# Maple Workshops F7.1SC3, 2008
# Tutorial 1 (Week 1)

This worksheet is intended to help you discover the basic features of Maple. The notes which have been handed out and the 'on-line' help should assist you to work through the sheet. Get into good habits: **layout your worksheet neatly and clearly number each answer**. The assessment next week will be made up of a few questions similar to examples on this sheet!

1. Give the exact fraction representation of

$$5/7 + 19/23 - 286/403$$

   and then convert the result to an 8 significant figure decimal expansion (`evalf`).

2. Find the floating point approximations of

$$\frac{2^{15}}{3^{11}} \quad \text{and} \quad e^{\frac{1}{3}\pi\sqrt{42}}$$

   correct to 10 and 20 significant figures in each case (`evalf, exp, sqrt, Pi`).

3. Factorize the expression

$$x^3 + x^7 - 2x^5.$$

   (`factor`)

4. (a) According to the binomial expansion, the coefficient of $x^3$ in $(2x+3)^5$ is given by

$$^5C_2 \times 2^3 \times 3^2 = \frac{5!}{2!\ 3!} \times 8 \times 9.$$

   Evaluate this coefficient using Maple (the factorial function is given by the ! key).

   (b) Expand $(2x+3)^5$ as a polynomial in $x$. Confirm that the coefficient of the $x^3$ term agrees with that found in part (a) (`expand`).

5. Find the solutions of the cubic equation

$$6x^3 + 25x^2 + 21x - 10 = 0.$$

   Check the solutions are correct by factorizing the polynomial (`solve, factor`).

6. Find the term in $x^8$ and the term independent of $x$ in the expansion of

$$\left(2x^3 + \left(\frac{1}{3x}\right)\right)^{12}.$$

7. Find

$$(1-i) \times (3+7i) \quad \text{and} \quad \frac{6-3i}{4-i}$$

   in Cartesian form $a + ib$ (recall Maple represents $\sqrt{-1}$ by `I`).

8. Work out the following complex number, using the function `exp` to get the exponential into Maple form and then using `simplify` to tidy up your results:

$$\frac{e^{3i\pi/4}}{e^{i\pi/4}} .$$

Check this by simplifying by hand.

9. Use Maple to obtain an answer for $\sqrt{6-7i}$ accurate to 4 significant figures. What is the second solution for the square root ?

10. (a) For the complex numbers $z = 2 + 3i$ and $w = 5 + i$, determine $zw$ and show that $\arg(zw) = \arg(z) + \arg(w)$.

(b) Repeat part (a) for the numbers $z = -1 + \sqrt{3}i$ and $w = -\sqrt{3} + i$, and explain why $\arg(zw) \neq \arg(z) + \arg(w)$ in this case. (`argument`).

11. Find all of the the solutions of

$$z^3 = 8.$$

Calculate the modulus and argument of each solution (`solve, abs`).

12. (a) Plot a graph of $\tanh(x)$ against $x$ for $-5 \leq x \leq 5$

(b) Similarly, plot $\ln(\sqrt{1+x^2})$ against $x$ for $-3 \leq x \leq 3$ (`plot`).

13. Plot the following cubic polynomials

(a) $x^3 - 1$

(b) $x^3 - 6x^2 + 11x - 6.$

In each case use your plot to determine the number of real roots (and consequently the number of complex roots).

14. Using the on-line help for plot (`?plot`) work out how to vary the colour and thickness of a plotted line. Plot the curve

$$y = \sin(x) + \frac{1}{3}\sin(3x) + \frac{1}{5}\sin(5x)$$

in the range $-4\pi \leq x \leq 4\pi$ using a green line of thickness 3.

15. Plot the curves of $\sin(x)$ and $x(2-x)$ for $-\pi \leq x \leq \pi$ on a single graph. Using your plot determine the number of solutions of $\sin(x) = x(2-x)$ and estimate their values.