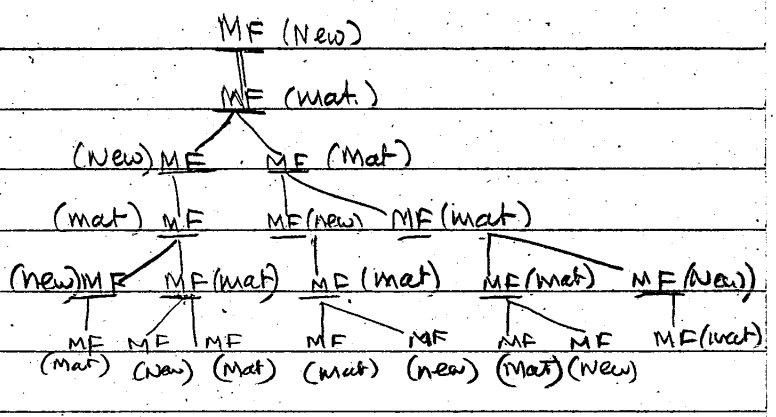
U3A, Maths

4-Mar-2025 Term 1 / Week 5

History of Mathematics

Home Work

- Fibonacci – Reproduction of Rabbits
  - Start with one MF pair
  - Each pair takes 1 mth to mature and produce another pair following month
- How many pairs will be there after one year (12 months)



- The numbers are

Month	1	2	3	4	5	6	7	8	9	10	11	12
Rabbits	1	1	2	3	5	8	13	21	34	55	89	144

- The above are Fibonacci numbers (series)

The total Number after 1 year is 144 (233?!)

Value of π (as per Brahma Gupta) (620 AD)

- The diameter and Square of the radius multiplied by 3 are practical circumference and area (of a circle)

The accurate (values) are square roots of the Square of these values multiplied by 10.

Ex:

Calculate the circumference and area of a circle with a diameter of 5 cms.

Using Brahma Gupta's methods.

- Calculate also the perentage error using exact value of π with a calculator.

Practical Values

$d = 5$ cms $\quad r = d/2 = 2.5$ cms

(Practical) Circumference $= (5) \times 3$

$= 15$ cms

Circumference (Calculator) $= \pi \times 5$ (πd) $= 15.708$ cms

$\therefore$ % Error $= \dfrac{15.708 - 15.0}{15.708} \times 100$

$= 4.51\%$

(Note: This is with in 5% error acceptable for Engg Design!)

(Practical) Area $= (2.5)^2 \times 3$

$= 18.75 \text{ cm}^2$

Area (calculator) $= \pi \times (2.5)^2$

(πr^2) $= 19.635$

$\% \text{ Error} = \frac{19.635 - 18.75}{19.635} \times 100$

$= 4.51\%$

Accurate Values

(Accurate) Circumference $= \sqrt{5^2 \times 10}$

$= 15.811 \text{ cms}$

(Using above "calculator" values)

$\% \text{ Error} = \frac{15.708 - 15.811}{15.708} \times 100$

$= -0.66\%$

(Accurate) Area $= \sqrt{(2.5^2)^2 \times 10}$

$= 19.764$ Sq cms

Using above "calculator" values

$\% \text{ Error} = \frac{19.635 - 19.764}{19.635} \times 100$

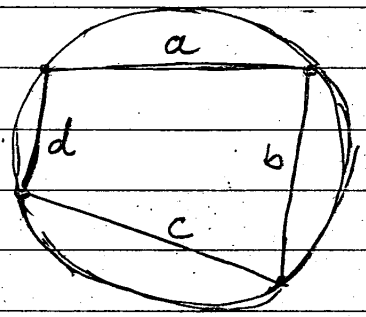
$= -0.66\%$

Note: The above accuracy is adequate for most Engineering design! Typical measurement accuracy in practice is about 1 to 2%

Homework

Repeat the above problem for diameter = 60 cms

- Brahma Gupta's formula for Area (A) of a cyclic Quadrilateral



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

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

('s' is also called the Semi-perimeter!)

- If one of the sides (say 'd') is set to 'zero' then the formula gives the area of a cyclic triangle

$\text{Area}(\Delta) = \sqrt{s(s-a)(s-b)(s-c)}$

The above formula is called the Heron's formula!

↳ Heron (Hero) of Alexandria (60 AD)

- The formula is applicable for any triangle! That is, all triangles are cyclic triangles!