Maple lab 1, MTH 131 (QE)

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To get warmed up on Maple, work through Maple projects 0.1b, 0.2.

Read the Maple help information on `Sum` (accessed using `?Sum` or via the Maple help menu), `evalf`, and `Digits`, and the page on approximations of π, URL

http://www.bath.ac.uk/ ns1sc/Pi/approx.html.

You may wish to use `series` and `Order` as well.

To hand in:

1: Determine what accuracy you get for the value of π computed using 10 terms in each of the series for the arctan, Euler and Ramanujan formulas. Set `Digits:=20` or more to get good accuracy.

2: Read the note on π by Borwein, URL www.cecm.sfu.ca/ pborwein/PAPERS/P159.ps and try out the Archimedes algorithm for π. Write code to implement the Archimedes algorithm for computing π. Use a `for` loop, see Maple help or honors project 1a for an example.

3: The following is a geometrically convergent algorithm for computing Pythagora's constant $\sqrt{2}$. Let $(p_0, q_0) = 1$ and for $n = 0, 1, 2, \ldots$, let

$$p_{n+1} = p_n + 2q_n$$
$$q_{n+1} = p_n + q_n$$

Then

$$\frac{p_n}{q_n} \to \sqrt{2}, \qquad \text{as } n \to \infty$$

Determine the number of steps you have to run this algorithm to achieve 4 digits accuracy. What about 8 digits? How fast does the accuracy increase with the number of iterations? See URL numbers.computation.free.fr/Constants/constants.html for more information. You may also construct your own algorithm for computing Pythagora's constant (or other roots) by using Newton's method, applied to the function $f(x) = x^2 - 2$. We will return to this later.