Reading

- Borwein[2], "On the history of the calculation of π".
- Stillwell, Chapter 9.5-9.7, 10-10.3
- Berkeley, *The Analyst*, sections I-XX, XLIV-XLVI
- Brown, "The fundamental anagram of calculus".

Exercises

Stillwell

- 9.5.3, 9.5.4 (binomial series and $\sin^{-1}$)

Borwein[2]

Exercise 4.

Hints: For the first part, complete the square and make a trig substitution (or use the arcsin integral). For the second part, use Newton's binomial series on page 169 of Stillwell and then integrate term-by-term.

Challenge: For Newton to compute π to 15 digits, how many terms of the series would he have needed?

Logarithms In these problems log is the natural logarithm.

1. Show that
$$\log(2) = 2\log(1.2) - \log(0.8) - \log(0.9)$$
and
$$\log(3) = \log(1.2) + \log(2) - \log(0.8).$$
2. Use the power series for $\log(1+x)$ to compute $\log(1.2)$, $\log(0.9)$, and $\log(0.8)$ to at least five decimal places, and then compute $\log(2)$ and $\log(3)$. Newton did this by hand, and it's not too hard. Use a caclulator if you must.
3. Use the Gregory-Newton interpolation formula (Stillwell pg 186) with $a = 2$ and $b = 1$ to compute an approximation to $\log(2.5)$. Use just the Δ term first, then compute $\log(4) = 2\log(2)$ and use the Δ^2 term as well. Compare your result with the correct value $\log(2.5) \approx 0.91629$.

Some History

1. What was the purpose of the anagram in Newton's 1677 letter to Leibniz?
2. What is Berkeley struggling to understand in The Analyst sections XLIV-XLVI?
3. What is the Lucasian Chair of mathematics? Who currently holds it?

More to come...?