## APPROXIMATING π WITH MADHAVA'S METHOD
Please do not write on the exam paper, and do not forget to give back the examination paper at the end of the test

Madhava of Sangamagrama (1340 –1425), was an Indian mathematician-astronomer from the town of Sangamagrama , India. He is considered the founder of the Kerala school of astronomy and mathematics. He was the first to useinfinite series approximations for a range of trigonometric functions, which has been called the "decisive step onward from the finite procedures of ancient mathematics to treat their limit-passage to infinity".
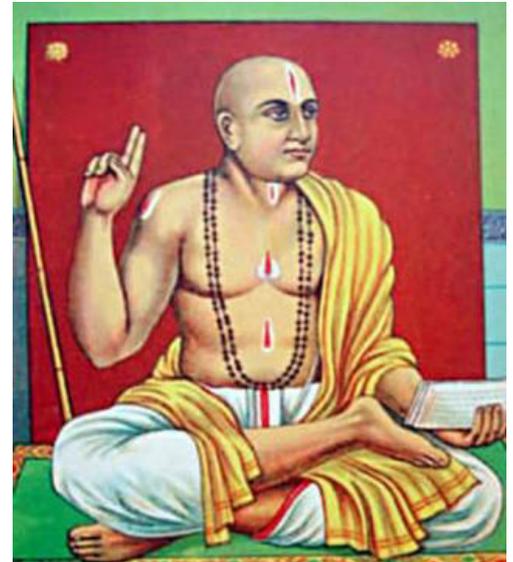
Madhava discovered that one can approximate π with the following

formula : $\pi = 4\left[1 - \dfrac{1}{3} + \dfrac{1}{5} - \dfrac{1}{7} + \dfrac{1}{9}...\right]$.

1) Understanding questions

  a) In which mathematical field was Madhava a precursor?

  b) Why do you think this formula is called an "infinite sum" (or an "infinite series")?

2) Using Madhava's formula, calculate an approximation of Pi:
- with a sum of 3 terms inside the square brackets
- with a sum of 5 terms inside the square brackets
- with a sum of 7 terms inside the square brackets

What do you notice?

3) Another infinite series which gives an approximation for Pi is the Nilakantha method. Kelallur Nilakantha Somayaji (1444–1544) was also a major mathematician and astronomer of the Kerala school of astronomy and mathematics.
His formula is:

$$\pi = 3 + \frac{4}{2\times3\times4} - \frac{4}{4\times5\times6} + \frac{4}{6\times7\times8} - \frac{4}{8\times9\times10} + ...$$

Using Nilakantha's formula, calculate an approximation of Pi:
- with a sum of 3 terms ($3 + \dfrac{4}{2\times3\times4} - \dfrac{4}{4\times5\times6}$)
- with a sum of 5 terms
- with a sum of 7 terms

What do you notice? Can you compare the two formulas?

4) Do you know any trigonometric functions? Why do you think Madhava's research was important in astronomy?