - \frac{4}{7} + \frac{4}{9} - \frac{4}{11} + \dots$$

$$\sin x = x - \frac{x^3}{6} + \frac{x^5}{120} - \frac{x^7}{5040} + \dots$$

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$$



- conditions
- $BD \perp AC$
 - $ME \perp BC$
- conclusion
- $AF = FD$

• $Area = \sqrt{(a-s)(b-s)(c-s)(d-s)}$

$$s = \frac{a+b+c+d}{2}$$